# COLLABORATIVE ENTERPRISE GOVERNANCE: SUSTAINABLE MANAGEMENT OF INTER-FIRM R&D RELATIONSHIPS IN THE GERMAN CAR INDUSTRY

MARIO BINDER

Doctor of Philosophy

ASTON UNIVERSITY

January 2007

# ASTON UNIVERSITY

## COLLABORATIVE ENTERPRISE GOVERNANCE: SUSTAINABLE MANAGEMENT OF INTER-FIRM R&D RELATIONSHIPS IN THE GERMAN CAR INDUSTRY

MARIO BINDER

Doctor of Philosophy, 2007

### Thesis Summary

This doctoral research reports on the appropriate governance, i.e. design and management, of inter-firm R&D relationships in order to achieve sustainable competitive success for the whole partnership as well as its individual members. An exploratory study in the German automotive industry using inductive Grounded Theory was conducted. This involved data collection via 28 semi-structured interviews with 16 companies in order to form a set of 35 tentative propositions that have been validated via a questionnaire survey receiving 110 responses from 52 companies. The research has resulted in the consolidation of the validated propositions into a novel concept termed *Collaborative Enterprise Governance* which draws on an inter-disciplinary body of knowledge.

The core of the concept is a competence based contingency framework that helps decision makers in selecting the most appropriate governance strategy (i.e. sourcing strategy) for an inter-firm R&D relationship between a buyer and its supplier. Thereby, the concept does not draw on whole company-to-company connectivity. It rather conceptualises an inter-firm relationship to be composed of autonomous cross-functional units of the individual partner companies that contribute value to a particular joint R&D project via the possession of task specific competencies. Hence, the concept takes the dyadic relationship between buyer and supplier as unit of analysis (and not the individual company) and embeds it in the context of the overall inter-firm relationship reflected by a particular R&D project.

The novel concept and its elements have been evaluated in a focus group with industrial experts of the German automotive industry and revealed positive effects on the sustainable competitive success of the whole partnership and the individual partner companies. However, it also showed that current practice does not apply the right mechanisms for its implementation and hence guidelines for practitioners and decision makers involved in inter-firm R&D collaboration in the automotive industry are offered on how to facilitate the implementation and usage of the *Collaborative Enterprise Governance* philosophy.

**Keywords:** Collaboration, Supply management, Competencies, Contingency, Grounded Theory

This thesis is dedicated to the memory of

Dr. Nelson Tang (1962 – 2003)

One of the finest people I have ever known.

## Acknowledgements

First of all, I would like to express special thanks to my family for their absolute and kind support in all matters over the past few years. Without them it would have been much harder (if even possible) to accomplish this challenging goal.

Extensive thanks is also given to all the companies, interviewees and questionnaire respondents from the German automotive industry who have greatly contributed to this research with their expertise. For reasons of ensured confidentiality they remain anonymous.

I would like to acknowledge my colleagues from the Technology and Operations Management Research Group for their input and inspirations. I further thank Dr. Jane Matthiesen for her helpful contribution to the completion of this research.

Furthermore, I would also like to take this as opportunity to thank Sue Rudd, Andrea McCann and Jeanette Ikuomola from the Aston Academy of Research in Management (AARM) Research Degrees Programme for their constant support in all administrative issues involved with a Ph.D. at Aston. They are fairy godmothers that make things work.

Last but not least I would like to recognise my supervisors Prof. John Edwards, as my associate supervisor, and especially Dr. Ben Clegg, as my main supervisor, for his continued support as well as many stimulating discussions that led to a variety of published work resulting from this research.

# Published work from this research

## Refereed Journals

**Binder, M.** and Clegg, B.T. (2007), "Enterprise management: a new frontier for organisations", *International Journal of Production Economics*, Vol. 106, No. 2, pp. 406-430.

**Binder, M.** and Clegg, B. (2006), "A conceptual framework for enterprise management", *International Journal of Production Research*, Vol. 44, Nos. 18/19, pp. 3813-3829.

## Refereed Book Chapters

Clegg, B.T. and **Binder, M.** "Managing the dynamic reconfiguration of enterprises", in Goran, D. and Cunha, M. (Eds.), *Encyclopedia of Networked and Virtual Organizations*, Idea Group, Hershey. (in press).

## Practitioner Journals

**Binder, M.** and Gust, P. (2006), "Gastkommentar: Als Partner auftreten - nachhaltige Erfolge in der automobilen Wertschöpfungskette erreichen" [Guest commentary: Appear as partners - achieving sustainable success in automotive supply networks], *ZulieferMarkt*, October 2006, p. 10.

## Refereed Conference Proceedings

**Binder, M.** and Gust, P. (2006), "Frontloading: a means to improving the competitiveness of R&D collaboration in automotive supply networks", *Proceedings of the Second European Conference on Management of Technology Doctoral Papers*, Aston Business School, Birmingham, 10-12 September, pp. 17-24.

**Binder, M.** and Clegg, B.T. (2006), "Designing and managing collaborative supply networks in the automotive industry", *Proceedings of the $13^{th}$ International Annual EurOMA Conference*, University of Strathclyde, Glasgow, 18-20 June, Vol. 1, pp. 957-966.

**Binder, M.** and Clegg, B.T. (2006), "Enterprise Management: a collaborative approach to managing modern supply networks" *Proceedings of the $17^{th}$ Annual Conference of Production & Operations Management Society*, Boston, 28 April – 01 May.

**Binder, M.** and Clegg, B.T. (2005), "Partial Evolutionary Multiplicity: an approach to managing the dynamics of supply structures", *Proceedings of the $18^{th}$ International Conference on Production Research*, Università di Salerno, Fisciano, 31 July – 4 August.

**Binder, M.** and Clegg, B.T. (2005), "The modular enterprise: a new governance architecture for inter-firm collaboration", *Proceedings of the $12^{th}$ International Annual EurOMA Conference*, Corvinus University, Budapest, 19-22 June, pp. 1385-1394.

Clegg, B.T. and **Binder, M.** (2004), "New thoughts on changing enterprise structures: vertical, virtual and extended", *Proceedings of the $11^{th}$ International Annual EurOMA Conference*, INSEAD, Fontainebleau, 27-29 June, Vol. 1, pp. 125-134.

## Working papers

Clegg, B.T. and **Binder, M.** (2005), "Enterprise Management: A New Frontier For Organizations", *Working Paper*, Aston Business School, Aston University.

# LIST OF CONTENTS

# LIST OF FIGURES

# LIST OF TABLES

# LIST OF ACRONYMS

| | |
|---|---|
| 3-DCE | Three Dimensional Concurrent Engineering |
| 3PL | Third Party Logistics |
| AARM | Aston Academy of Research in Management |
| ABS | Antilock Braking System |
| AE | Autonomous Enterprise |
| B.C. | Before Christ |
| B2B | Business-to-Business |
| BCG | Boston Consulting Group |
| BMW | Bayrische Motorenwerke |
| CAD | Computer Aided Design |
| CAQDAS | Computer Assisted Qualitative Data Analysis Software |
| CAS | Complex Adaptive Systems |
| CBC | Competence Based Competition |
| CE | Concurrent Engineering |
| CT | Competence Theory |
| DC | DaimlerChrysler |
| DCV | Dynamic Capabilities View |
| EBIT | Earnings Before Interest and Taxes |
| EDP | Electronic Data Processing |
| ESP | Electronic Stability Program |
| FMEA | Failure Mode and Effects Analysis |
| GE | General Electric |
| GM | General Motors |
| HRM | Human Resource Management |
| ICT | Information and Communication Technology |
| IMP | International Marketing and Purchasing (Group) |
| IO | Industrial Organisation |
| IT | Information Technology |
| KBA | Kraftfahrt-Bundesamt (Driver and Vehicle Licensing Agency) |
| LE | Linked Enterprise |
| Ltd. | Limited |
| M&A | Mergers & Acquisitions |
| N/A | Not Applicable |
| NACE | Nomenclature générale des activités économiques (Nomenclature of Economic Activities) |
| NPD | New Product Development |
| NUD*IST | Nonnumerical Unstructured Data Indexing Searching and Theorising |
| NVivo | NUD*IST Vivo |
| OEM | Original Equipment Manufacturer (car manufacturer) |
| OM | Operations Management |
| OpenBC | Open Business Club |

| | |
|---|---|
| PDP | Product Development Process |
| PE | Partner Enterprise |
| PhD | Philosophiae Doctor (Doctor of Philosophy) |
| PLC | Product Life Cycle |
| PSR | Purchasing Social Responsibility |
| QSR | Qualitative Solutions and Research (International Ltd.) |
| R&D | Research and Development |
| RBV | Resource Based View |
| RDT | Resource Dependency Theory |
| RTF | Rich Text Format |
| SCM | Supply Chain Management |
| SE | Simultaneous Engineering |
| SME | Small and Medium Sized Enterprise |
| SOP | Start of Production |
| SPSS | Statistical Package for the Social Sciences |
| SUV | Sports Utility Vehicle |
| TCE | Transaction Cost Economics |
| TM | Trademark |
| TOPP | Total Process Partner |
| TQM | Total Quality Management |
| U.S. | United States (of America) |
| UK | United Kingdom |
| USP | Unique Sales Point |
| VDA | Verband der Automobilindustrie (Association of the German Automotive Industry) |
| VW | Volkswagen |
| XML | Extensible Markup Language |

# GLOSSARY

The terms explained below reflect the specific terminology used in the context of the novel *Collaborative Enterprise Governance* concept developed in Chapter 7 of this thesis.

**(Collaborative) Enterprise**

An entity, regardless of its legal form, including partnerships or associations regularly engaged in economic activities.

**Enterprise Module**

An autonomous cross-functional part of an individual company consisting of highly task specific competencies that determine its value proposition complemented by lower task specific relational interface capabilities that enable the unique competence to be deployed within a collaborative activity of an enterprise.

**Collaborative activity**

A collaborative activity is a joint business activity between value members in an enterprise and can involve a product, a service, or a project consisting of certain value adding tasks that are fulfilled by the value members that possess the most appropriate value proposition.

**Value stream**

The value stream is a collection of tasks that have to be fulfilled along the product development stages within a collaborative activity.

**Enterprise (Value) Member**

Individual companies consisting of one or more enterprise modules that contribute value through the delivery of their competencies to one or more specific tasks of a collaborative activity within an enterprise.

**Engage-ability**

Engage-ability determines the ability of a value member to be involved in a collaborative activity based on its value proposition.

**Value proposition**

Value proposition is the potential of a value member to create a distinct value for an enterprise based on the transferability, attractiveness, and maturity of its competencies.

**Enterprise Governor**

The leader of an enterprise who possesses the meta-competence for enterprise design and management.

**Meta-competence**

Capability of evaluating the enterprise modules of the value members, allocating suitable modules to tasks of the collaborative activity, and defining the responsibilities of and boundaries between the collaborating value members.

**Enterprise Design**

Enterprise design involves the evaluation of potential value members for participation in an enterprise, the allocation of the value member to tasks in the collaborative activity, and the selection of an appropriate relationship strategy and structure with the value member based on its engage-ability.

**Enterprise Structure**

An enterprise structure reflects the specific relationship strategy and structure between the enterprise governor and a value member and can be characterised in terms of depth, scope, longevity, proximity, and governance style.

**Enterprise Management**

Enterprise management involves facilitating the collaboration between value members and between the value members and the enterprise governor (in case of delegation of the enterprise management to a significant value member), i.e. coordinating the delivery of competencies to tasks of the collaborative activity.

**Sustainable Enterprise Competitiveness**

Sustainable enterprise competitiveness is related to a superior value proposition of the enterprise to the customer that competing enterprises cannot adopt. It emerges from the integration of individual value members' competencies through effective and efficient enterprise design and management.

# 1. INTRODUCTION

> *"The greatest change in corporate culture, and the way business is being conducted, may be the accelerating growth of relationships based not on ownership, but on partnership"* (Drucker, 1996).

New industrial circumstances, such as hypercompetition (D'Aveni, 1994; Ilinitch *et al.*, 1996) and clockspeed (Fine, 1998),[1] are leading to a vertical disintegration or disaggregation of companies and a stronger involvement in activities that are outside their traditional company boundaries (Gittell and Weiss, 2004; Miles and Snow, 1986). In order to adapt to the resulting changes in nature and locus of competition in a globalised 'information age' (Sampler, 1998) connections, i.e. strategic relationships nurtured by collaboration, with specialised companies are crucial for the '21st century corporation' (Davidow and Malone, 1992) or 'fifth generation organisation' (Savage, 1990).[2] A generic but useful definition is given by Gulati (1998) who defines alliances as:

> *"voluntary arrangements between firms involving exchange, sharing, or codevelopment of products, technologies, or services"* (p. 293).

Similarly, Das and Teng (2000) view alliances as "voluntary cooperative inter-firm agreements aimed at achieving competitive advantage for the partners" (p. 33). As such they can be distinguished from joint ventures (JVs) that are commonly perceived as:

> *"independent organisations formed by the pooling of resources and sharing of equity by two or more firms"* (Kumar and Seth, 1998).

Thereby, collaborative relationships, alliances or partnerships can provide access to specific assets and resources the organisation does not possess or cannot develop itself and can also provide the opportunity to leverage its existing capabilities into more significant strategic positions via the 'relationship capital' of the collaboration (Hamel, 1991; Hamel *et al.*, 1989) without investing in equity. Hence, they are the 'supply chain's lifeblood' (Liker and Choi, 2004) or 'Marketing's fifth 'P'' (Dull *et al.*, 1995) and become a matter of survival rather than choice for many companies (Hamel *et al.*, 1989) as "finding a strong partner to complement

[1] Bowersox *et al.* (2000) outline ten mega-trends that challenge the foundation of relationships.
[2] The underlying philosophy of work specialisation is rooted in the original work of Adam Smith (1776) and later Charles Babbage (1835) who transferred the idea from manual work to intellectual work.

an area of weakness gives an organisation an island of stability in a turbulent world" (McFarlan and Nolan, 1995; p. 11).

Over the past years, collaboration with partners outside the company boundaries has become a more integral part of business life and is now among the most dramatic and visible manifestations of strategy for (sustainable) competitive advantage on the corporate level (e.g. Dyer, 1996a and 2000; Dyer and Ouchi, 1993; Dyer and Singh, 1998; Hines, 1994; Kanter, 1994).[3] IBM's recent Global CEO Study 2006 among 765 business leaders of 20 industries revealed that almost 40% of respondents consider business partners to be the most significant source of innovation and an even higher percentage (75%) of respondents thinks that collaboration and partnering are of great importance (IBM, 2006).

Inter-organisational collaboration is thereby justified by the extent to which it serves as a 'competitive weapon' that adds value to the companies and their customers, e.g. improving performance, delivering savings, and allowing to focus on core activities by engaging in partnerships and cooperation with various players (Drago, 1997). The combined effects of these factors have stimulated the emergence of a new business model in which competitive advantage is based on the development of relationships with partners (Hamel *et al.*, 1989; Walters, 2004). The success of the resulting webs of complex and dynamic relationships (Harland and Knight, 2001) depends on the ability of the partner companies to intermediate their internal core competencies into collaborating companies' value streams and simultaneously strategically outsource their own peripheral activities to companies that can perform them quicker, cheaper, and more effectively (Hakansson and Snehota, 1989; Quinn and Hilmer, 1994). In other words, the peripheral activities of one company must be complemented by core competencies of a partner company within a collaborative venture.

In this context, the traditional market (buy) and hierarchy (make) dichotomy only represents endpoints on a continuum of inter-organisational strategies which could mislead managers and researchers to overlook the possibilities of intermediate alliance or partnership strategies (hybrids) as sustainable source of competitive advantage by combining advantages of vertical integration and transactional contracts whilst overcoming some of their disadvantages (Dyer and Hatch, 2004; Jarillo, 1988; Jones *et al.*, 1997; Thorelli, 1986). However, there is also a 'dark side' to close relationships characterised by opportunistic behaviour of the partners, a

[3] Quélin and Duhamel (2003; p 651) provide an overview of outsourcing mega-deals over the past few years in different areas such as Logistics, Production, IT, etc.

certain lock-in due to a lack of alternatives, path dependency in relationship behaviour, etc. (Anderson and Jap, 2005; Bruner and Spekman, 1998; Rossetti and Choi, 2005). Companies need to be aware of this and hence should not only focus on their internal transformation activities but also on inter-organisational structures, processes and transactions, because collaboration is particularly difficult when processes and structures do not exist (Chesbrough and Teece, 1996).

This led to an increased focus on new value structures, beyond linear value chains towards more hub and web-based structures (Cousins and Crone, 2003). In other words, the previous relatively simple vertical business-to-business relationships at arms length are becoming embedded in complex inter-organisation networks (Harland *et al.*, 2003). Similarly, Bowersox *et al.* (2000) and Hamel and Prahalad (1994) acknowledged that many industries move away from vertical integration toward virtual integration leading to a rethinking of the economic model of an organisation from firm centric that is focused on transformation within firm boundaries to network centric that is focused on interaction across firm boundaries. This is shown in Figure 1.1.[4]

Aston University

Illustration removed for copyright restrictions

**Figure 1.1: The collaborative economy – the theory of the firm in a post-supply chain era**

These emerging network structures based on virtual integration are not only a hybrid form in the continuum of a firm's inter-organisational governance strategies but also an intermediary between the industrial micro (firm) and macro (industrial sector) level as a vehicle for firms to

[4] Similarly, Kemppainen and Vepsäläinen (2003) provide a three stage model on the developments in supply chain integration (p. 708) and coordination (p. 710).

influence industry (Thorelli, 1986; Madhavan *et al.*, 1998); and hence are becoming more significant as an organisational form (Ketchen and Giunipero, 2004). Camps *et al.* (2004) even go a step further by creating the terminology of 'chain and network science' to stress the importance of the network phenomenon as an emerging science.

Either way, the underlying change in analysis focus is particularly important when considering the fact that the competition of whole networks or supply chains rather than single firms is the central tenet in modern supply chain management (Christopher, 1998; Gomes-Casseres, 1994); and the partnership with the most efficient and effective structure and processes will ultimately dominate the market and its competitors. For that reason, the central unit of analysis in the strategic management of supply relationships has to be shifted from the organisational firm level to the inter-organisational level of groups of firms that compete against other groups of firms (Bettis, 1998; Harland, 1996; MacBeth and Ferguson, 1994; Wood and Gray, 1991). In this context Kopczak and Johnson (2003) identify six key shifts in management thinking and business focus that come along with this change.

Lamming *et al.* (2000) have summarised and categorised major studies on network conceptualisation and have come to the overall conclusion that "none of the existing approaches appears adequate for managers facing the practical problems of creating and operating them on a day-to-day basis" (p. 675), particularly addressing networks from a holistic and total system perspective that is widely postulated in the supply chain literature (e.g. Christopher, 1998; Jones and Womack, 2002).

Hence, it is necessary to ask **how inter-firm relationships can be turned into a win-win situation for the partner companies and a sustainable competitive success for the whole collaborative venture within the industrial landscape through successful inter-firm collaboration of the partner companies.** Ultimately, this involves the sustainable management of relationships and partnerships based on successful inter-firm collaboration. Sustainability thereby refers to the fact that competing inter-firm relationships cannot adopt one's superior capability attributes (Coyne, 1986). Hence, the analytical focus of this study will be on exploring and analysing the sustainable competitive success of partnerships in the German automotive industry through the efficient and effective governance of their collaborative R&D activities.

In this context two questions arise: (1) why focus on R&D collaboration in the automotive industry, particularly the German automotive industry, and (2) what knowledge contribution does this provide for the field of supply management.

***Focus on R&D collaboration in the German automotive industry***

The automotive industry does not only fulfil one of the most fundamental desires of mankind, namely mobility and freedom, but is also one of the most important industries in the world. A basic reason lies within its leading role as pacemaker and influencer for various other industries with innovative concepts that revolutionised industrial development, such as assembly line production at Ford, Toyota Production System, Just in Time and Just in Sequence philosophy, Lean Production and Management, Simultaneous and Concurrent Engineering (SE, CE), Total Quality Management (TQM), etc. This important role has been accounted for by a series of influential scholarly contributions (e.g. Dyer, 1996a/1996b/2000; Holweg and Pil, 2004; Jürgens *et al.*, 1993; Liker, 2003; Womack *et al.*, 1991) and research initiatives (e.g. 3DayCarProgramme, International Car Distribution Programme, International Motor Vehicle Program) over the years. Hence, the automotive industry's scope promises potential as driver for key technological and managerial innovation as well as economic growth in the future (Mercer Management Consulting, 2001).

Within the global automotive industry, Germany still occupies an exemplary position. Being the home country of some of the greatest inventors in the automotive field (e.g. Carl Benz, Gottfried Daimler, Robert Bosch, etc.), German car manufacturers (OEMs), such as Porsche, BMW, AUDI and Mercedes,[5] gained a worldwide reputation for being innovation leaders becoming an industry benchmark, especially in the premium car segments, which justifies the analysis focus of this study. Furthermore, treating the European or even the global automotive industry as a whole would be too a daunting and not realistic assumption even if Jürgens (2004) shows ground for a distinctive European approach based on certain characteristics.

Products like cars involve complex design and engineering skills that cannot be achieved by companies on their own but are produced through multi-level 'innovation networks' of specialists with complementary competencies (Bullinger *et al.*, 2004; Lamming *et al.*, 2000; Quinn, 2000). This is supported by various studies (Becker and Dietz, 2004; Fritsch and Lukas, 2001; Miotti and Sachwald, 2003; Von Corswant and Fredriksson, 2002) showing that

[5] Automotive practitioners often refer to these car manufacturers as the 'southern German automotive excellence cluster'.

firms in R&D intensive industries, such as automotive, are increasingly relying on (vertical) partnerships with external suppliers not only for manufacturing and production but on an increasing level also for product development and innovation activities.

Therefore, the development of successful inter-organisational collaboration concepts and relationships to achieve sustainable competitive advantage for the whole partnership and its members via a world-class R&D performance and effectiveness becomes crucial (Hurmelinna *et al.*, 2002; Morton *et al.*, 2006). Hence, a strategic focus on the R&D area and the product development stages of the automotive product life cycle seems appropriate for various reasons:[6] (i) during the product development stages strategic supply and sourcing decisions are made that influence and determine the collaborative relationship structure between the partners in the supply network (A.T. Kearney, 2004); (ii) R&D and product development are key value drivers for competitive advantage of an automotive company (and the whole alliance) based on the deployment of innovative capabilities and competencies (Harmsen *et al.*, 2000; Prajogo and Sohal, 2006); (iii) during the product development stages most errors are built into the products and processes which affect the competitiveness of the company and the collaborative venture (Jahn, 1988; Rommel *et al.*, 1994). This is shown in Figure 1.2.



**Figure 1.2: Error emergence and removal in the R&D process (based on Jahn, 1988)**

[6] In alignment with Ulrich and Eppinger (1995), R&D or product development is generally described as the sequence of steps or activities that a company employs to conceive, design and commercialise a product or service. In this context, joint R&D can be described as the jointly agreed conduction of research and development on a definite technology between two or more companies without equity involvement (Chiesa *et al.*, 2000).

*Knowledge contribution in the field of supply management*

Basically a company can apply three different strategies for developing competencies and innovative capability for sustainable competitive advantage: first, building on inhouse specialism through successful human resource policy; second, merger and acquisition (M&A) in order to integrate companies which possess the necessary knowledge and capabilities; third, any kind of partnerships or strategic alliances with supplier and buyer firms to access the required know how (Larsson *et al.*, 2003). The emphasis of this research is put on the third issue but extends its focus by exploring and analysing the sustainable competitive success of the holistic partnership (and not only the individual firm in it) through the efficient and effective governance of the R&D collaboration between the individual participating companies; thereby combining issues of supply chain management and product development towards a **strategic supply management** approach similar to Fine's (1998 and 2000) three dimensional concurrent engineering (3-DCE) approach.

Therefore, the contribution of this study in the area of strategic supply management is to **shed light on the inter-firm relationship phenomenon and explore its potential for the sustainable competitive success of the whole relationship entity and its individual members in the specific context of R&D** in a knowledge-intensive and innovation-driven industry such as automotive.

This study is structured as shown in Figure 1.3.

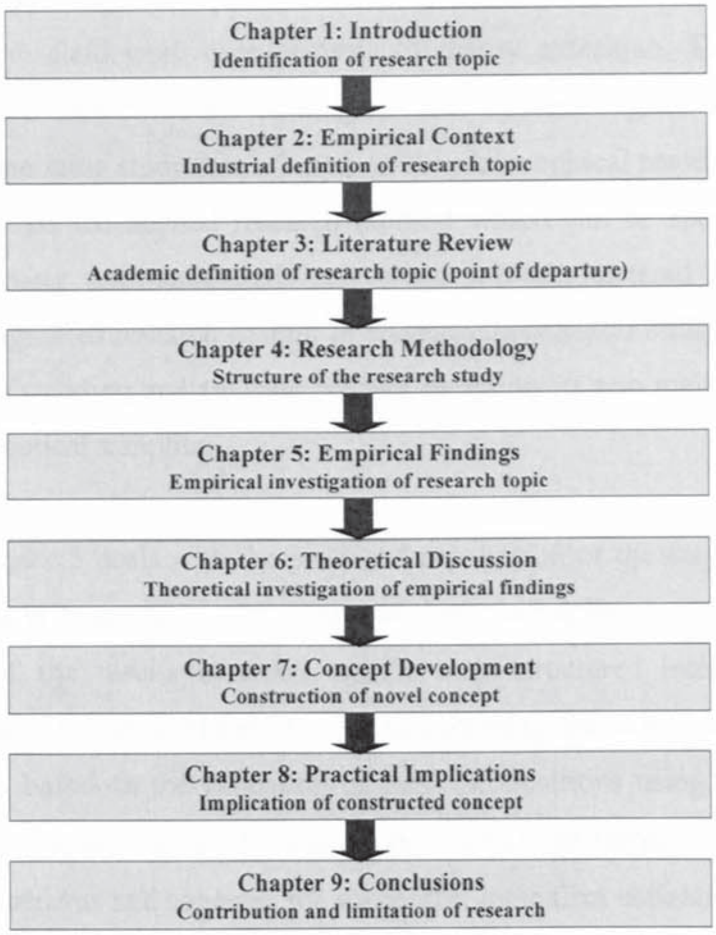


**Figure 1.3: Structure of thesis**

In the following Chapter 2 the problem area of this research is defined from an empirical perspective by providing the reader with an overview of the current and future problems and challenges in the German automotive industry. It is shown that an increasing percentage of competitive value is generated by suppliers which force the OEMs to develop innovative concepts for collaboration, especially with focus on R&D activities.

In Chapter 3 the challenge of gaining sustainable competitive success through the governance of inter-firm relationships is specified from an academic perspective investigating the relevant literature on the topic and embedding it in an interdisciplinary body of knowledge. This includes disciplines such as Organisation Economics, Strategic Management, Organisation Science, Industrial Marketing Management and Supply Chain Management. It will lead to the point of departure of this study showing that not enough research on this particular topic has been done in order to engage in large scale hypotheses testing research which justifies the adoption of a qualitative and inductively applied hypotheses generating research approach.

The methodological research concept with its set of research objectives guides the entire research process from field work over analysis to theory extension. This is described in Chapter 4, which also introduces the ontological and epistemological background of this qualitative theory generating study that is based on the philosophical paradigm of constructive realism. It also outlines the applied research method which can be specified as inductive Grounded Theory using semi-structured interviews, self-administered questionnaires and focus groups as triangulated research design. In addition this chapter outlines the peculiarities of Grounded Theory's coding and analysis process based on its two main elements constant comparison and theoretical sampling.

The subsequent Chapter 5 deals with the profound description of the empirical investigation of the research topic in terms of its coding and analysis and delivers empirical findings and results. One part of the results is based on the semi-structured interviews in form of theoretical narratives of the codified data that led to a set of tentative propositions. The second part of the results is based on the validation of these propositions using a self-administered questionnaire survey. Findings show that current practice in the German automotive industry does not apply mechanisms and concepts for successful inter-firm collaboration although it is considered as a means for sustainable competitive success for the partnership as well as the participating companies.

The theoretical investigation of the research topic in Chapter 6 is based on the frequently propagated procedure of postponed literature review. This led to a confrontation of the empirical findings and results with existing theoretical concepts, models, frameworks and theories involving the inter-disciplinary body of knowledge outlined in Chapter 3.

A comparison of the two perspectives, namely the empirical results in form of validated propositions and the related literature, in Chapter 6 forms the empirical and theoretical foundation for the development of a novel conceptual framework in Chapter 7. This provides the novel contribution of this research to knowledge in strategic supply management by introducing a competence based contingency model for a sustainable governance of inter-firm R&D relationships within the automotive industry. It is subsumed under the banner of *Collaborative Enterprise Governance*.

In Chapter 8 the implications of the framework's application for the sustainable competitive success of the inter-firm relationship (and not only the individual firm in it) is discussed. This is based on the results and insights gained from the conducted focus groups with academic and industrial experts. Recommendations for OEMs and suppliers alike will be derived.

Finally, the main aspects and the contribution of this research study are summarised in Chapter 9, which also outlines the research limitations and future research issues emerging from this study.

In addition, each chapter (apart from Chapters 1 and 9) concludes with a brief summary of the main aspects discussed within it to support the reader in reflecting on the content.

# 2. EMPIRICAL CONTEXT OF THE RESEARCH

*"The automotive industry is at the edge of a third revolution: the breaking of its traditional industrial model"* (Managing R&D Director, System Supplier).*[7]

The main aim of this chapter is to define the identified research area from an empirical point of view to provide the appropriate setting for the empirical work of the study described in Chapters 4 and 5. A separation of context description and its analysis seems necessary because a combined descriptive and analytical section would blur the boundaries between pure description of facts and their respective analysis. Hence, the description of the current and future problems and challenges within the German automotive industry in this chapter serves as a useful background for the readers' rich understanding of the empirical context and also clarifies why it is of analytical interest in order to conduct a further empirical investigation.

In section 2.1 basic facts of the German automotive industry are presented. Its past, present and future aspects are then discussed in section 2.2. before specifics of the product development process (2.3) and the resulting need for sustainable R&D collaboration between OEMs and suppliers (2.4) are highlighted. The final section 2.5. provides a brief summary of the main aspects of this Chapter. The insights and facts presented were gained from a mixture of sources including internal company documentation, press releases, industrial studies, and scholarly publications.

## 2.1. The German automotive industry – facts and figures

According to the 2006 annual report of the Association of the German Automotive Industry (VDA, 2006), the German car industry (manufacturers of motor vehicles and motor vehicle parts, NACE 34) more than doubled its turnover over the past ten years up to € 236bn in 2005, now accounting for 19% of the total turnover in German manufacturing as opposed to 12% ten years ago. This was accompanied by an increase in workforce from 671,000 in 1995 to 766,350 in 2005 now constituting 13.2% of total employees in manufacturing. This

[7] Quotations marked with * were translated from German into English by the author throughout the whole thesis.

increase was mainly due to an increase of workforce in the R&D area leading to a total amount of R&D expenditures of € 16bn in 2005 (≈ € 6.5bn in 1995) and a number of 3,600 patents making the German automotive industry a top performer in worldwide patent statistics (35% of worldwide patents) thereby underpinning its role as innovation leader. Its key role in the global automotive industry is further supported by a production of 13.5m vehicles in manufacturing sites of German car makers all over the world accounting for 20% of the worldwide vehicle production. In Germany itself the production increased by 3% to 5.8m cars in 2005 making Germany the third largest vehicle manufacturer after U.S. (11.9m) and Japan (10.8m) due to the success of the premium segment cars that account for more than 50% (38% in 1995) of German production. Together with a total industrial investment of € 57.5bn over the last five years (23.5% of total industrial investments in Germany) this awards the automotive industry with a key role within the overall German industry.

## 2.2. The German automotive industry – past, presence and future

Over the next years there will be a continuous transformation process in the automotive industry leading to a third revolution, after Fordism and Toyotism (Jürgens, 2004; Voss, 1995), driven by a fundamental rethinking of current business strategies and industrial models. It is characterised by moving away from the traditional adversarial and contractual model towards a partnership and relational model between all players in the automotive industry but without mutual financial stakeholding. It can be argued that this time Europe (especially Germany) takes the lead within the triad (U.S., Japan, Europe) based on the restructuring of its automotive and supplier industry that began in the 1990s. It facilitated the industry's regaining of its competitiveness through the development of specific capabilities related to innovativeness and inter-organisational collaboration (Gottschalk, 2001): "If the future lies in the increased specialisation of [and collaboration between] actors in the value chain, the European automotive industry seems to be specifically well positioned in terms of structures and capabilities" (Jürgens, 2004; p. 132).

Over time, two contrasting models for characterising the relationships between buyers and suppliers in the automotive industry have emerged: the contractual and the relational model. Whereas the contractual model is characterised by adversarial relationships that aim at maximising ones own power position, the relational model involves high levels of collaboration and information exchange between the partners. Firms of the Western automotive industry (particularly U.S. based firms) have traditionally been located within the contractual model, whilst Japanese companies have been more closely related to the relational model (Dyer *et al.*, 1998; Singh *et al.*, 2005). However, this ignores hybrid models which characterise the 'European model' towards partnerships in the automotive industry. Hence, three different generic approaches towards sourcing and supplier management in the automotive industry can be identified as shown in Table 2.1.



**Table 2.1: Comparison between U.S., European and Japanese governance models (based on Ali *et al.*, 1997; Cousins and Stanwix, 2001; Dyer and Ouchi, 1993; Dyer *et al.*, 1998)**

However, the boundaries between these distinct models are becoming increasingly blurred. For example, due to years of recession the Japanese *keiretsu* seem to give way to more competition in their relationships (Ahmadjian and Lincoln, 2001; Lamming, 2000; Zirpoli and Caputo, 2002). Moreover, each of these models has to be considered as a continuum of approaches and strategies. Whereas, for example, German volume manufacturers such as VW or Opel (GM) are closer to the U.S.-European interface, premium manufacturers such as BMW and Porsche are closer to the Japanese-European interface. And others such as AUDI and DC seem to be more centred within the hybrid European model. Similar results are revealed by Zirpoli and Caputo (2002) for the Italian automotive industry.

Nevertheless, the author of this research study argues - supported by recent evidence (e.g. A.T. Kearney, 2003) - that there is still a long way to go for the German automotive industry. The implementation of a 'European model' implies the redefinition and restructuring of the industry, moving away from the image of the OEM dominated linear tier pyramid to the image of webs or networks of partners integrating specific and complementary competencies in which suppliers will exploit the value of increasing modularity[8] whilst value of orchestration through the focus on product planning, design and marketing will create the modern management approach of the OEMs (Bullinger *et al.*, 2004; Doran, 2003; Dudenhöffer, 2002; Jürgens, 2004). Hence, there is a **need for guiding models and frameworks to facilitate practitioners in managing the transition towards and the management of the 'European model'.**

Based on their core competencies, value focus, and contribution suppliers can be allocated to six basic strategic role models in a restructured supplier industry (based on insights from this research; also Mercer Management Consulting, 2001; Jürgens, 2004): *engineering service providers* specialising in product development and design activities (e.g. IVM, EDAG, Bertrandt, etc.); *part and component suppliers* providing high technology and innovation expertise on specific standard parts and components (e.g. Meritor, Nedschroeff, Mahle, Stabilus, etc.); *module suppliers* and *system suppliers* specialising in the integration of parts and components to supply whole modules and systems (e.g. Hella, Siemens VDO, Bosch, Edscha, Valeo, Johnson Controls, Visteon, etc.); *logistics and assembly service providers* focusing on low value added assembly and just in time delivery services (e.g. Scherm Group, Faurecia, etc.); *prime contractors* or *system integrators* providing total process support including sub-supplier management and engineering capabilities for developing and manufacturing whole car series (e.g. Magna, Karmann, Bertone, Valmet, etc.). This is

[8] According to a study, modules and systems accounted for 22%, standards parts and components for 70%, and raw materials 8% of the total supply for European car manufacturers in 1993. In 2000 these proportions have already changed to 43% for modules and systems, 50% for standard parts and components, and 7% for raw materials with a tendency of extrapolating the trend (A.T. Kearney, 2003).

illustrated in Figure 2.1 showing the various players (including OEM and suppliers), their value contribution and competencies as well as their interrelations.



**Figure 2.1: Network of specialists for product development in the German automotive industry (adapted from Jürgens, 2000)**

However, this restructuring of the industrial landscape in the German automotive industry led and still leads to tensions between OEMs and suppliers in a vicious circle of 'hostile' competition resulting in isolation of the players and a mutual blame culture based on irreversible know how shifts from OEMs to suppliers ('hollowing out'; Becker and Zirpoli, 2003), increasing quality problems in car development and production, and a further consolidation of actors in the supplier industry. For example, a study by Mercer Management Consulting (2004) estimates that from the current 5,500 suppliers around 2,500-3,000 will disappear from the market by 2015 with the top 20 suppliers accounting for approximately 50% (today 27%) of the total OEM supply. Similarly, only seven to ten of the current 12 independent global car manufacturers will be left to compete.

Resulting from this, Jürgens (2004) identified the challenge of an inter-firm cooperation at the point of product development in the automotive industry, especially due to the increasing model variety and the more specific knowledge necessary for product development that cannot be handled by the OEMs alone. Hence, in order to stay competitive a certain degree of outsourcing R&D and production activities from OEMs to external suppliers is necessary. In this respect, recent developments of a few OEMs in the German automotive industry (mainly premium manufacturers) show the adoption of more strategic sourcing policies towards collaborative partnerships and active supply management based on long-term R&D decision making and a stronger strategic focus on core competencies in order to cope with the emerging challenges of industrial change (also cf. Wolters and Schuller, 1997). However, other OEMs and big suppliers (mainly volume manufacturers) continue the trend of excessive outsourcing of ever larger performance packages to external suppliers in order to cut down R&D and production costs. This can be confirmed with results from a Mercer study (Mercer Management Consulting, 2004) revealing that especially mass producers (e.g. VW, GM, Ford, etc.) are further decreasing their own overall value added in product development and production, whereas premium manufacturers (e.g. AUDI, BMW, Porsche, Mercedes, etc.) are increasing their value added for brand defining and differentiating components. This is shown in Figure 2.2.



**Figure 2.2: Percentage of change in value added of selected OEMs from 2002 until 2015 (Source: Mercer Management Consulting, 2004)**

## 2.3. Key factor product development

The overall success of a (car) brand depends on its value for the customer which is determined by a multiplicity of factors such as product quality, price, variety, safety, after sales service, etc. Barwise and Meehan (2004) term these 'generic category benefits'. They argue that most companies are too focused on their differentiation activities and thereby forget or neglect to satisfy their customers with products and services that simply provide better generic category benefits. These authors use Toyota as an example for a company that meets basic customer needs at the highest level and relate its market success to the capability of creating generic category benefits. Although the author of this study agrees with Barwise and Meehan's position, the generalisation of this is difficult.

It has to be observed that in the automotive sector this strategy works well for cars in lower and middle segments but not so well for car manufacturers that possess a premium and luxury image like many of the German OEMs do. Hence, even a 120% fulfilment of generic category benefits does not automatically create a desirable and highly emotional car. This can be underpinned by Lexus' current underperformance on the highly competitive German premium market compared to Toyota's success story in the midsize segments in the rest of the world (Koehler, 2006). In 2003 Toyota only sold around 2,500 Lexus in Germany (Katzensteiner, 2004).

In these product segments, the degree of quality and innovation and the country of origin are especially decisive for the customers' purchase decision (Lamming *et al.*, 2000; Proff, 2000). Hence, premium OEMs of the German automotive industry, such as AUDI, BMW, Mercedes and Porsche, can only gain and maintain a sustainable competitive success by innovation and quality supremacy at an acceptable price. This importance of innovation for economic growth was already postulated by Schumpeter (1934) and later by Drucker (1985). However, most innovations in car development stem from the suppliers (Dudenhöffer, 2003) which explains a general tendency of an increasing shift of value added in car development from OEMs (premium and others) towards suppliers, despite the increasing value added for brand specific components among premium OEMs (cf. Figure 2.2). This is shown in Figure 2.3 for various areas of a car leading to an aggregated view of value shifts between OEMs and suppliers in product development and production in Figure 2.4.

Aston University

Illustration removed for copyright restrictions

**Figure 2.3: Value added of suppliers in car development (Source: Arthur D. Little, 2005)**

Aston University

Illustration removed for copyright restrictions

**Figure 2.4: Aggregated value shifts between OEMs and suppliers in product development and production (adapted from Roland Berger Strategy Consultants, 1999)**

This fundamentally alters the view on the automotive product life cycle. As opposed to the past where efficient production processes and outsourcing of manufacturing determined the competitiveness of a car via its price, nowadays innovation, design and quality are increasingly important and need to be built into the product together with specialised suppliers during the development and R&D phase of the lifecycle already (Dudenhöffer, 2002). Hence, especially in the premium car segments product development is the most important part of the automotive product lifecycle because it determines the overall competitiveness of the car (cf. Chapter 1).

In Figure 2.5 the main aspects characterising the product development process in the automotive industry are summarised including the major activities at each of the main stages (product planning, concept design, pre-series design, series design), their critical success factors and major decision gates along a monthly time scale during the development process. In the literature these stages are sometimes referred to as initial stage, concept stage, detail engineering stage and process engineering stage/product introduction (e.g. Hauschildt, 2004). Similar models can for example be found in Ulrich and Eppinger (1995) and Mikkola (2003).

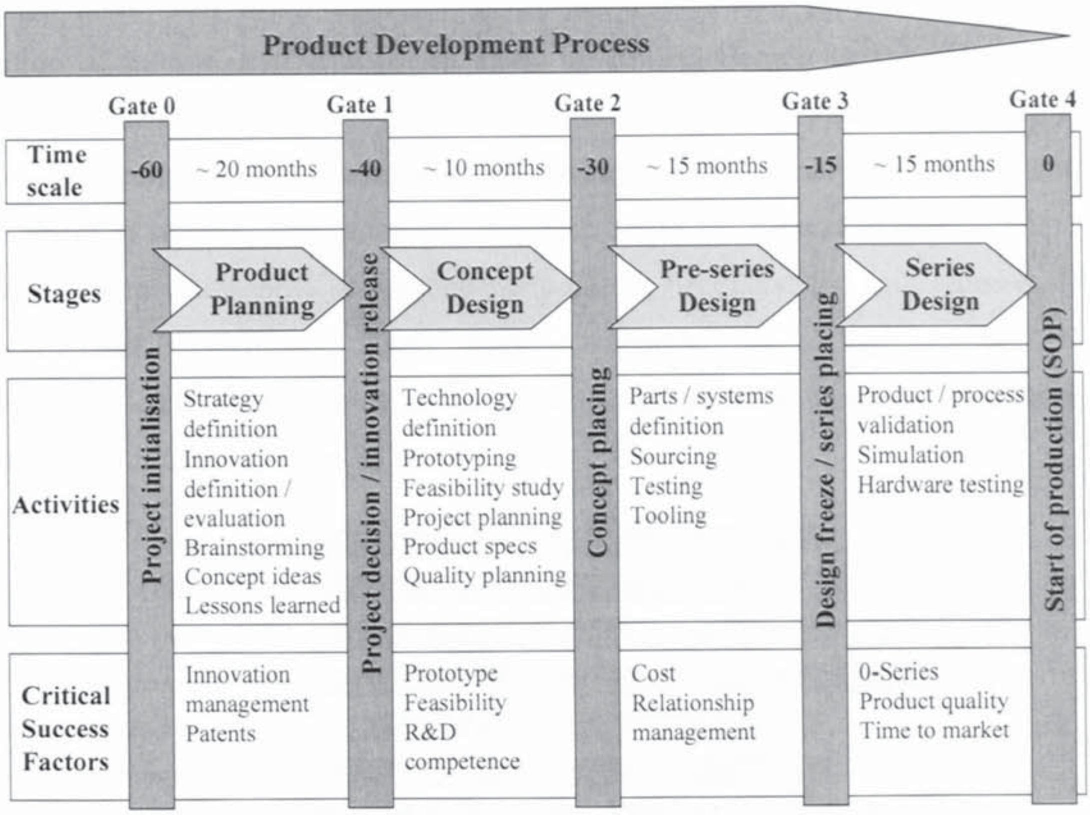


**Figure 2.5: Product development as a stage gate process**

## 2.4. The inevitable need for sustainable inter-firm R&D collaboration

It became evident during the above discussion that the full range of skills needed to develop innovative and high quality cars is not existent under a single roof. OEMs mainly possess strong brand management, design capabilities and the link to the end customer whereas suppliers have specialised knowledge in technologies, parts and components. This is reinforced by an increasing electronics and mechatronics content in cars, a main domain of supplier competency, which is estimated to increase up to 40% of the total vehicle cost by 2010 (VDA, 2006). Hence, sustainable competitive success will require OEMs to involve the right suppliers for each specific task of product development and establish systematic linkages with them, ensuring the effectiveness and efficiency of the collaborative venture at the same time.

> *"It is not the supplier that is captured in a cost-slavery that delivers innovation but the supplier with sufficient degrees of freedom to innovate. Hence, the key to success lies within strategic supplier management"* (Dudenhöffer, 2003; p. 4).*

The necessity for more effective and efficient collaboration between OEMs and suppliers is postulated more than ever, especially in the areas of R&D, product development and innovation (Calabrese, 2001). A recent study by Roland Berger Strategy Consultants and WHU – Otto Beisheim School of Management on supply chain organisation in the German industry revealed that 69% of companies in the automotive industry see great potential for improvement in supplier integration and management in the context of collaboration within the supply chain which 66% of respondents consider beneficial for both partners. (Roland Berger Strategy Consultants, 2006). This is supported by a high number of inter-organisational R&D arrangements in the German automotive industry in contrast to other industries, as illustrated in Figure 2.6.

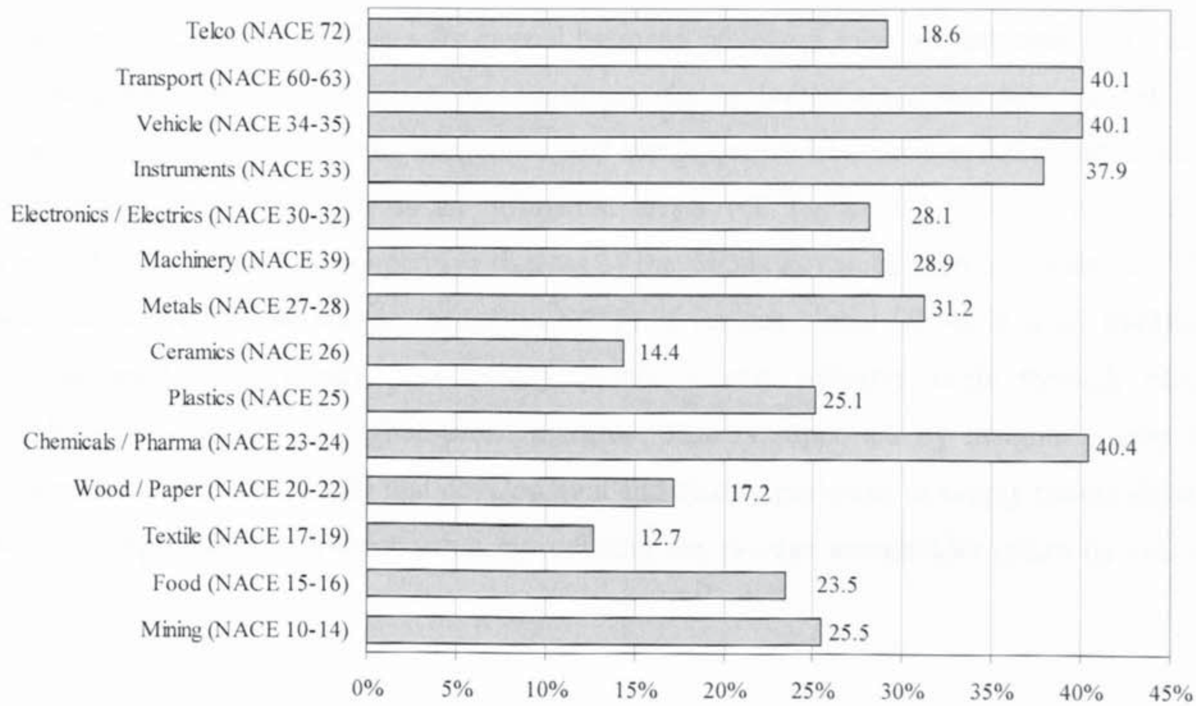


**Figure 2.6: Percentage of firms with R&D collaboration in different industrial sectors in Germany between 2002 and 2004 (Based on ZEW (2005) data panel)**

At the same time the establishment of an intensive collaboration culture for information and know how exchange between OEMs and suppliers to create a win-win situation is one of the greatest challenges in inter-organisational collaboration and strategic supply management. That is why despite all good intentions of a few players, the German automotive industry is still (or again based on newly emerging cost pressure; Dudenhöffer, 2005) facing major quality problems leading to an increasing number of excessive recall initiatives that dissatisfy customers and thereby destroy brand value and competitive advantage (Bates *et al.*, 2007). Whereas in 1998 there was an average number of recalls of 55 the number steadily increased to 137 in 2004 with a little decrease to 123 recalls in 2005 (KBA, 2005). Nevertheless, this decrease is not significant enough for OEMs and suppliers to rest in the future. Some recent examples of this are shown in Table 2.2.

| Date | Problem | Brand (OEM) | Number of recalled cars | Geographical Scope |
|---|---|---|---|---|
| August 2006 | Airbag | Audi (VW) | 36,000 | Worldwide |
| July 2006 | Buffer | BMW | 46,000 | Worldwide |
| May 2006 | Brake lights | VW | 362,000 | USA |
| April 2005 | Fuel pumps | Mercedes (DC) | 1,300,000 | Worldwide |
| May 2004 | Brake Control | Mercedes (DC) | 680,000 | Worldwide |
| May 2004 | Safety belt rear | Porsche | 41,000 | Worldwide |
| April 2004 | Front axle | Audi / VW (VW) | 870,000 | Worldwide |
| January 2004 | Gear | DC | 2,700,000 | USA |

**Table 2.2: Major recall initiatives of German OEMs over past few years**

Although these quality problems are caused by many factors or even a combination of these, e.g. increasing product variety, more complexity due to increasing electronics content and unnecessary gimmicks, etc., the ineffective and inefficient collaboration in R&D and product development has to be seen as an influential driver (cf. Figure 1.2 in Chapter 1). This ultimately determines the competitive success of the OEMs as can be seen in Figure 2.7. The figure depicts the profit margin (based on EBIT) of various global OEMs in 2005 implying that, amongst other things, less quality problems and warranty costs through better collaboration can lead to higher profit margins. This is supported by insights gained by Anderson and Delattre (2002) that development and quality problems in supply chains show a negative impact on shareholder value by reducing the average shareholder return by around 10%.

Aston University

Illustration removed for copyright restrictions

**Figure 2.7: Profit margins (based on EBIT) of various global OEMs in 2005 (Adapted from Bratzel and Tellermann, 2006)**

Although an exclusive causality cannot be established, the importance of this dependency can be justified by the existence of various industry driven projects. For example, a VDA (Association of the German Automotive Industry) initiated project in 2004 on collaborative quality management within the supply chain aims at a harmonisation of the whole supply chain through quality in collaboration between OEMs and suppliers, using quality focused decision gates in the product development process (cf. Figure 2.5). This is supported by research showing that a lack of quality focus during the design process leads to dysfunctional supply chains and hence results in expensive rework in the downstream production processes (Love *et al.*, 1999). Another example is the project 'Management of Partner Networks' of a premium OEM that tries to achieve synergies in product development through a more intense collaboration with key suppliers at early stages of the development process.

Nevertheless, in the opinion of the author these projects can only be seen as a drop in the ocean, even if they stimulate thinking outside the box to a certain extent, because models, guidelines and frameworks on a larger scale to support practitioners in their strategic decision making for R&D collaboration are still missing. This creates the need for this systematic and extensive three year research project that focuses **on how one partnership alliance in the German automotive industry can gain a sustainable competitive success over competing alliances through the successful governance of inter-firm R&D collaboration**.

## 2.5. Summary

The changes in the German automotive industry as a result of worldwide overcapacities, global competition, increasing customer demands, product proliferation and shorter product life cycles, technological advancement, and changing government regulations provide the empirical context of this study (cf. sections 2.1. and 2.2.). This manifests in an increasing shift of value added in car development and production from car manufacturers (OEMs) towards suppliers although premium OEMs are increasing their own value added in customer sensitive areas (cf. section 2.3.). Either way, the OEMs need to develop innovative concepts for collaboration with suppliers, especially with focus on R&D activities as main determinant of the competitive success in the automotive industry (cf. section 2.4.). Currently there is a lack of models and frameworks that guide practitioners in this context which opens the ground for this empirical research that investigates the governance of inter-firm R&D collaboration in the German automotive industry.

# 3. LITERATURE REVIEW ON INTER-FIRM RELATIONSHIP GOVERNANCE

*"If we did not carry in us the basic biological urge to cooperate with our fellow men, we would never have survived as a species"* (Morris, 1969; p. 26).

*"The development of collaborative relationships has been a challenge for mankind throughout history"* (Price, 1996; p. 103).

*"Relationships are one of the most valuable resources that a company possesses"* (Hakansson, 1987; p. 10).

As argued in Chapter 2, the German automotive industry, and especially the premium segment, is facing the challenge of delivering high quality and innovative products in a short time to market at an acceptable price level to the end customer. This is particularly crucial given the increasing quality problems that have occurred in the industry lately that affect the competitive success of the OEMs and their suppliers. Because OEMs do not possess all the necessary resources and competencies for the resulting product development requirements themselves, collaboration with suppliers in R&D and product development is inevitable. However, in this context the legitimate questions arises **how a sustainable competitive success can be achieved through the governance of inter-firm R&D relationships** between car manufacturers and suppliers in the German automotive industry.

This chapter serves as academic counterpart to Chapter 2 with the aim to describe this research topic from an academic and more theoretical point of view to provide the appropriate setting for the detailed theoretical discussion in Chapter 6 of this thesis. More specifically, the general literature on inter-firm relationships and partnerships is reviewed in section 3.1. This leads to the identification of gaps in the extant literature which form the rationale and focus of this research study from an academic point of view in section 3.2. In the subsequent section 3.3. the governance of inter-firm relationships (and the related research area of strategic supply management) is embedded in its interdisciplinary body of knowledge to provide the reader with the conceptual background; this includes areas such as Organisational Economics, Strategic Management, Organisation Science, Industrial Marketing Management, Purchasing and Supply Chain Management. In the final section 3.4. the main aspects of this chapter are summarised.

## 3.1. Inter-firm relationships and collaboration – an overview

As shown in Chapters 1 and 2, the underlying research of this thesis aims to make a knowledge contribution in the area of **strategic supply management** by **exploring and investigating the sustainable governance of inter-firm R&D relationships**. Thereby the study combines fairly recent but increasingly important topic areas in the wider Logistics and Operations Management (OM) arena, such as supply chain management, strategic purchasing and product development (Drejer *et al.*, 2002; Krishnan and Loch, 2005; Pannirselvam *et al.*, 1999). However, rather than emphasising all aspects of delivering products and services to end customers, this research on supply management has to be seen on the strategic and therefore 'softer' end of the research spectrum inherent in the basic Logistics and OM discipline by primarily focusing on issues of upstream inter-firm (buyer-supplier) relationships (Leenders *et al.*, 2002) which could be seen as one of its most important and difficult elements (Croom *et al.*, 2000). In particular it involves aspects such as building (partner selection, evaluation, involvement) and managing (partner integration, coordination, collaboration, communication) collaborative inter-firm relationships in order to create a sustainable competitive advantage for the whole partnership and its participating partners (impact and outcomes of relationships). Furthermore, while supply chain management ideally considers all entities in the supply chain, a practical approach seems to be the focus on integrating strategic partners from within the network of specialists (cf. Figure 2.1 in Chapter 2) in order to keep the complexity manageable (Tan *et al.*, 1998). This strategic approach towards the integration of traditional purchasing, logistics, supply chain and product development management across inter-organisational boundaries is understood as **strategic supply management** (Harland *et al.*, 1999; Leenders *et al.*, 2002; Tan *et al.*, 2002).

The aim of this section is to provide an overview of the extant literature in this area in order to identify existing deficiencies that form the final point of departure for this research study. The selection of relevant high quality journals to be reviewed was guided by the author's subjective assessment of the research area but was also based on more objective journal ranking results within various disciplines available in the literature (e.g. Goh *et al.*, 1997; Linton and Thongpapanl, 2004; Vastag and Montabon, 2002). This resulted in the selection of 40 journals that seem to provide the main population or *lebensraum* (an expression used by Vastag and Montabon (2002)), for researchers in the area of strategic supply management. They can be clustered into five different disciplinary groups as shown in Table 3.1.

| Group | Selected Journals |
|---|---|
| Operations & Supply Management | European Journal of Purchasing & Supply Management<br>International Journal of Logistics Management<br>International Journal of Logistics: Research and Applications<br>International Journal of Operations & Production Management<br>International Journal of Physical Distribution and Logistics Management<br>International Journal of Production Economics<br>International Journal of Production Research<br>Journal of Business Logistics<br>Journal of Operations Management<br>Journal of Purchasing & Supply Management<br>Production and Operations Management<br>Production Planning & Control<br>Supply Chain Management Review<br>Supply Chain Management: An International Journal |
| Technology & Innovation Management | International Journal of Innovation Management<br>International Journal of Technology Management<br>Journal of Product Innovation Management<br>Research Policy<br>R&D Management<br>Technovation |
| General & Strategic Management | Academy of Management Executive<br>Academy of Management Journal<br>Academy of Management Review<br>Administrative Science Quarterly<br>California Management Review<br>Harvard Business Review<br>Journal of Management<br>Journal of Management Studies<br>Long Range Planning<br>Sloan Management Review<br>Strategic Management Journal |
| Marketing Management | Industrial Marketing Management<br>Journal of Business & Industrial Marketing<br>Journal of International Business Studies<br>Journal of Marketing |
| Management Science | Decision Sciences<br>Management Decision<br>Management Science<br>OMEGA – International Journal of Management Science<br>Organization Science |

**Table 3.1: High quality journals relevant to strategic supply management research**

In order to gain a comprehensive and contemporary picture of the topic, all publications from the year 2000 until present within each journal were evaluated for their relevance to the topic. That way nearly 600 papers were pre-selected. The decision for inclusion in the overview was based on a content analysis of the articles in terms of four major themes in the context of inter-firm relationship governance (adapted from Cousins, 2002; Gulati, 1998; Olsen and Ellram, 1997a): (i) building and developing inter-firm relationships, (ii) managing inter-firm relationships, (iii) performance impacts and benefits of inter-firm relationships and (iv) specific studies of inter-firm relationships in the automotive industry. It has to be mentioned, that snowballing was also used to integrate interesting articles from earlier issues or other journals referenced within the pre-selected articles. Ultimately, this resulted in a quite exhaustive and detailed overview of inter-firm relationship governance including around 150 relevant publications with the most significant Journals being: *Strategic Management Journal*, *International Journal of Operations & Production Management*, and *Journal of Operations Management*.

Each of the relevant articles is categorised regarding to one (or more) of the four themes, its focus, its unit of analysis, its theoretical perspective and its applied methodology. This extensive literature can be justified by the necessity to draw on previous research studies in order to avoid redundancy and ambiguity (Olsen and Ellram, 1997a). In the following Table 3.2 only an excerpt of the full table is given, highlighting some contributions that seem most relevant to the main aim of this research study. The full table is available in Appendix A.

| Theme | Author(s) | Focus of study / contribution | Unit of analysis | Theoretical perspective | Applied Methodology |
|---|---|---|---|---|---|
| Building and developing inter-firm relationships (supplier selection, evaluation, involvement, segmentation, etc.) | Anderson *et al.* (1994) | Argue that dyadic relationships have to be built within the context of the business network in which the relationships take place | Dyad | Social network theory | Validity assessment |
| | Bensaou (1999) | A portfolio of relationships is necessary to be adaptive to product and market characteristics | Buyer firm | Contingency theory, Portfolio modelling | Questionnaire survey |
| | Das *et al.* (2006) | Argues for an optimal level of supplier integration that leads to maximal performance through the configuration of internal and external integration practices | Buyer firm | Contingency theory | Questionnaire survey / Interviews / Correlation and regression analysis |
| | Fine (1998 and 2000) | Develops framework for strategic sourcing under banner of three dimensional concurrent engineering (3-DCE) combining product, process and supply chain issues | Buyer firm | SCM | Conceptual / Case applications |
| | Hallikas *et al.* (2002) | Suggests a partner portfolio matrix based on the current transactional effectiveness and the future potential value of the partner | Buyer firm | Contingency theory | Conceptual |
| | Miotti and Sachwald (2003) | Argues that the selection of partners for R&D collaboration mainly depends on the possession of complementary resources | Buyer firm | RBV | Questionnaire survey / correlation analysis |
| | Nellore and Söderquist (2000) | Combines purchasing portfolio idea with product specifications to identify most appropriate suppliers | Buyer firm | Contingency theory | Case studies |
| | Petroni and Panciroli (2002) | Buyer assigns different roles to supplier in product development depending on innovative capabilities | Supplier firm | RBV | Questionnaire survey / Structural equation modelling |
| | Vonderembse (2006) | Identify different supply chain strategies based on product characteristics and stages of product life cycle | Network | Contingency theory | Case studies |
| | Wynstra and Pierick (2000) | Introduces supplier involvement portfolio to distinguish degrees of supplier involvement in development projects | Buyer firm | Contingency theory | Case study |
| Managing inter-firm relationships (supplier development, management, trust, sustainability, | Ballou *et al.* (2000) | Recognises that the management of inter-firm relationships requires intra-functional, inter-functional and inter-organisational coordination | Buyer firm | SCM | Conceptual |
| | Croom (2001) | In managing interactions with suppliers, relational capabilities have a significant impact on collaborative product development performance | Buyer firm | RBV | Interviews / Observation |
| | Harland and Knight (2001) | Identify specific roles for network management | Buyer firm | SCM | Action research / Case study |

| | | | | | |
|---|---|---|---|---|---|
| etc.) | Koufteros *et al.* (2005) | Internal integration is an important enabler of external integration with a supplier or a customer | Buyer firm | Contingency theory | Questionnaire survey /Structural equation modelling |
| | Lakemond *et al.* (2006) | Discusses various forms of supplier involvement in product development and the managerial implications related to their coordination | Buyer firm | Contingency theory | Case studies |
| | Möller and Svahn (2003) | Proposes a classification of different types of relationships and the different types of capabilities needed to manage these | Network | Industrial network theory, DCV | Conceptual |
| | Petersen *et al.* (2005) | Investigates managerial practices important to effectiveness in new product development through the involvement of suppliers | Dyad | New product development, Strategic sourcing | Questionnaire survey / Structural equation modelling |
| | Ritter (1999) | Introduce the concept of network competence, a company specific capability to build and use inter-organisational relationships | Buyer firm | RBV | Standardised interviews / Regression analysis |
| | Wagner and Hoegl (2006) | Supplier involvement needs not only to be managed on the organisational but more importantly on the project level | Buyer firm | Relational view | Case study / Interviews |
| Impacts / benefits of inter-firm relationships (competitive advantage, risk sharing, learning, etc.) | Carter (2005) | Shows that purchasing acting socially responsible (purchasing social responsibility) improves supplier performance and thereby reduces cost | Buyer firm | RBV, Organisational learning | Questionnaire survey / Structural equation modelling |
| | Dyer and Singh (1998) | Argue for the relationship as source for competitive advantage based on relations assets, knowledge sharing routines, complementary resources and effective governance | Dyad | Relational view | Conceptual |
| | Janda *et al.* (2002) | A relational orientation is positively related to product quality but negatively to acquisition cost | Buyer firm | TCE | Questionnaire survey / Structural equation modelling |
| | Martinez Sánchez and Pérez Pérez (2003) | Cooperation increases the ability to reduce time and cost of new product development through the use of related NPD practices | Supplier firm | Contingency approach | Questionnaire survey / Regression analysis |
| | Petersen *et al.* (2005) | Supplier involvement in product development facilitates better decision making and leads to better design quality | Dyad | New product development, Strategic sourcing | Questionnaire survey / Structural equation modelling |
| | Primo and Amundson (2002) | Impact of supplier involvement on product quality, project development and project cost | Buyer firm | Contingency Theory | Survey / Structural equation modelling |
| | Van der Valk and Wynstra (2005) | Benchmarking study reveals that supplier involvement in product development can have positive effects on performance but largely depends on the management of the relationship | Buyer firm | SCM, Strategic sourcing | Case studies |
| Inter-firm relationships in automotive industry | Cusumano and Takeishi (1991) | Shows that Japanese suppliers perform better in dimensions such as quality and price compared to US suppliers | Buyer firm | Relational view | Questionnaire survey / Interviews / Correlation analysis |
| | Dyer (1997) | Reveals that high asset specificity and low transaction cost can be achieved simultaneously based on effective interfirm relationships | Buyer firm | TCE | Interviews |
| | Dyer and Hatch (2004) | Argues that sharing knowledge in close partnerships can be a source of competitive advantage | Buyer firm | Organisational learning, Knowledge based view | Case study of Toyota |
| | Garel and Midler (2001) | Demonstrates that co-development in relationships plays a major role in reducing the number and cost of modifications in the development process | Buyer firm | Concurrent engineering, Strategic sourcing | Case studies |
| | Geffen and Rothenberg (2000) | Strong partnerships are a significant element of the successful development of innovation | Buyer firm | Strategic sourcing, Relational view | Case studies |

**Table 3.2: Classification of literature on inter-firm relationships**

Similar, but less comprehensive, exhaustive and contemporary, reviews of inter-firm relationships can be found in the literature (e.g. Chen and Paulraj, 2004; Cousins, 2002; Gulati, 1998; Ireland *et al.*, 2002, Johnsen *et al.*, 2000; Olsen and Ellram, 1997a). Practical examples of inter-firm relationships based on complex governance forms and organisational structures are scattered all over the industrial world, not only the automotive sector. Table 3.3 lists some potentially interesting cases organised by industry. On an abstract level these cases could be regarded as 'replicated multiple sites' (Leonard-Barton, 1990) that could be used as supporting evidence to substantiate the findings of this research study that has only focused on one industry and a limited number of cases within it (cf. Chapter 4).

| Industry | Literature |
|---|---|
| Aerospace | Boardman and Clegg (2001), Graham and Ahmed (2000), Morton *et al.* (2006) |
| Biotech | Chiesa and Toletti (2004), Hakansson *et al.* (1993), Powell (1998), Powell *at al.* (1996), Weisenfeld *et al.* (2001) |
| Computer | Baldwin and Clark (1997), Eisenhardt and Tabrizi (1995), Magretta (1998) |
| Construction | Briscoe (2001), Eccles (1981), Kornelius and Wamelink (1998), Usdiken *et al.* (1988) |

**Table 3.3: Selected industrial examples on inter-firm relationship in the literature**

It has to be observed that within these industrial examples and the wider literature on inter-firm relationships no consistent terminology on their governance is evident. Hence, to give an overview of indicative rather than exhaustive nature, the main terms used for describing the governance structure of an inter-firm relationship and for identifying its most strategically influential member are summarised in Table 3.4. A similar but slightly outdated overview is provided by Jones *et al.* (1997).

It is *not* the aim of this research to establish the differences between these types and terms but to emphasise the fact that modern inter-firm relationships must consider factors beyond the metaphor of a traditional company and its supply chain which is often considered to be a simplistic, linear and unidirectional model as opposed to dynamic and multidirectional relationships in network like structures (Harland, 1996; Lamming *et al.*, 2000).

| Terms used to describe the structural form of an inter-firm relationship | |
|---|---|
| **Terms** | **Authors** |
| Quasi Firm | Eccles (1981)<br>Luke *et al.* (1989) |
| Strategic Network<br>Dynamic Network<br>Project Network | Gulati *et al.* (2000)<br>Jarillo (1988)<br>Sydow (1992) |
| Industrial District | Ellegaard *et al.* (2003) |
| Clan<br>Keiretsu | Ouchi (1980)<br>Dyer (1996b) |
| Virtual Corporation / Organisation | Byrne and Brandt (1993)<br>Davidow and Malone (1992)<br>Chesbrough and Teece (1996) |
| Holonic Organisation / Network | McHugh *et al.* (1995)<br>Walters (2004) |
| Supply Network | Cousins and Crone (2003)<br>Lamming *et al.* (2000)<br>Mills *et al.* (2004) |
| Virtual Enterprise | Martinez *et al.* (2001)<br>Mintzberg *et al.* (1998) |
| Extended Enterprise | Boardman and Clegg (2001)<br>Davis and Spekman (2003)<br>Kanter (1999) |
| Collaborative / networked enterprise | Bititci *et al.* (2004)<br>Noori and Lee (2004) |
| Lean enterprise<br>Vertically Integrated enterprise | Binder and Clegg (2006a)<br>Womack and Jones (1994) |
| Extraprise | Karlsson (2003) |

| Terms used to identify the most strategically influential member in a relationship | |
|---|---|
| **Terms** | **Authors** |
| Hub firm<br>Focal firm<br>Core firm | Dyer and Hatch (2004)<br>Gulati *et al.* (2000)<br>Harland and Knight (2001)<br>Nassimbeni (1998) |
| Architect<br>Designer<br>Integrator | Boardman and Clegg (2001)<br>Mills *et al.* (2004)<br>Snow *et al.* (1992)<br>Walters (2004) |
| Network Manager<br>Project Manager | Harland and Knight (2001)<br>Martinez *et al.* (2001) |
| Broker<br>Orchestrator<br>Navigator | Karlsson (2003)<br>Miles and Snow (1986)<br>Snow *et al.* (1992) |
| Captain<br>Leader<br>Convenor | Johnsen *et al.* (2000)<br>Ritter and Gemünden (2003a) |

**Table 3.4: Main terms used in inter-firm relationship literature**

However, while the forms and labels for these inter-firm relationships differ, Nassimbeni (1998) identifies three basic characteristics that inter-firm relationships have in common:

- They are formed by two or more firms (separate legal entities) leading to a voluntary exchange relationship;
- The mechanism used to govern these transactional exchanges is some form of relational contract that usually departs from economic motives and becomes socially embedded over time;
- Between the parties in the relationship dynamic forms of communication and coordination are used in order to synchronise the partners' activities to the whole relationship that ultimately enables the adaptability of the relationship to exogenous and endogenous contingencies.

In other words, "they all describe the phenomenon whereby the role of a tightly integrated hierarchy is supplanted by 'loosely coupled' networks of organisational actors" (Schilling and Steensma, 2001).

## 3.2. Gaps in the literature

Although scholarly research has addressed the issue of inter-firm relationships to a great extent (cf. Table 3.2), important issues require further empirical and theoretical investigation. The following discussion in this section is mainly based on the review of the relevant literature in terms of its contribution to the identified research topic of **governing inter-firm R&D relationships for sustainable competitive success in the automotive industry.** However, it is also informed by existing literature that outlines research gaps on the topic as well as future research needs in the area of strategic supply management. Together this forms the rationale and focus of this research study based on existing gaps in the literature. The issues can be subsumed under the following headings (based on the categories from Table 3.2. and Appendix A):

### 3.2.1. Unit of analysis applied in research on inter-firm relationships

Nearly all consequences of inter-firm collaboration identified in Table 3.2 (and Appendix A) have been discussed from the individual firm (buyer or supplier) level. However, since the competitive scenario of network vs. network (or chain vs. chain) rather than firm vs. firm will be more commonplace in the future (cf. Chapter 1), the limitation of existing theory in terms of focusing on the individual organisational perspective have to be overcome by shifting the analytical focus from the organisational to the inter-organisational level of relationship problems and their impact on performance.

That means, that although inter-firm relationships are essentially dyadic exchanges, to understand these business relationships greater attention must be directed to the embedded context in which these dyadic relationships exist (Gulati, 1998). Similarly, Granovetter (1992) cautions that it is easy to slip into 'dyadic atomization', a form of reductionism in which an analysed relationship is abstracted out of its embedded context. Hence, if research is to act as a guide to practice, inter-firm relationships have to be studied as situated dyadic buyer-supplier practices in the context of the network as overall unit of analysis. This requires a perspective on total system optimisation in that organisations must be integrated into the inter-firm relationship, not simply interfaced (Olsen and Ellram, 1997a).

This integration, however, links to the challenge of creating a synthesised, i.e. holistic and integrated, model of inter-firm relationships that is capable of analysing relationship processes at the intra- and inter-organisational levels (Koufteros *et al.*, 2005). This combination is a rather neglected view on inter-firm relationships within the reviewed literature. A few studies that seem to acknowledge this fact are for example Gittell and Weiss (2004) and Das *et al.* (2006). Nevertheless, because real systems, such as inter-firm relationships, span functional and organisational boundaries, the inter-firm relationship phenomenon cannot fruitfully be studied without reflecting this complexity by crossing levels of analysis from intra- to inter-organisational (Gersick, 1991; Gittell and Weiss, 2004).

### 3.2.2. Theoretical perspectives applied in research on inter-firm relationships

As can be seen from Table 3.2 (also cf. Appendix A) above, many studies on inter-firm relationships in the literature take an isolated view of single theoretical concepts and neglect the necessity for using a multi-perspective approach although widely postulated in the literature. Moreover, most studies not only take an isolated view of an exogenous or endogenous position, but also mainly focus on the most common conceptual representatives within these streams, such as Transaction Cost Economics (Coase, 1937; Williamson, 1975) for an exogenous position and Resource Based View (Barney, 1991; Wernerfelt, 1984) for an endogenous position. Thereby, these studies overlook the potential of less commonly used concepts, such as Resource Dependency Theory (Pfeffer and Salancik, 1978) or Complex Adaptive Systems (Kauffman, 1993), that might provide valuable and fruitful insights into the governance of inter-firm relationships (Parkhe *et al.*, 2006); particularly in a R&D context.

Similarly, researchers (e.g. Amit and Schoemaker, 1993; De Toni and Tonchia, 2003) argue that traditional 'outside-in' (exogenous) and 'inside-out' (endogenous) views of the firm need to be integrated, complemented and balanced as excessive focus on either approach is not beneficial. For example, governance choices may have a significant impact on how rents created through valuable resources are appropriated (Barney *et al.*, 2001), on the one hand, and capability differences can be seen as a necessary condition for vertical specialisation (Jacobides and Winter, 2005), on the other hand. However, to date a simple conceptual framework addressing this in the context of inter-firm relationship governance is currently absent from the literature (Fynes *et al.*, 2005; Narasimhan and Nair, 2005). Borys and

Jemison (1989) even went as far as calling inter-firm forms 'theoretical orphans' because of the lack of addressing multiple theoretical issues.

### 3.2.3. Methodology applied in research on inter-firm relationships

Although a majority of the studies reviewed can be allocated to the empirical rather than theoretical research domain based on case studies or questionnaire surveys (which confirms findings of other studies, e.g. Croom *et al.*, 2000; Olsen and Ellram, 1997a), much knowledge on the nature of inter-firm relationships either remains unexplored or is not supported by reliable empirical evidence (Goffin *et al.*, 2006). This can be explained with a lack of qualitative theory building research on the topic (Handfield and Melnyk, 1998; Ho *et al.*, 2002) and hence a necessity for more prescriptive research that proposes normative rather than descriptive models and frameworks that can be further tested and modified (Burgess *et al.*, 2006; Olsen and Ellram, 1997a). This conforms with the postulation and tendency to put more reliance on interpretive and qualitative or at least multi-paradigmatic research in the Logistics and OM area to overcome the positivistic hegemony and to allow for more holistic and contextual thinking (Beach *et al.*, 2001; McCutcheon and Meredith, 1993; Meredith, 1998).

> *"...embracing a field investigation technique such as case studies is bound to make the individual researcher, and the field in general richer and better prepared to solve real OM problems"* (McCutcheon and Meredith, 1993; p. 252).

### 3.2.4. Research conducted on building inter-firm relationships

On the subject of building inter-firm relationships there is a variety of issues available in the literature, such as supplier selection, supplier involvement, supplier evaluation, etc. mainly taking the upstream perspective from the view of the buyer. However, it is the feeling of the author that most research tends to focus on established inter-firm relationships, thereby identifying factors that influence the selection or evaluation process but often ignore the actual investigation of how to establish these relationships. Hence, the process of establishing and developing inter-firm relationships needs to be investigated in more detail, especially at the early stages of product development and R&D collaboration, which is an important aspect of this research. In this context Lambert and Cooper (2000) identify some crucial questions that remain largely unanswered by the reviewed literature. These are: What determines whom to engage with in relationships? What are the steps to take to determine with whom to link? What are the critical factors that determine the degree of engagement? What are the critical factors that enable the firm to link with other companies in a relationship? How should the relationship be structured?

This creates the necessity to consider the relationship structure as a dependent variable in order to understand what influences a particular structure (Madhavan *et al.*, 1998). In existing studies, there seems to be a particular lack of strategic product development issues (R&D, innovation, NPD) as opposed to well covered operations and logistics issues for the adoption of appropriate inter-firm arrangements.

Based on their fit typology model Slack *et al.* (2004) argue that there is a particular gap between research in OM for business-to-business services, which R&D and product development account for, and the interest and importance of these issues in practice through an overemphasising of manufacturing related issues in OM. However, product design and development (R&D) has a fundamental impact on quality related costs (cf. Figure 1.2 in Chapter 1) as well as on the supply base configuration via modular product architectures (Doran, 2003; Fine, 1998). Hence, further empirical studies, such as Twigg's (1998) research on 'design chain management' to describe the potential joint product development between buyer and supplier firms, need to be undertaken in order to explicitly include product development and its impact on the configuration of inter-firm relationships (Mabert and Venkatarmanan, 1998).

> *"Addressing the path forward, beyond limited approaches requires greater alignment between new product development and supply chain, it requires a focus that goes beyond just ensuring product availability and it requires alignment much further upstream in the new product development process"* (Van Hoek and Chapman, 2006; p. 385).

### 3.2.5. Research conducted on managing inter-firm relationships

From the above review a bulk of research on managerial aspects for governing inter-firm relationships can be observed. Only a few studies take into account that inter-firm relationships are dynamic entities that require different settings depending on varying contingencies (e.g. Choi *et al.*, 2001; Noori and Lee, 2004; Olsen and Ellram, 1997b). Similarly, Nassimbeni (1998) states that dynamic forms of coordination of inter-firm relationships have often been neglected in the literature.

Inter-firm relationships can be seen as dynamic and complex systems that need to change and reconfigure in order to be adaptive to the industrial environment because strategies and organisational forms that were effective at a competitive juncture in the past might be entirely inadequate for the future (Ilinitch *et al.*, 1996). This seems especially crucial in the automotive industry that has to deal with challenges of increasing customer requirements, stricter government regulations, increasing competition in global markets, etc. Hence, it is important to investigate what factors, exogenous and endogenous to inter-firm relationships, are associated with their evolution and how their re-configuration takes place over time (Gulati, 1998).

In this context, it is the management processes, such as the coordination of joint product development in a relationship, rather than the operating processes, that sustain competitive advantage for the relationship and its members by responding to changes in their internal and external environment (Bititci *et al.*, 2003). It is therefore essential to develop a better understanding of strategic management processes between partners operating as part of an inter-firm relationship by asking what skills and capabilities are crucial for managing inter-firm relationships and what degree of collaboration within the relationship is necessary to be competitive in relation to the environment. Some studies that lead in this direction are for examples Harland and Knight (2001), Möller and Svahn (2003) and Ritter *et al.* (2004).

However, referring to the debate on the unit of analysis above, it is also important to include the related aspect of how internal collaboration within each partner (e.g. R&D, purchasing, quality assurance, etc.) and collaboration between partners (e.g. OEM and supplier) can be sufficiently linked to achieve overall competitiveness. This creates certain demands on managerial instruments and tools for managing inter-firm relationships that have to be explored (e.g. R&D contracts, service agreements, etc.). Based on the insights gained it is important to provide firms with some guidelines regarding what management components to apply to achieve the desired relationship and management of exchanges within the partner firms as well as the relationship as a whole (Lambert and Cooper, 2000).

Within inter-firm relationships increased focus on value and knowledge aspects can be expected through the specialisation of the individual partners and the integration of this know how within the relationship to form superior customer value in the industrial environment (Karlsson, 2003). Thereby, each of the partners plays a certain role (e.g. systems supplier, module supplier, etc.) contributing a certain value to the relationship which requires more detailed analysis (Bessant *et al.*, 2003), e.g. what characterises and determines different positions and roles in the relationship, what value is thereby created for the relationship, how can a position or role within the relationship be improved, etc. (e.g. study by Petroni and Panciroli, 2002). In the R&D context of this study it is particularly important to consider the R&D or product development process and the related supply base as well as the interfaces between them (Van Hoek and Chapman, 2006).

### 3.2.6. Research conducted on outcomes of inter-firm relationships

Most literature on inter-firm relationships refers to the theme of relationship impacts and outcomes. However, as mentioned above, it is mostly discussed from the individual firm (buyer or supplier) rather than holistic relationship perspective. Hence, with the competition moving from the level of the individual firm towards the whole supply chain, a deeper understanding of the phenomenon of collaborative improvement, which is regarded as one of the cornerstones of inter-firm competitiveness, is necessary (Boer, 2003). This is closely linked to the problem of managing external integration and outsourcing to achieve competitive advantage, i.e. as to how and when suppliers should be involved (Takeishi, 2001).

Although the literature seems to be united in the opinion that relationships impact positively on performance, it can be observed that this theme of inter-firm relationships particularly lacks of models and frameworks that help to accomplish this benefit. This requires development work on concepts and tools that enable to optimise performance and thereby sustain inter-firm relationships (Bennett and Dekkers, 2005) as well as facilitate an in-depth understanding of how value is created in inter-firm relationships (Bititci *et al.*, 2004).

> *"In so volatile a competitive environment, strategy is no longer a matter of positioning a fixed set of activities along a value chain. Increasingly, successful companies do not just add value, they reinvent it. Their focus of strategic analysis is not the company or*

> *even the industry but the value-creating system itself, within which different economic actors – suppliers, business partners, allies, customers – work together to co-produce value"* (Normann and Ramirez, 1993; p. 65-66).

### 3.2.7. Point of departure of this research

Harland *et al.* (1999) already made the valuably point that the plethora of subject titles related to the study of inter-firm relationships might appear to discourage researchers from conducting a new research, at least at first glance. However, they dispute in such as the academic understanding in this research area is still playing 'catch up' with the business practice which, in the author's opinion that is substantiated by the discussion above, has not changed over the past few years since their article has been published. However, the author is fully aware that addressing all the research issues identified above is not a realistic task for one Ph.D. study. This will probably involve many future research endeavours. Hence, this study does not claim to deal with all the problems identified but claims to make a contribution in the area of strategic supply management by focusing on the aspect of governing inter-firm relationships which can be understood as:

> *"... a matter of knowing whom to include in the network and managing the complex web of relationships required"* (Harland *et al.*, 1999; p. 669).

Hence, the research in this thesis does not engage in the general discussion of whether to make, buy or ally.[9] This research study is based on the assumption, or rather the fact as shown in Chapter 1, that inter-firm collaboration is an inevitable part in today's business life and has to be an integral part of the strategy of every company. In this context, the aim of this study based on the identified gaps in the literature is to **develop a framework and practical guidelines on how to govern, i.e. design and manage, these inter-firm relationships in a sustainable way to create a competitive advantage for the whole relationship and its individual members.** Thereby, this research is embedded in the empirical context of inter-organisational R&D collaboration in the German automotive industry for reasons addressed in Chapter 2.

More specifically, this involves a focus on the dyadic buyer-supplier relationships in the context of the upstream supply network as unit of analysis (cf. Croom *et al.* (2000), Harland

[9] Some examples of studies are discussed in Cánez *et al.* (2000).

(1996) and Ritter and Gemünden (2003a) for overview of different levels) in order to provide a technological and innovative competitive advantage by leveraging the inter-firm relationship in R&D and product development. The study thereby takes a dynamic network perspective (as defined by Mills *et al.*, 2004) concerned with the mechanisms through which inter-firm relationships are created and evolve over time. Because the unit of analysis is the inter-firm relationship and its upstream network, exogenous factors imply aspects external to the overall relationship network whereas endogenous factors are aspects internal to the relationship but external to the individual firm acting as partner.

The remaining challenge now is to identify and structure the theories that contribute to this study in strategic supply management, to build the frameworks that will enable their explanation, and to establish trajectories for the developments in management practice that may be expected to emerge as a result of those frameworks (Harland *et al.*, 1999). However, the following theory discussion is only of introductory nature (rather than an exhaustive and detailed synopsis) to shape the ground for a more detailed discussion of the empirical findings in the context of the theoretical perspectives in Chapter 6 (after the empirical data has been presented in Chapter 5).

### 3.3. Strategic supply management – an interdisciplinary body of knowledge

As can be seen from the classification of the literature in Table 3.2 the theoretical grounding (i.e. theoretical perspectives applied) of inter-firm relationship governance varies greatly across academic disciplines. Hence, a certain degree of interdisciplinarity in this research seems necessary. This is supported by many researchers (e.g. Croom *et al.*, 2000; Ho *et al.*, 2002; Ilinitch *et al.*, 1996; Ketchen and Giunipero, 2004; Min and Mentzer, 2000; Svensson, 2003; Trienekens and Beulens, 2001) who argue that a cross-fertilisation of theories from related fields or even more abstract metaphors from fields such as biology or military is necessary for a further theoretical development and conceptual grounding of SCM. The polyvalent body of knowledge that provides relevant insights for the governance, i.e. design and management, of inter-firm relationships in this research was identified by the author as: *Purchasing and Supply Chain Management*, *Industrial Marketing Management*, *Strategic Management*, *Organisational Economics*, *Organisation Science*, and *Knowledge Management*.

In the following each discipline, their associated theoretical perspectives and their relevance in the context of inter-organisational (buyer-supplier) relationship governance is briefly described. The discussion of these fields will have to be limited to the most prominent and relevant theoretical approaches as identified in the context of this research due to the profundity of these different disciplines.

### 3.3.1. Organisational Economics

Inter-firm relationships are basically social economic entities which results in a certain responsibility of institutional or organisational economics in analysing inter-firm relationships.

***Transaction Cost Economics***

From an exogenous perspective inter-firm relationships have originally been considered by Coase's (1937) seminal work on firm theory and Williamson's (1975 and 1979) work on transaction cost economics (TCE) which became one of the dominant frameworks applied in the literature. In his work, Williamson (1981) challenged the neo-classical theory of the firm as a system of production and considered it to be a system of exchange transactions within the firm as well as between the firm and its environment ('efficient boundaries', Ouchi, 1980) in which the decision on the most efficient governance structure is based on economic reasoning by balancing production economics and transaction cost (Cox, 1996).

In general, "a transaction occurs when a good or service is transferred across a technologically separable interface" (Williamson, 1981; p. 552) implying that transaction costs are the buyer's costs of being in the exchange relation (Ellegard *et al.*, 2003). Typical costs involved are those of setting up and negotiating the relation (*ex ante*), i.e. partner selection in an inter-firm relationship, and the costs of running, securing and correcting the relation (*ex post*), i.e. managing the partners in the relationship, (Williamson, 1975). These are determined by the critical transaction dimensions of (i) the uncertainty surrounding the transaction, (ii) the frequency of the transaction and (iii) the asset specificity required to support the transaction (Williamson, 1979). The composition of these influences the efficacy of the governance mode which entails the contingency idea of adapting the governance form dependent on the type of transaction:

> *"...efficiency is realized only if governance structures are tailored to the specifics needs of each type of transaction "* (Williamson, 1981; p. 568).

For example, skills or services with high asset specificity (which Williamson, 1975 considered to be the most important transaction dimension) are recommended to be deployed internally due to their well established and embedded nature within the organisation as well as to reduce the opportunistic behaviour of the transacting parties. In this context, asset specificity refers to the degree to which resources are well established and 'sunk' within the standard operating procedures and human assets of an organisation (Cox, 1996), i.e. to which degree assets can be deployed for various uses by different parties within an inter-firm relationship.

Williamson (1975, 1979 and 1981) originally identified two modes for governing relationships between organisations, namely market and hierarchy, which became known as the traditional 'make or buy' decision. He later took a more differentiated view by also allowing hybrid or intermediate forms of governance, between market and hierarchy, (what he would term 'strategic use of interorganizational relations' first; Williamson, 1981; p. 570) but kept his line of argumentation that firms must "...align transactions with governance structures in a transaction cost economising way" (Williamson, 1990; p. 13). Hence, considering the assumption of TCE that transactions are governed under the conditions of bounded rationality and opportunism of the human agents involved, contractual safeguards to secure the inter-firm relations are necessary (Williamson, 1979 and 1981).

However, being grounded in the illusion of the *homo oeconomicus* this approach neglects the biological urge of mankind to collaborate (cf. quote of Morris above) and hence fails to consider and de-emphasise respectively situations in which suppliers are seen as partners in a joint strategic relationship (Provan, 1993), e.g. collaborative product development in the German automotive industry. Similarly, Gulati (1995) argues that singular emphasis on transaction costs ignores the role of trust that emerges from repeated collaboration between partners in an alliance relationship. Furthermore, the creation of innovation as a major component of (inter-firm) R&D and product development does not respond predictably to purely rational economic circumstances. As Price (1996) points out, rather the process of 'condition setting' across organizational boundaries encourages innovation. This point is also highlighted by Goshal and Moran (1996) as well as Cousins and Crone (2003) who suggest that firms do not only need to consider their contractual situation (i.e. make or buy decisions particularly based on transaction costs) but must also consider other strategic issues such as developing their competencies in order to govern certain kinds of economic activities. Nevertheless, the TCE concept can help in identifying the appropriate boundaries and modes of governance between partner firms in an inter-firm relationship in a transaction cost economising way.

### 3.3.2. Strategic Management

Strategic Management is mainly concerned with the strategic positioning of a company in its environment to gain competitive advantage and hence could be used to explain the competitiveness of inter-firm relationships in its industrial context as well as the positioning of partners within the relationship.

*Industrial Organisation Theory (IO)*

For many years the dominant paradigm in the strategy discipline was the industrial organisation (IO) perspective (Bain, 1956; Porter, 1980), which looked to the external industry structure as the primary determinant of firm profitability (Sampler, 1998). It is rooted in the structure-conduct-performance paradigm (Bain, 1956) that draws a causality between the performance of a company (performance) and the adaptation of its behaviour (conduct) to existing requirements of the industrial environment (structure). In this paradigm Porter (1980) argues that a firm's main strategic focus should be orientated at locating the best competitive market position relatively to the industrial forces of its operating environment. In his Competitive Industry Forces Model he identifies five forces that determine the competitive position and strength of a company: its suppliers, substitutes, new entrants, rivals and customers. According to his argumentation, a firm can gain competitive advantage in the marketplace by effectively positioning itself vis-à-vis these forces building on two generic strategies: cost leadership and differentiation. In this context Porter and Fuller (1989) argue that inter-firm relationships can be used to improve the competitive positions of a company through (i) economies of scales, (ii) the access to technologies and know how, (iii) risk sharing and (iv) the influence on the industry structure. Thereby, Porter's (1980) assumptions support the open-systems theory which emphasises the intimate exchange relationships between an organisation and its environment.

However, in the context of inter-firm relationships and their holistic competitiveness Porter's model needs to be extended from the individual firm boundaries to the relationship as unit of competitive analysis within the German automotive industry as its empirical context. Furthermore, Porter's framework based on exogenous industrial factors that "treats the firm as a black box" (Reve, 1990; p. 133) can only be a partial theory of strategy which needs to be understood as 'duality' through "... the match between a firm's unique resources and its relationship to an ever-changing environment to attain its best performance" (Reve, 1990; p. 134). This implies that internal organisation and structure have to be considered similarly important to external industry market factors for a firm's (or inter-firm relationship's) strategic advantage in the competitive landscape (Lewis, 2003).

***Competence Theory (CT)***

This thought is reflected in the resource based school or resource based view (RBV) of the firm (Wernerfelt, 1984; Barney, 1991; Peteraf, 1993) which looks more to firm-specific factors, in particular the possession and effective utilization of unique resource pools or bundles, as the main determinant of competitive advantage (Eisenhardt and Martin, 2000).

Resources can be conceptualised as a set of tangible and intangible assets (Wernerfelt, 1984) that confer competitive advantage to the extent that they are difficult to create, buy, substitute, or imitate, i.e. 'heterogeneity' and 'imperfect mobility' (Barney, 1991; Peteraf, 1993). In the resource based literature several types of resource assets have been proposed (e.g. Grant, 1991) stressing intangible assets, such as routines (Winter, 2000), capabilities (Stalk *et al.*, 1992), best practices (Eisenhardt and Martin, 2000), core competencies (Prahalad and Hamel, 1990), or brand image (Itami, 1987), as increasingly important sources for generating competitive advantage due to their potential for manipulating the resource base. This is particularly important in the context of R&D and product development where technological know how and innovativeness lead to competitive advantage. Using the words of Eisenhardt and Martin (2000) this means that the value of intangible assets for competitive advantage lies in their ability to alter the resource base by creating, integrating, recombining, and releasing resources. This is supported by Grant's (1991) observation that competencies determine how two different firms with similar objectives and exactly the same resources can achieve different performances and hence differ in their competitiveness.

> *"A competence is a bundle of skills and technologies ... that must be competitively unique ... [and] make an important contribution to customer perceived value ... [in order to be] the gateway to tomorrow's markets."* (Hamel and Prahalad, 1994; pp. 202-206).

This competitive advantage, in terms of creating superior customer value, is especially sophisticated when the related resource configurations are combinations of tightly woven activities (Prahalad and Hamel, 1990). Hence, the overall construct of competencies can be traced back to Selznick's (1957) original definition in the way, that competencies represent commitments to ways of acting that are built into the organisation and which at the same time define the character of the organisation. Therefore, organisations should be conceived as a portfolio of core competencies rather than a portfolio of distinct businesses (Prahalad and Hamel, 1990). Based on Stalk *et al's.* (1992) notion of capability based competition the idea that a firm's competitiveness derives from the ability to build and maintain competencies at lower costs more quickly than competitors (cf. Prahalad and Hamel, 1990) could be termed competence based competition (CBC) (De Toni and Tonchia, 2003). Thereby it differs from the RBV of the firm in that it tries to determine *a priori* which competencies lead to competitive advantage rather than *ex post* as in RBV.

Recently, the traditional RBV has been extended to dynamic markets by various scholars (e.g. Eisenhardt and Martin, 2000; Teece *et al.*, 1997; Winter, 2003) who acknowledge that in order to stay competitive the structural patterns of the resource base have to be reconfigured depending on dynamic market requirements (such as quality and innovation pressure in the German automotive industry), hence creating the notion of dynamic capabilities and the related dynamic capabilities view of the firm (DCV). Eisenhardt and Martin (2000) recognise that dynamic capabilities can be seen as a set of specific processes that show communalities across firms (similar to Amit and Schoemaker's (1993) 'strategic industry factors') thereby contradicting the fundamental assumption of heterogeneity in the RBV.

These approaches share the same conceptual principles (with fine distinctions) to such an extent that they could be seen as fundamentals of a competence theory (CT) which forms the most concrete alternative to the IO model in strategic management (De Toni and Tonchia, 2003). However, some important criticism on CT in the context of inter-firm (R&D)

relationships can be identified as: (i) the focus on a firm without its empirical context (Amit and Schoemaker), (ii) the rigidities competencies can cause especially in the context of highly dynamic and innovative circumstances such as product development (Leonard-Barton, 1992) and (iii) the neglecting of resources that might not be considered as strategic but are important to the positioning of a firm within a relationship (Montgomery, 1995).

Similarly to IO, CT needs to be extended to the inter-firm level in the context of this research. In addition, taking the inter-firm R&D relationship as the unit of analysis in this study, two major concerns arise that cannot be addressed by IO and CT in their traditional form. *First*, the partners within the inter-firm relationship are interdependent in terms of their R&D competencies which affects their position and role within the relationship. *Second*, the determination of the competencies of the partners needs to be done with respect to the requirements of the joint product development process. Whereas Resource Dependency Theory seems to provide some merit in terms of the first aspect, the context for the second aspect is generally provided by Porter's (1985) Value Chain Concept.

***Resource Dependency Theory (RDT)***

The starting point of the resource dependency approach is based on various assumptions (Van Gils, 1984):

- the source of interdependency between organisations in a relationship (and hence the dependency of the relationship on its members) is the restricted availability of resources (which in the context of R&D could mean product development and design know how);
- firms can gain these resources via exchange with other companies;
- the interdependency between firms reduces the autonomy of each firm;
- firms try to compensate their loss of autonomy through the development of inter-firm relationships.

Pfeffer and Salancik (1978) define dependency as: "the product of the importance of a given input or output to the organisation and the extent to which it is controlled by a relatively few organisations" (p. 51), showing that firms are 'other directed' or externally constrained in a socially constructed environment rather than self-directed autonomous actors pursuing their individual goals. In this context Aldrich (1979) notes that:

> *"it is probable that most interorganizational networks are bound together by dependence rather than pure exchange relations"* (p. 273).

In an inter-firm context this implies, that the more important and critical the competencies for the competitiveness of the inter-firm relationship and the fewer the firms that possess these competencies, the more power will accrue to the competence owner within the relationship. Hence, the possession of control over critical competencies determines the strategic positioning of the firm within the inter-firm relationship relative to the other partners (Pfeffer and Salancik, 1978). Therefore, the key to survival within an inter-firm relationship is the ability to gain and maintain competencies that are valuable to the competitiveness of the relationship as a whole. In response to the existing competence restrictions and dependencies, Pfeffer and Salancik (1978) identify two basic strategies for gaining critical competencies: vertical integration through acquisition or collaboration through the successful structuring of relationships with other partners.

A criticism to RDT is the assumption of a rational management that is concerned with a reduction of dependency and an increase in control which neglects the choice of inter-firm relationships for various other reasons (Sydow, 1992), e.g. past experience of OEMs with suppliers in joint product development. Nevertheless, it can be argued that RDT provides a fruitful source for analysing inter-firm relationships because it recognises the presence of industrial factors and resource base factors alike, and hence may represent a bridge between organisation based and industry based perspectives in explaining competitive advantage (Trienekens and Beulens, 2001).

***Value chain concept (VC)***

Porter (1985) has developed the value chain concept as a systematic tool for analysing the sources of competitive advantage of a firm by examining how it performs its activities. Thereby, the value chain disaggregates a firm in its strategically relevant activities in order to understand the behaviour of costs and the existing sources for differentiation. Porter (1985) identifies nine generic activities divided in five primary activities (inbound logistics, operations, outbound logistics, marketing and sales, and after sales service) and four support activities (procurement, technology development, human resource management, and firm infrastructure). Value activities are the physically and technologically distinct activities and are considered as the building blocks by which a firm creates value to its customers through the way each value activity is performed, i.e. a company is considered to gain competitive advantage by performing these activities better than its competitors.

In the context of inter-firm R&D relationships, the joint R&D or product development process can be seen as a virtual value chain (Rayport and Sviokla, 1995), an extended value system (Jones and Womack, 2002) or a value constellation (Normann and Ramirez, 1993). Thereby, the product development process as outlined in Figure 2.5 in Chapter 2 can also be divided into primary activities (product planning, concept design, pre-series design, and series design) and support activities (e.g. sourcing, CAD software such as Catia or Cats, etc.; these are not specified in Figure 2.5). Important is the change in focus of managing inter-firm value streams rather than intra-firm value chains towards the management and leveraging of intellectual competencies of the partner companies (appropriation of value through exchange; Cox, 1996) in appropriate value configurations (as a third competitive strategy dimension; Stabell and Fjeldstad, 1998) in order to create superior value and hence competitive advantage:

> *"Indeed, one of the conditions for the application of effective Value Chain Management is a clear emphasis on co-operation and collaboration"* (Al-Mudimigh *et al.*, 2004; p. 319).

### 3.3.3. Organisation Science

Organisation science basically stresses organisations as ever changing phenomena based on the market circumstances they are existing in (population ecology). The original work on organisation design and behaviour addressed the design of mechanisms for integrating activities across units within firms. More recent work has extended this view to include mechanisms for integrating activities across organisations, such as inter-firm relationships.

***Contingency Theory***

In today's dynamic business environments the universally applicable management strategy does not exist. It is rather that every company has to find its own optimal relationship with its environment. This is reflected in the contingency approach to the design of organisational structures which suggests that organisations tend to seek the most appropriate structure to achieve their purposes given prevailing situational contingencies (Watson, 2003). Woodward

(1965) for example described the relationship between production environments and organisations stressing the role of technology as an internal contingent factor in the design of organisations whereas Burns and Stalker (1961) emphasised the external environment (although related to technology) as a contingent factor.

Hence, one of the key issues for the efficiency of organisations is the 'fit' of their internal organisational structure with environmental contingencies. In the context of inter-firm relationships this assumption implies the necessity of a twofold 'fit': (i) adaptation of the relationship structure to contingencies internal to the inter-firm relationships and (ii) adaptation of the relationship structure to contingencies external to the inter-firm relationship (Sydow, 1992). This extends the traditional organisation theory in such that not only the influence of the environment on a focal company is investigated but also the influence of other organisations within the task environment, recognising that the environment of a focal company mainly consists of other companies with which the company interacts.

Similarly, representatives of the Aston Group (e.g. Hickson *et al.*, 1969) argue (although in a firm rather than inter-firm context) that once you move away from the shop floor or operative level towards the strategic level of an organisation (which applies to the R&D context of this study) the structural pattern will be more influenced by the organisation's degree of interdependence from other organisations (e.g. within an inter-firm relationship context) which links to aspects of the Resource Dependency Theory discussed above. However, by introducing the important element of strategic choice of the management (termed 'dominant coalition') Child (1972) provided a certain corrective to the view that organisational structures automatically react to or are determined by external and internal contingent factors. This implies, that the structure of the inter-firm relationship not only depends on innovation pressure from the industrial environment or resource dependency between the relationship partners but also on the strategic choice of the relationship manager.

Nevertheless, one of the main criticisms to Contingency Theory, especially in an inter-firm relationship context, seems to be the high abstraction of the environmental contingencies and their interdependencies with the organisation or inter-firm relationship (as unit of analysis) (Sydow, 1992). Furthermore, contingency researchers do not offer useful explanations on the re-configuration of organisational structures over time as contingencies change thereby ignoring the complexities of organisational adaptation:

*"Organisational adaptation is process. It takes place over time. The static snapshots of contingency theorists may not reveal the interesting dynamics of the process"* (Miller and Friesen, 1980; p. 269).

*Complex Adaptive Systems (CAS)*

Complex adaptive system, as one major research stream in the wider research area on complexity, views organisations (or inter-firm relationships) as complex, evolving and adaptive systems which is based on the ecological view of organisations (e.g. Hannan and Freeman, 1977). Thereby, complexity theories complement the view of the contingency approach by emphasising the importance of the internal consistency of structure, technology or culture for the efficiency of an (inter-)organisational structure. Hence, the aim is to strive for a certain harmony between these parameters without ignoring the situational contingencies:

*"The organisation is driven toward one of the configurations in a search for harmony in its structure"* (Mintzberg, 1979; p. 473).

These environment-strategy-structure configurations are termed archetype (Miller and Friesen, 1980; Mintzberg, 1979), quantum (Miller and Friesen, 1984) or dynamic equilibrium (MacBeth, 2002). Thereby, complex behaviour arises from the inter-relationship, interaction, and inter-connectivity of elements within a system (e.g. collaboration within inter-firm networks) and between a system and its environment which affects the structure, relationship and interaction of the entities and the system; Kauffman (1993) specified this as co-evolution within a social ecosystem. In this context, Mintzberg (1979) points out that conflicts between internal consistency and external fit can emerge whereby organisations (or inter-firm relationships) would have to trade-off both which could lead to an adaptation of the (inter-) organisational structure.

Whereas contingency theory favours a step by step adaptation of organisational structures to changing situational contingencies (piecemeal change), Miller and Friesen (1984) advocate a radical change (quantum change) to overcome momentum, i.e. paths that have been followed by the organisation over time and on which they became dependent (path dependency). Either way, when an organisation moves away from an equilibrium condition (i.e. from established patterns of work and behaviour) new ways of working are created and new forms of organisation may emerge (Mitleton-Kelly, 2003).

To date, not much complexity work has been applied to social systems in general and inter-firm contexts in particular although Miller and Friesen (1984) explicitly suggest that their approach is not only applicable to organisations but also inter-firm relationships. Notable exceptions are e.g. Dekkers *et al.* (2004), MacBeth (2002) and Stacey (1995) that all view organisations as some kind of complex dynamic systems. In essence, inter-firm relationships facing unstable environments and rapidly changing markets require flexible approaches meeting Asby's (1958) law of requisite variety (Bennett and Dekkers, 2005).

### 3.3.4. Industrial Marketing Management

The essence of Marketing is the voluntary exchange process of value between parties, internal and external to the boundaries of a firm, to create customer satisfaction (Kotler, 1997).

***Relational View***

Hence, inter-firm relationships should be originated from (and not towards) the customer's perspective and eventually from the ultimate consumer's perspective in order to prosper in the dynamic marketplace (Svensson, 2003). This is conceptualised in the marketing literature as marketing concept (Kotler, 1997), marketing myopia (Levitt, 1960) and market orientation (Slater and Narver, 1995) which drive firms to establish, maintain and enhance relationships within and outside the firm via a relationship marketing approach (Min and Mentzer, 2000). This means, a relational view involves the restructuring of the organisation into a boundary-less system through the elimination of boundaries between internal functions and the blurring of firm boundaries to the external environment which clearly links to an open system approach (Borys and Jemison, 1989).

This clearly creates the necessity for: (i) intra- and inter-functional coordination within the company as internal source of customer value, e.g. through managing cost trade-off between transportation and inventory (Ballou *et al.*, 2000) or through the creation of teams across functional silos within a firm (Kahn and Mentzer, 1990); (ii) close inter-firm relationships within the supply chain as external source of customer value, e.g. through information sharing and joint planning (Cooper *et al.*, 1997b; Ellram and Cooper, 1990). As opposed to TCE that uses specific contracts the closeness and trust inherent in the relational view can be seen as safeguard mechanisms in the governance of inter-firm relationships. Ultimately, these close inter-firm relationships tie firms together in the sense that they create joint customer value in the form of relational rents (Dyer and Singh, 1998) thereby tying their individual success to the success of the overall system (Cooper *et al.*, 1997a):

> *"We define a relational rent as a supernormal profit jointly generated in an exchange relationship that cannot be generated by either firm in isolation and can only be created through the joint idiosyncratic contributions of the specific alliance partners"* (Dyer and Singh, 1998; p. 662).

***Interaction model of Industrial Marketing and Purchasing Group (IMP)***

Another marketing approach is the industrial market approach based on the interaction model of the IMP which originally focused on long-term dyadic relationships in markets for industrial goods (Hakansson, 1982) but was then expanded to the network approach in various applications (e.g. Hakannson, 1987; Hakansson and Snehota, 1989). The IMP's network approach views a firm as a node in a network of dyadic relationships composed of actors, resources and activities. Actors are defined by the resources they control and by the activities they perform and can be individuals, groups of individuals, firms or groups of firms. They are connected to other actors via the exchange of resources which are heterogeneous and mutually dependent and include human and physical assets. Activities performed within an actor are referred to as transformation (e.g. production) whereas activities carried out between actors are referred to as transactions (e.g. joint product development).

Networks of organisations (i.e. inter-firm relationships) emerge because of the necessity to gain and exchange resources (MacBeth and Ferguson, 1994) which links to the Resource Dependency Theory (RDT) discussed above. Thereby, relationships between actors can be used as a bridge to gain access to resources of another actor (Harland, 1996). However, in alignment with RDT assumptions, the interaction options of an actor are dependent on its network position which depends on factors such as its relative importance in the network, its current function in the network, or its relationship to other actors, i.e. a company has to co-develop with the relationship (similar to co-evolution in complexity terms) and can thereby improve its position within the inter-firm relationship (Ford, 1990). Hence, for the strategic positioning of a firm in an inter-firm relationship not the adaptation to situational contingencies is the focus (as in Contingency Theory) but the establishment of a relationship to its network context. Thereby, the evolving interactions function as coordination mechanism similar to prices in markets and instructions in hierarchies but also lead to interdependencies between actors in the relationship (Sydow, 1992).

### 3.3.5. Purchasing and Supply Chain Management

The concept of SCM, as it is understood today, is a fragmented amalgam rooted in various antecedent theoretical concepts such as production economics, industrial dynamics, transportation and inventory decisions, social theory, marketing and purchasing (Cooper *et al.*, 1997a; Croom *et al.*, 2000; Mabert and Venkataramanan, 1998). Hence, despite strong attention on the topic over the past few years by scholars and practitioners alike (Cooper *et al.*, 1997b) yet there is no unified conceptual understanding of supply chains and their management which not only leads to a great deal of differing definitions (cf. Croom *et al.*, 2000; Mentzer *et al.*, 2001) but also limits the applicability of the concept in practice (Chen and Paulraj, 2004; Mentzer *et al.*, 2001). However, the common value of most definitions can be seen as their focus on the coordination of activities and processes between the organisation and its external environment in order to create customer value (Cooper *et al.*, 1997a).

***Total System Optimisation***

In this context, Mentzer *et al.* (2001), make the specific and important distinction between supply chain orientation (SCM as a philosophy) and supply chain management (implementation of the philosophy). Whereas the supply chain orientation implies viewing the supply chain as a single entity rather than as a set of fragmented parts (clearly drawing on the systems thinking paradigm, e.g. Checkland, 1999), supply chain management refers to the related set of activities and processes necessary to realise effective and efficient supply chains through the implementation of this holistic orientation (e.g. sharing information, cooperation, building and maintaining long-term relationships). Hence, supply chain orientation and supply chain management can be defined as:

> *"The recognition by an organisation of the systemic, strategic implications of the tactical activities involved in managing the various flows in the supply chain"* (Mentzer *et al.*, 2001; p. 11).

> *"The systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole"* (Mentzer *et al.*, 2001; p. 18).

Since suppliers are getting a more profound and direct impact on cost, quality, time and responsiveness of the buying firms (Chen and Paulraj, 2004), the adoption and implementation of a supply chain orientation becomes crucial for the governance of inter-firm relationships in order to achieve sustainable competitive success by creating customer value (Ellram and Cooper, 1990). In this context Cooper *et al.* (1997a) propose that all business processes that create end customer value are subject to supply chain management, including product development (integration of key customers and suppliers into the product development process in order to reduce time to market) and procurement (management of relationships with strategic suppliers).

***Strategic Sourcing***

This competitive pressure has led to major changes in the way in which purchasing or procurement is perceived within companies by moving from a money-saving activity to a resource-planning function (Gadde and Hakansson, 1994). Spekman *et al.* (1994) identify some specific changes such as coordinating the supply value chain for competitive advantage, redefining relationships with suppliers, customers and competitors, or removing tension between firms through partnering in complex inter-firm relationships.

This implies a change of purchasing from getting parts at the cheapest price in the traditional make or buy dichotomy towards a strategic purchasing and sourcing function that focuses on the establishment of inter-firm partnerships by selecting the right type of relationships with the suppliers and the strategic management of these. Hence, strategic sourcing needs to be proactive rather than reactive (Cox, 1996). In recent studies Cousins *et al.* (2006) and Giunipero *et al.* (2006) provide empirical evidence for this exhortation of the purchasing and supply management function becoming strategic.[10]

Thereby, strategic sourcing not only involves the supply of parts and components but also product design and development services (Mabert and Venkataramanan, 1998). Rossetti and Choi (2005) even go as far as considering strategic sourcing as the integration of a buyer's strategic decisions with its key suppliers. MacBeth (1994) concludes that purchasing becomes central to the whole cost-reducing, innovation-enhancing, market-competitive positioning of an organisation through the evolution of its role to business relationship management. This ultimately provided the ground for Total Cost of Ownership (Ellram, 1993) becoming Total Cost of Relationship (Maltz and Ellram, 1997).

[10] An overview of related literature can be found in Cousins and Spekman (2003). Goffin *et al.* (1997) provide a comparison between the traditional purchasing approach and the strategic supply management approach.

Similar discussions drawing on different theoretical perspectives in the context of inter-firm relationships can for example be found in Ellegaard *et al.* (2003) who provide a synopsis of TCE, relationship marketing and IMP. Olsen and Ellram (1997a) compare the basic concepts of marketing, purchasing and IMP, whereas Trienekens and Beulens (2001) provide an overview of perspectives within SCM, Strategic Management, Organisational Economics emphasising their complementarity in the context of inter-firm relationships. Gulati *et al.* (2000) consider strategic networks in the context of TCE, RBV and IO issues similarly to Dyer and Singh (1998) who compare IO, RBV and Relational View of the firm. Sydow (1992) and Grandori and Soda (1995) provide the most comprehensive overviews drawing on a plethora of economic, political and inter-organisational theories.

In general the above discussion shows that none of the outlined disciplines and its theoretical perspectives can sufficiently explain the sustainable governance of complex inter-firm relationship constellations to its full extent. Although these approaches can be seen as complementary tools for the governance of inter-firm relationships (Trienekens and Beulens, 2001), the simple addition of their deductive assumptions to a exhaustive concept seems inappropriate because of their distinction with regard to the causal perspectives on inter-firm relationships that can even be contradictory. However, a partial integration that considers the evolution of inter-firm relationships and the development of inter-organisational structures seems feasible and desirable alike (Sydow, 1992). Hence, a summary of the body of knowledge, i.e. the main disciplines, their theoretical perspectives and their relevance for the research topic of sustainable governance of inter-firm R&D relationships, is shown in Table 3.5.

<table>
<tr><th>Discipline</th><th>Theoretical perspective</th><th>Key issues</th><th>Relevance for inter-firm relationship governance</th></tr>
<tr><td>Organisational Economics</td><td>Transaction Cost Economics</td><td>• Search for most economic mechanism to govern transaction<br>• Efficacy of mechanism determined by transactions specificity, uncertainty and frequency<br>• Contracts safeguard bounded rationality and opportunism<br>• Ignores necessity to collaborate even if not transaction cost economic</td><td>Identification of appropriate inter-organisational forms to govern collaborative transactions in inter-firm relationships</td></tr>
<tr><td rowspan="4">Strategic Management</td><td>Industrial Organisation Theory</td><td>• Competitive advantage determined by external industry factors<br>• Sees inter-firm relationship as means for firms to gain competitive advantage<br>• Ignores relationship as unit of competitive analysis</td><td rowspan="4">Positioning and role of individual partners within inter-firm relationship based on competencies relevant to joint R&D and product development in order to gain competitive advantage for whole relationships and partners within competitive empirical context</td></tr>
<tr><td>Competence Theory</td><td>• Competitive advantage determined by internal resource base<br>• Resources are heterogeneous and imperfectly mobile<br>• Firms should be considered as portfolios of competencies<br>• Ignore external context and rigidities that can be caused by competencies</td></tr>
<tr><td>Resource Dependency Theory</td><td>• Firms are interdependent due to restricted availability of resources<br>• Control over critical resources determines power position relative to other firm<br>• Collaboration reduces autonomy but enables access to resources</td></tr>
<tr><td>Value Chain Concept</td><td>• Firm conceptualised as set of strategically relevant activities<br>• Conceptualisation of joint product development process as virtual value chain</td></tr>
<tr><td rowspan="2">Organisation Science</td><td>Contingency Theory</td><td>• Organisational structure dependent on fit with internal and external contingencies as well as strategic choice of decision maker<br>• Inter-firm relationship require twofold fit<br>• Lacks of explanations for re-configuration of structures as contingencies change</td><td rowspan="2">(Re)structuring of inter-firm relationships to be adaptive to environmental (exogenous) and relationship (endogenous) contingencies</td></tr>
<tr><td>Complex Adaptive Systems</td><td>• Organisations are complex adaptive systems that co-evolve within social ecosystem<br>• Trade-off between internal structural consistency and fit to external contingencies needs to be managed<br>• Change occurs radically rather than moderately</td></tr>
<tr><td rowspan="2">Industrial Marketing Management</td><td>Relational View</td><td>• Boundary-less organisation through elimination of boundaries within and across firm boundaries<br>• Close relations create joint customer value in form of relational rents</td><td rowspan="2">Establishing close relationships within and across company boundaries to create customer value</td></tr>
<tr><td>Interaction model of IMP Group</td><td>• Relationship as most important resource for a firm<br>• Interaction options of actors depend on their position in network</td></tr>
<tr><td rowspan="2">Purchasing & Supply Chain Management</td><td>Total System Optimisation</td><td>• Views supply chain as single entity tying individual success to success of overall supply system</td><td rowspan="2">Building and managing effective inter-firm relationship based on total system optimisation and strategic sourcing</td></tr>
<tr><td>Strategic Sourcing</td><td>• Move from traditional commodity purchasing to business relationship management<br>• Total cost of relationship becomes crucial</td></tr>
</table>

**Table 3.5: Body of knowledge related to inter-firm relationship governance**

### 3.4. Summary

This chapter provides the theoretical grounding and point of departure for this research. The relevant literature on inter-firm relationships was reviewed from a selected list of 40 crucial journals (cf. section 3.1.). The review revealed that there are gaps to be found in various dimensions of research (cf. section 3.2.):

- Necessity to create a synthesised, i.e. holistic and integrated, model of inter-firm relationships by not focusing on individual firms but embedding dyadic relationships in their network context **(applied unit of analysis)**
- Mecessity for taking a multi-perspective approach by addressing multiple theoretical issues related to inter-firm relationship governance **(applied theoretical perspectives)**
- Necessity for more qualitative theory-building research on inter-firm relationship governance that proposes normative rather than descriptive models **(applied methodology)**
- Necessity of investigating the process of establishing and developing inter-firm relationships, especially at early stages of collaboration **(building relationships)**
- Necessity to explore dynamic aspects of inter-firm relationships, i.e. adaptation and reconfiguration of roles and governance structures **(managing relationships)**
- Neccesity to establish models that enable to optimise performance and thereby sustain inter-firm relationships **(impact on relationship success)**

Based on the identified gaps this led to the aim of this research study (cf. section 3.2.7.) in the form of **developing a framework and practical guidelines on how to govern, i.e. design and manage, these inter-firm relationships in a sustainable way to create a competitive advantage for the whole relationship and its individual members.**

Subsequently, the topic of inter-firm relationships within the area of **strategic supply management** was embedded in its interdisciplinary body of knowledge (e.g. Organisational Economics, Strategic Management, etc.) outlining the most relevant theoretical perspectives and their contribution in the discussion of inter-firm relationship governance (cf. section 3.3.). This provides the basis for the discussion of the empirical findings in the context of the theoretical perspectives in Chapter 6 after the empirical findings have been presented in Chapter 5.

# 4. METHODOLOGY OF THE RESEARCH

*"We can regard the research process as a series of logically ordered ... choices. Those choices run from formulation of the problem, through design and execution of a study, through analysis of results and their interpretation. The series of choices is locally directional: Plan must come before execution; data collection must come before data analysis. But the set of choices is systematically circular: It starts with a problem, and gets back to the problem. The end result of the process, however, never arrives back at the exact starting point, even if all goes well."* (McGrath, 1982; p. 71)

As reasoned in Chapter 1, the topic of the research is the sustainable governance of inter-firm relationships. Thereby, this research is embedded in the empirical context of inter-firm R&D relationships in the German automotive industry for reasons addressed in Chapter 2. In the previous Chapter 3 (cf. section 3.2.) it was shown that gaps in the current literature are to be found on various dimensions of inter-firm relationship governance leading to the research aim of **developing a framework and practical guidelines on how to govern, i.e. design and manage, these inter-firm relationships in a sustainable way to create a competitive advantage for the whole relationship and its individual members.**

This chapter explains the methodological conceptualisation of the underlying study along with a discussion of the necessary 'choices' apparent at the different steps of the research process. The structure of the chapter is based on Morgan's (1979) three levels of application of a methodological paradigm which can be seen as 'strategic entities' involved in the research process: "There is a connection between [1] the concepts of reality to which social scientists adhere [ontology], [2] the schools of thought to which they belong [epistemology], and [3] the kinds of 'tools' which they use [methodology]..." (p. 137).

The subsequent section 4.1. aims at outlining the ontological paradigm which underpins the nature of this study followed by its epistemological research approach described in section 4.2. Section 4.3. concentrates on the particular research methodology including the selection of an appropriate method and its related empirical research process that defines the quality of this research as described in section 4.4. Finally, the main aspects of this chapter are summarised in section 4.5.

## 4.1. Ontological paradigm of this research

"To have value or not to have value" (p.15) - in reference to Shakespeare - reflects for Becker (1971) a dilemma in research which apparently does not exist. Given the fact that a value free, 'uncontaminated', research is not possible, the question is not whether we should take side but rather whose side we are on. This leads to the question of the ontological world view of the researcher which is closely interrelated with the epistemological preference for more qualitative or more quantitative research approaches (cf. section 4.2.). This was already claimed by Kuhn (1970) when he elaborated that scientific research could not take place without paradigms, since science needs an organising principle. However, it is both difficult and dangerous at the same time to allocate qualitative or quantitative approaches to certain ultimate ontological paradigms. Just as quantitative researchers would resist to be seen as 'positivists' because "...they do not claim to produce a science of laws (like physics) but aim simply to produce a set of cumulative generalizations based on the critical sifting of data..." (p. 5), there is no general basis underlying all qualitative approaches (Silverman, 2000).

Nevertheless, people view the world differently and operate in different paradigms due to which the immanent paradigm of this particular research study also needs to be specified. Whereas the traditional paradigms, i.e. positivism[11] vs. interpretivism[12], reflect rather extreme positions in the philosophy of social science, today it is no longer a question of language versus consciousness, understanding versus explanation or theory versus practice, but a question to which extend social reality is constructed by social science (Delanty, 2002). This means, although there is a clear dichotomy between the two ontological perspectives, the reality of research involves a lot of compromise between the pure positions. Each investigator must decide what assumptions are appropriate for the topic of interest and then use strategies and methods consistent with the selected paradigm (Crabtree and Miller, 1999a).

[11] The key idea of representatives of positivism, such as Dürkheim, Mill, Popper or Kuhn, is that the world exists of relatively concrete artefacts and relationships (termed 'objectivism'; Bryman, 2004), rather than being inferred subjectively through reflection or intuition (discourse of science). Hence, methods, principles, and procedures of the natural sciences can be applied to the study of the social world (Burrell and Morgan, 1979). In terms of theory generation this means that theory is deduced as a result of testing hypotheses in a rather pragmatic manner and therefore the development of knowledge is a cumulative process where new results are constantly added to an existing "stock of knowledge" (Burrell and Morgan, 1979; p. 5).

[12] The interpretive tradition is rooted in the phenomenological and hermeneutic tradition of theorists such as Weber, Schutz, Husserl, Heidegger or Gadamer. It takes the view that world and reality are not objective and exterior but relative and are given meaning by the implicit interactions of the 'entities' intrinsic in the real system (termed human constructions or 'constructivism'; Bryman, 2004). Hence, a goal of interpretive fashioned research is to use yourself as a research instrument in order to get a deep understanding of the social phenomena, i.e. you have to 'take the role of the other' to acquire social knowledge (Frankel, 1999).

Truly everyone is a specialist in a certain field of interest. For that reason every researcher will only be able to address a research problem with a certain toolbox which is subjective and influenced by his or her individual background, education and theory basis in which he or she has been trained. Concerning this factor in connection with a fragmented, complex and ambiguous world that is to be observed, there is no sense in claiming the ultimate truth of one's findings and communicate them as such, because everyone will have different views on the same problem. It rather opens space for individual interpretations and the use of one's own toolbox and framework in order to make some contributions to knowledge by reconstructing the complexity immanent in the explored problem (Delanty, 2002). All this requires to shift away from the value free research and accept the scientist as a part of society. This is clearly reflected in the 'constructivist' paradigm, which builds on the premise of the social construction of knowledge by its context (Delanty, 2002). There is no ultimate but only contextual truth - with context-bound constructions that are part of a larger universe - which can be obtained by constant interpretation and reflection (Crabtree and Miller, 1999a). However, it is also necessary to accept parts of the social reality as objective, i.e. to accept a realist ontology of the social world, because behind the constructions of social actors there are objective realities to be found (Delanty, 2002).

Considering this, for the purpose of this research study, the author would like to argue for a somewhat combined paradigm of realism and constructivism, which Beck (1979) termed 'reflexive realism' or 'constructive realism'; it can be seen as an abstraction of the idea of 'interpretivism' with all its implications. In terms of the ontological discussion the author defines it as a middle ground between an objective and subjective world view based on the framework provided by Johnson and Duberley (2000; p. 180).

Although inter-firm relationships, which are the subject of investigation in this study, are a socially constructed phenomenon, they are still part of the greater objective reality of business activities in which certain common rules and pressures apply to all participants. But because these structures are human activity systems and the investigated collaboration activities between companies in a relationship are of a dynamic nature, constant interpretation and reflection is necessary throughout the research process in order to get outside the constructivist processes and obtain some sort of objective position for description and explanation (Lee, 1991). In doing so, the investigated processes need to be embedded in their wider context of action and reaction, whereby it is important to capture the perspectives of the 'entities' involved. This is reflected in the paradigm of 'constructive realism' (Delanty and Strydom, 2003). However, in the understanding of the author this combination can only be achieved by taking over an active role in the research process which will inevitably affect the design of the research process with its specific techniques for data collection and analysis (cf. section 4.3.).

## 4.2. Epistemological paradigm of this research

When determining the appropriateness of a methodological research concept, one must trace it back to its epistemological roots: the qualitative and quantitative paradigm. Johnson and Duberley (2000) argue that "how we come to ask particular questions, how we assess the relevance and value of different research methodologies so that we can investigate those questions, how we can evaluate output of research, all express and vary according to our underlying epistemological commitments" (p. 1).

Qualitative and quantitative methods are two distinctive but interrelated research approaches in the field of social science that actually complement each other (Auerbach and Silverstein, 2003). Whereas quantitative methods were originally developed in the natural sciences in a more positivistic domain to study natural phenomena, qualitative approaches should enable researchers to explore empirical, social, and cultural phenomena in social sciences. In many peoples minds the notions of 'qualitative' and 'quantitative' research are used interchangeable with terms like 'subjective' and 'objective' (Burrell and Morgan, 1979) or 'soft' and 'hard' (Lincoln and Guba, 1985).[13] In response to this, qualitative data is often characterised as rich, deep, earthy, holistic, symbolic and reflexive whereas quantitative data is seen as hard, reliable, measurable and valid (Miles and Huberman, 1994; Bryman, 2004).

However, it is a common misconception that quantitative research is 'scientific' because it pretends to be based on objective values and measures, whereas qualitative methods seem to be 'unscientific' because they are based on subjective judgements and interpretations that can hardly be generalised or objectively tested and therefore lack of dependability (Bryman, 2004). Nevertheless, for the reasons of further argumentation and evaluation of an appropriate

[13] A good overview of equivalent terms used for 'qualitative' and 'quantitative' can be found in Silverman (2000; p. 2).

research approach for this study, it is important to clarify some basic differences of qualitative and quantitative research.

### 4.2.1. Quantitative approaches

Quantitative methods are well established and well tested approaches (Auerbach and Silverstein, 2003). The quantitative research approach can basically be described as a structured and deductive procedure from theory to research, as shown in Figure 4.1. A big emphasis is thereby put on the analysis and measurement of data via statistics due to the issues of validity and reliability. Popular methods used in a quantitative approach are for example questionnaire surveys, structured interviewing or structured observation, which have to be made very clear and explicit in order to achieve replication and objectivity of the results (Bryman, 2004).

Aston University

Illustration removed for copyright restrictions

**Figure 4.1: Outline of quantitative and qualitative research approaches (Source: Bryman, 2004)**

One of the main concerns of quantitative research is to explain phenomena, i.e. examining their causes, which is reflected in the idea of dependent (effect) and independent (cause) variables that are developed for measuring purposes leading to hypothesis-testing research (Auerbach and Silverstein, 2003). The data on these variables have then to be collected, analysed and interpreted to the extent that general conclusions beyond the particular context of the research can be drawn, i.e. the generation of theory. This is indicated with the 'feedback loop' (dotted line) in Figure 4.1.

### 4.2.2. Qualitative approaches

Qualitative methods were developed in response to the limitations faced by quantitative research and thereby often challenge the assumptions of the positivist paradigm (King, 1994). As opposed to its quantitative counterpart, the qualitative research approach interprets phenomena from the perspective of the subjects being studied, because social phenomena are recognised to result from a blend of social, economic, political and environmental factors that cannot be studied in isolation (Bryman, 2004).

Therefore, the process is a less structured and more inductive procedure from empirical research to theory generation, which starts with fairly general research questions (Bryman, 2004) leading to hypothesis-generating research (Auerbach and Silverstein, 2003). This is necessary because keeping the structure simple not only raises the opportunity of genuinely capturing the perspectives of the participants but also ensures the necessary flexibility which is needed for the iteration between data collection, data interpretation and deriving conceptual frameworks ('iteration loop' indicated trough dotted lines in Figure 4.1).

An important objective of the qualitative approach is to describe and explain the different elements of the explored social system and their interconnection in very much detail, i.e. to provide a holistic view of the context (Miles and Huberman, 1994). Hence, it aims at the contextual understanding of social behaviour rather than extensive measurement (Symon and Cassell, 1998). This should lead to substantive theories that are generated from the data, i.e. they are 'grounded' in the data (Glaser and Strauss, 1967). Miles and Huberman (1994) elaborate that "qualitative data are a source of well-grounded, rich descriptions and explanations of processes in identifiable local contexts" (p.1).

In contrast to the quantitative, the qualitative approach allows the researcher to get first hand experience, i.e. development of analytical, conceptual, and categorical components of explanation, from the data itself, rather than from the preconceived and structured definitions constructed by the researcher (Filstead, 1971). In addition, qualitative researchers believe that their own experience can be a source of knowledge about the phenomenon under investigation, which is subsumed under the term reflexivity (Auerbach and Silverstein, 2003). Common techniques that are used for the purpose of data collection and analysis are for example focus groups, textual analysis, ethnography, observation or unstructured interviews (Bryman, 2004).

### 4.2.3. Mixed approaches

> *"Not everything that can be counted counts, and not everything that counts can be counted."* (Albert Einstein, 1879 – 1955)

Even if both approaches show distinctive characteristics, which put them in advantageous positions for specific research situations, there are large overlaps offering complementary tools for data collection and analyses (Bryman, 2004). In this context Van Eijkelenburg (1995) argued that it is time for advocates of both sides to declare a "rhetorical cease-fire" (p.209). Considering the fact that there is nothing about any single method *per se*, the choice as to whether a research is conducted in qualitative, quantitative or mixed dimensions is a technical decision that should simply stem from their appropriateness to solve the research problem and the goals of the researcher (Silverman, 2000). He further argues that such dichotomies or polarities in social science are "highly dangerous" in general (p. 11).

For that reason, Yin (2003) argues that a more appropriate view of the different approaches should be a pluralistic one, in which each approach can be used for all three general research purposes: exploration, description and explanation. Similarly, Gioia and Pitre (1990) argue for multi-paradigm approaches towards theory building that "offer the possibility of creating fresh insights because they start from different ontological and epistemological assumptions and, therefore, can tap different facets of organisational phenomena and can produce markedly different and uniquely informative theoretical views of events under study" (p. 591). This is acknowledged by various examples of mixed methods in the literature (e.g. Argyris, 1979; Larsson, 1993; McClintock *et al.*, 1979).

## 4.3. Applied research method

As outlined above, methodology is the guideline for obtaining knowledge, i.e. it entails the process, principles, and procedures by which we approach problems and seek answers (Delanty and Strydom, 2003). In this sense the research methodology is central for the theoretical contribution of knowledge to the scientific discipline as well as for the application of this knowledge to practice (Van de Ven, 1989).

The methodological point of departure for the empirical work is a lack of testable theoretical propositions and hypotheses, which makes the approach of hypothesis testing inappropriate. This is because not enough explicit hypotheses exist or are too abstract to be tested in a large scale deductive manner due to the embryonic stage of hypothesis-generating research on strategic supply management issues (Handfield and Melnyk, 1998). Furthermore, investigating and analysing the governance aspects of inter-firm relationships requires attention to details of contextually rich data and the understanding of subjective experience of employees in the German automotive industry which cannot be reflected in quantifiable variables of quantitative hypothesis-testing research (Auerbach and Silverstein, 2003).

Such research is rather exploratory in nature which favours an empirical and more qualitative hypothesis-generating research approach rather than theory testing (Eisenhardt, 1989; Snow and Thomas, 1994). This will provide the necessary openness and flexibility to gain a sound understanding of the research topic by grasping the 'hows' and 'whys' of it and thereby uncovering themes not previously accounted for in the existing literature (Leary, 2001), i.e. a "strategy concerned with the discovery of substantive theory, not with feeding quantitative researchers" is necessary (Glaser and Strauss, 1971; p. 289).

Since this research aims at extending current theory on strategic supply management through hypotheses generation and theory building, Grounded Theory (Glaser and Strauss, 1967) was chosen as an inductive qualitative theory building approach. This also addresses the fact that today's complex and dynamic world calls for less hypothesis testing and more systematic observation to help managers deal with their actual problems in operations and supply chain management (Hayes, 2000). Grounded Theory has to be considered as a touchstone for scholars conducting qualitative research in social sciences (Suddaby, 2006).

> *"Glaser and Strauss offered a compromise between extreme empiricism and complete relativism by articulating a middle ground in which systematic data collection could be used to develop theories that address the interpretive realities of actors in social settings."* (Suddaby, 2006; p. 634).

> *"Grounded theory is a detailed grounding by systematically and intensively analysing data, often sentence by sentence, or phrase by phrase of the field note, interview, or*

*other document; by constant comparison data are extensively collected and coded, thus producing a well-constructed theory"* (Strauss, 1987; p. 22)

The choice for this research methodology, given the nature of this study, is also supported by various other scholars (Crabtree and Miller, 1999a; Miles and Huberman, 1994).[14] Yin (2003) and Benbasat *et al.* (1987) refer to some basic conditions that particularly determine the selection of an appropriate method: (1) the types of research questions, (2) the extend of control or manipulation of subjects and events, and (3) the degree of focus on contemporary in contrast to historical events. This study mainly asks 'why' and 'how' questions and focuses on very current collaboration tendencies in automotive businesses over which the researcher has no control. This involves an explorative and explanatory nature that favours Grounded Theory because of its ability to provide depth and richness for constructing knowledge and building theories of contemporary and little known phenomena. Furthermore, Locke (1996) postulates that "grounded theory ... must *closely fit* the substantive area studied, be *understandable* to and *usable* by those in the situation studied, and be sufficiently *complex* to account for a great deal of variation in the domain examined." (p. 240).

Grounded Theory research uses the basic principles of (1) questioning rather measuring and (2) generating hypotheses using coding techniques (Auerbach and Silverstein, 2003), i.e. it enables the researcher to 'ground' the hypotheses in the empirical data given by the research participants that are the experts on the phenomenon being studied: "Most hypotheses and concepts not only come from the data, but are systematically worked out in relation to the data during the course of the research" (Glaser and Strauss, 1967; p. 6). Hence, this method is an 'envelope' with the unique ability to cultivate fruitful insights from a great variety of sources and evidence - documents, archival records, artefacts, interviews, transcripts of meetings, questionnaire answers, field observations, etc. – which enables the researcher to group the holistic and meaningful characteristics of reality and therefore understand complex social phenomena (Glaser, 1978).

Grounded Theory is particularly appropriate when (i) research and theory are at their early, formative stage and not enough is known on the phenomenon to state hypotheses prior to the investigation (Auerbach and Silverstein, 2003) and when (ii) the major research interest lies in the identification and categorisation of elements and the exploration of their connections

[14] A good overview of a classification of research methods and when to use them can be found in Ellram (1996; p. 98).

(Tesch, 1990). Hence, it is a discovery orientated approach which allows for a contextual analysis of empirical data and facilitates theory construction from it.

Hence, this study claims to produce theoretical propositions, contentions and theory extensions that can be developed into generalised theory and general frameworks to improve the understanding of inter-firm relationships. This is possible as qualitative data are "generalizable to theoretical propositions (analytical generalisation) and not to populations or universes (statistical generalisation" (Yin, 2003; p. 10). The goal of qualitative research, and hence of this study, is an analytic generalisation via the extension of theories and not a statistical generalisation via the enumeration of frequencies (Yin, 2003) which Lee and Baskerville (2003) in their classification framework of generalisability introduced as the concept of 'Type ET Generalizability: Generalizing from Description to Theory' (p. 235).

The key feature of Grounded Theory is a recursive, process-orientated, analytic procedure using the two key operations: *constant comparison* and *theoretical sampling*. These operations are essential to develop dense, tightly woven and integrated theories and are the major difference between the grounded style and other qualitative research strategies (Strauss, 1987). They deliver a substantive theory related to the substantive area of research rather than a formal theory pertaining to a conceptual area (Glaser, 1994). It normally begins with the definition of a research problem, proceeds to the collection of the relevant data and continues onto a tentative explanation of that problem via forming provisional categories and abstractions of the data (involving constant comparison). This comparison challenges the properties of the initial concepts and categories and the researcher needs to go back to redefinition of the propositions or to further data collection and analysis (theoretical sampling). In this process the researcher moves back and forth between inductive and deductive modes of data collection, coding and interpretation in an iterative manner (analytic induction) until theoretical saturation is achieved which leads to a tightly woven theory that emerges from and is 'grounded' in the data: "They should blur and intertwine continually, from the beginning of an investigation to its end." (Glaser and Strauss, 1967; p. 43).

By using Grounded Theory, major prejudices of qualitative research can be overcome. *Firstly*, the often mentioned concern of a lack of generalisability of results because of applying a qualitative and *ad hoc* method (Ellram, 1996; Yin, 2003) can be compensated with the more abstract approach of Grounded Theory applying different levels of coding and categorising through the features of constant comparison and theoretical sampling that enable the generalisation of empirical results to basic theory. *Secondly*, the 'postponed' literature review of the Grounded Theory method strengthens, i.e. tests, the developed propositions and theories instantly in an iterative manner by confronting them with the relevant literature (cf. Chapter 6). However, as mentioned above, this study does not claim to generalise results to populations (statistical generalisation) rather it aims at generalising results to the extension of theories (analytical generalisation).

In the context of this study, the author would like to draw the readers' attention to the emphasis of using the notion 'proposition' rather than 'hypothesis' for the reason that propositions involve concepts whereas hypotheses require measures and can technically be tested without understanding the 'whys' behind the concept (Whetten, 1989), which is not the aim of this research.

To summarize, three main reasons why Grounded Theory is appropriate for this study can be identified: *Firstly*, the researcher can study inter-firm R&D relationships in the automotive industry in their contemporary and natural setting, understand and learn about their foundations to generate theory from practice. *Secondly*, this method allows to answer 'how' and 'why' questions in an explorative as well as explanatory manner to understand the dynamic complexity behind the governance of inter-firm R&D relationships and its influence on the competitive success of the whole partnership. *Thirdly*, the approach is an appropriate way to research an area where little theoretical foundation exists so far by exploiting a full variety of evidence.

In order to facilitate the elements of constant comparison and theoretical sampling sufficiently, ultimately leading to theoretically saturated propositions, and eventually a novel concept, the methodological research process of this particular study was structured in four main phases as shown in Figure 4.2: design, data collection, data coding and analysis, and data validation. In addition, within each box of the diagram the respective chapter that deals with its subject is given to guide the reader through the structure of this thesis. A similar approach and research design has been adopted by others in comparable research studies (e.g. Baines *et al.*, 1999).

Aston University

Illustration removed for copyright restrictions

Figure 4.2: Outline of the methodological research process (Adapted from Yin, 2003)

The remainder of this section 4.3. will be structured around these four phases discussing each phase and its related methodological aspects in turn in order to provide the reader with a logical and easy to follow presentation of the empirical research approach of this study.

### 4.3.1. Design phase

The main aim of the research design stage is to ensure a high level of rigour of the study to avoid conclusions that the research does not actually reveal and at the same time ensure a connection to 'real' problems (Auerbach and Silverstein, 2003). In this sense Yin (2003) states that the reader should be able to follow the derivation of any evidence from the initial research question to the final conclusion of the study.

***Research objectives***

The first step in entering the empirical research process was to identify appropriate research objectives that guide the empirical work. Based on the potential gaps in the extant inter-firm relationship literature that have been identified in Chapter 3 (cf. section 3.2.), the aim of this research is to **develop a framework and practical guidelines on how to govern, i.e. design and manage, inter-firm relationships in a sustainable way to create a competitive advantage for the whole relationship and its individual members.**

Hence, this study builds a broad understanding of inter-firm relationships by exploring, describing and explaining in detail 'what' underlies successful collaboration in inter-firm relationships, and 'why' and 'how' an appropriate governance based on inter-organisational structures can facilitate the competitive success of inter-firm relationships as a whole as well as for their individual members. In trying to achieve this general purpose, several specific research objectives can be identified that are based on the research themes and gaps identified in the literature above (cf. section 3.1. and 3.2. in Chapter 3):

- Explore the current practice of R&D collaboration within inter-firm relationships in the German automotive industry
- Determine strategic factors and contingencies that influence the creation and management of inter-firm R&D relationships and the development and management of the related inter-organisational governance structure
- Determine operative practices and tools that influence R&D transactions and collaborative activities within inter-firm relationships
- Develop guidelines for achieving sustainable competitive success of inter-firm R&D relationships

Because at the beginning of the investigation not enough was known on inter-firm R&D relationships in the German automotive industry to formulate specific hypotheses, the author adhered to the basic guidelines of inductive qualitative research (cf. Figure 4.1). Hence, the author was looking for open and unclear issues that emerged from a basic literature review (cf. section 3.2. in Chapter 3) leading to more general research concerns expressed by the research objectives above (Auerbach and Silverstein, 2003). These objectives guided the data collection and analysis process and were implicitly refined during coding and analysis. Ultimately this led to the development of tentative propositions and the initialising of a second empirical phase in form of a questionnaire survey to validate the emerging findings. Thereby, the author followed the suggestions of Glaser and Strauss (1967) in that substantive theory is a starting point for the formulation of formal theory that is grounded in the data.

***Triangulation***

A second important decision that needs to be made during research design focuses on the selection of appropriate data collection techniques. In this context, triangulation refers to the use of different techniques for data collection and analysis to study the same phenomenon and at the same time provide validity and reliability within the research method (Jick, 1979). As such, it does not only enhance the quality of the research but also helps in avoiding typical and crucial mistakes in the research process by identifying essential issues from different perspectives.[15] Triangulation forms a rich and comprehensive set of data surrounding the specific research problem to capture the contextual complexity of the research topic (Benbasat *et al.*, 1987).

In this context Jick (1979), distinguishes between 'within-method' or 'internal' triangulation, i.e. different approaches within a given data collection technique, and 'between-method', 'multi-method' or 'external' triangulation, i.e. different data collection techniques to examine the same phenomenon. No matter which triangulation 'approach' (or a combination of both) is chosen, the notion of triangulation implies that "qualitative and quantitative methods should be viewed as complementary rather than as rival camps" (Jick, 1979; p. 602). Since the effectiveness of triangulation is based on the assumption that the weaknesses of one method are compensated by the counter-balancing strength of another one, the data collection techniques used in this research represent a mixture between qualitative and quantitative approaches with respect to the their individual strengths and weaknesses (cf. section 4.2.). This provides transferability, credibility, and confirmability of the study (cf. section 4.4.).

Primary techniques used in qualitative research are observation, interviewing including many sub-techniques such as focus groups, and some kind of document and textual analysis, which are often referred to as the 'big three' (Cassell and Symon, 1994; Silverman, 2000). Common techniques applied in quantitative research are questionnaire survey, and forms of structured interviewing and observation (Bryman, 2004). Despite the qualitative and theory building nature of this research study, Grounded Theory rarely relies on interviews as its sole form of data collection (Suddaby, 2006). Hence, a multi-method approach has to be applied that

[15] The mistakes in the research process referred to above can be classified into four categories of research errors (Crabtree and Miller, 1999a; Kirk and Miller, 1986):
Type 1 error: believing a principle to be true when it is not
Type 2 error: rejecting a principle when in fact it is true
Type 3 error: solving the wrong problem or asking the wrong questions
Type 4 error: solving a problem not worth solving

provides answers to the 'what', 'why' and 'how' questions on the governance of inter-firm R&D relationships in the automotive industry. Hence, techniques that were used for data collection, analysis and validation in this study involved semi-structured interviews, self-completion questionnaires, and focus groups. Thereby, this research design also fulfils the requirements of sequential triangulation (Creswell, 1994) in that the results of prior empirical steps drive the planning of subsequent empirical phases.

***Sampling***

A third fundamental issue of the research design in this empirical research is to decide on the sample size and sampling procedure concerned with the three data collection techniques that will allow for the 'generalisation' of the findings into theoretical propositions.

Grounded theory does not think that random sampling is realistically possible since it aims for research participants who are experts on the phenomenon under investigation (Auerbach and Silverstein, 2003). Random sampling even violates the central analytic tenets of Grounded Theory philosophy (Locke, 1996). In this study this involved managers within car manufacturers and their suppliers who have strategic insights and responsibilities in inter-firm R&D collaboration in their respective supply relationships (practical consideration). Random sampling, however, would imply that the researcher has equal access to all members of a subculture (e.g. managers) that are then equally likely to be selected by a random sampling technique. This was definitely not the case in this study where the access to experienced managers in the automotive industry as research participants was one of the major constraints.

Therefore, for this research the author used a combination of convenience and snowball sampling by recruiting interview participants whom the author had access to through personal contacts and asking those participants to provide further contacts. Surprisingly, this method actually worked to a certain extent because the German automotive industry shows a quite interwoven structure wherein the managers, especially on higher organisational responsibility levels, are well connected with their counterparts of other companies, not only within their respective supply relationships. For example, a middle manager in R&D of a car manufacturer was won as interview participant via a senior R&D manager from another car manufacturer. A similar approach was used for gaining a sufficient sample in the questionnaire survey. There, the original interviewees were contacted for the completion of the questionnaire and further asked to forward the questionnaire to co-workers, colleagues or business contacts in other automotive companies (car manufacturers and suppliers). Finally, convenience sampling based on personal contacts was also used for the focus group sessions.

Regarding the selection of the right sample size no clear recommendations can be found in the literature. Eisenhardt (1991) and Stake (1995) somewhat point out that a criterion is the maximisation of the learning effect, i.e. how much is known and how much new information can be gained of any further participant. In Grounded Theory research the sample size cannot be determined in advance because each research participant potentially embodies the opportunity to develop and refine theory (Auerbach and Silverstein, 2003). In alignment with Eisenhardt's (1991) and Stake's (1995) opinion, the researcher has to keep recruiting and interviewing research participants until no new data is produced that adds new insights to theory construction or no new information is learned about the research topic. This procedure is called 'theoretical sampling' (Glaser and Strauss, 1967) and ultimately determines the sample size of the study (Auerbach and Silverstein, 2003). This approach was followed throughout the interview phase of this study which involved iterative steps in data collection and analysis in order to determine a certain level of saturation ('overlapping data analysis'; Eisenhardt, 1989), i.e. following interviews became informed by analytic questions and hypotheses about data relationships drawn from previous interviews (Strauss, 1987).

For the questionnaire survey no saturation limit was applied because the larger the size of the sample, the more likely it is to provide a reliable picture of the population in which the studied phenomenon is observable. However, since this second empirical phase was mainly used for the validation of the emerging propositions from the interviews and not for large scale hypothesis testing, it was not considered imperative to gain a statistically representative sample size. Nevertheless, it was the aim of the author to generate a sample which shows a greater variety in participating companies and respondents than the interview sample. With regard to the focus group, the author followed the advice given in the literature (Morgan, 1998) that suggests a typical group size of six to then members or smaller groups if participants are likely to have to say a lot on the topic.

Due to the limited access to research sites and participants, for the selection of the actual sites from which the interview participants are to be selected this study followed the recommendations of Pettigrew (1990) and Eisenhardt (1989) to choose cases such as extreme situations or 'polar types' in which the topic of interest was expected to be observable.

Therefore, as research sites companies that reflect different roles, and hence participate differently within inter-firm relationships, were chosen. This included: car manufacturers, systems suppliers, module suppliers, parts or components suppliers, and engineering service providers (cf. Figure 2.1 in Chapter 2).

These multiple sites represent replication that allow for the development of a rich theoretical framework and hence might be more generalisable, i.e. valuable for theory building (Eisenhardt, 1989; Yin 2003). Multiple sites also allow for 'cross-case' analysis, which Glaser and Strauss (1971) refer to as multiple comparison groups for providing new data, suggesting new hypotheses and verifying initial hypotheses in diverse contexts. In short, replication is build into this research, which maximises transferability and confirmability of the research results.

***Interview guide***

The fourth and last step to be taken within this research design phase deals with the design of an interview guide for the semi-structured interviews. In alignment with the ideal of a bias free research, for this study a literature review was only conducted to the extent that enabled the researcher to identify and suggest important topics on which the interview questions should focus (cf. Chapter 3). Thereby the author tried to avoid to gain too much *a priori* knowledge about particular concepts and frameworks in order to let the data "speak for itself" and overcome what Van Maanen (1979) terms as 'Sherlockian prescription' (p. 539), i.e. "the temptation to form premature theories upon insufficient data" (Baring-Gould, 1967 cited in Van Maanen, 1979), an analogy for the tendency of researchers to theorise in advance of the facts leading to the possibility that the facts emerging from a study are twisted to influence a given theory.

Together with the recommendation to conduct 'narrative interviews' (Auerbach and Silverstein, 2003), i.e. asking questions that take the participants through their history with the investigated phenomenon, the author developed an interview guide that contained aspects on (i) the company's industrial and competitive environment, (ii) the company's value system and competence context, and (iii) the basic collaboration issues between car manufacturers and suppliers in their inter-firm relationships. Since the interviews were exploratory in nature and aimed to collect a great variety of data on inter-firm R&D collaboration to facilitate hypotheses generation, the researcher provided the interviewees with opportunities to bring up unanticipated topics since they are the experts of the studied phenomenon (Auerbach and Silverstein, 2003).

Hence, the interview guide did not pose a set of exclusive questions but rather a collection of topics and aspects to be discussed. In order to avoid being deterministic in this inductive research the author had to be careful not to lead the interviewees. Therefore specific academic terms (such as 'virtual' and 'extended enterprises; cf. Table 3.4 in Chapter 3) were deliberately not used during the interviews and in the interview guide. In most cases the interview guide was requested by the participants beforehand and was sent to them two to three weeks prior to the interview to allow for sufficient time of preparation for the interviewees (see Appendix C for the interview guide).

The interview guide was tested on a small sample of two participants (managers of one German car manufacturer) in July / August 2004, critically evaluated by two researchers (the author and his supervisor) in terms of its value to the studied phenomenon and amended before being employed to the other interviews in order to serve the purposes of credibility, dependability and confirmability of the study and the data. It has to be noted that these two pilot interviews are included in the overall data sample for two major reasons: Firstly, the changes made to the interview guide and the interview process were only incremental and hence the data obtained in the pilot interviews was very valuable to the study. Secondly, the access to managers was too much a constraint to this research in order not to exclude them from the data sample for analysis purposes.

### 4.3.2. Data collection phase

The first phase of field work comprised the basic data collection for this research study via semi-structured interviews with managers in the German automotive industry. Thereby, the main objective of the data collection phase is to create a rich context of the research objectives stated above.

***Semi-structured interviews***

Semi-structured interviews are a flexible and adaptive research technique that can be modified to suit the needs of different groups of participants (King, 1994). It is, however, an intermediate step in a continuous spectrum of possible interviewing characteristics ranging from structured interviews in a more quantitative domain to completely unstructured in-depth interviews in a more qualitative approach (Bryman, 2004). In this sense, semi-structured interviews leverage the strengths of both structured and unstructured interview methods. This kind of interview is sometimes also referred to as focused interview (Merton *et al.*, 1956).

The researcher refers to some kind of interview guide, which is a brief list of topics and questions to be covered that should be guided by collecting the data necessary for shedding light on the research topic and problem (Bryman, 2004). This allows the investigation to begin with a fairly clear focus rather than a too general basis and thus avoids for the interview to 'drift' into a pure conversation that lacks of rich context and an appropriate degree of comparability between the different interviews for dependability purposes (Bryman, 2004). At the same time it leaves space to capture the perspectives and perceptions of the interviewees on the phenomenon in an open ended manner by allowing sufficient opportunities for an unobstructed flow of narrations; this provides more detail and insight into the explored phenomenon rather than imposing a fixed set of questions with pre-selected answer choices onto the respondents like in structured interviews (Merton *et al.*, 1956). The advantage is that individuals will not only reveal those factors that they consciously believe to influence the research topic but also subconsciously discuss factors that they might not be aware of (Leary, 2001).

Contact to interview participants was gained through personal contacts of the author as mentioned in the paragraph on sampling above. It was aimed for managers that are involved in inter-firm R&D relationships between car manufacturer and supplier in some way (ideally R&D, Purchasing and Quality managers within car manufacturers as well as R&D and Marketing / Sales managers within suppliers; cf. McIvor and Humphreys, 2004) because informant competency is likely to be higher for informants whose roles are closely associated with the investigated topic (Kumar *et al.*, 1993). Interviews were carried out by the researcher himself and conducted face-to-face at the workplace of the interviewees in order to make participation more convenient. Apart from one interview that was conducted with a manager of an UK based car manufacturer belonging to the brand group of a German car manufacturer, all interviewees were based in Germany and hence the interviews were conducted in German. The interviews were conducted between December 2004 and March 2005 each lasting between 1 and 2,5 hours. If possible, the interview was conducted with one interviewee only so that participants would not influence each others answers and opinions. However, in four occasions this was not possible due to time constraints of the interviewees so that the interviews were conducted with two participants at the same time. Additionally, some demographic data in form of the interviewee's area of work and organisational responsibility level was obtained, basically through the exchange of business cards.

Unless disapproved by the participants, the interviews were taped and transcribed which is imperative for ensuring credibility, dependability and confirmability of the data (McCutcheon and Meredith, 1993). In this context Bryman (2004) postulate that if an interview contains open questions and narrative parts, an audio recording is inevitable. It has to be noted that no single interviewee rejected the tape recording and transcription of the interviews which produced a total of 45 hours of interviews (1,5 hours on average) and over 300 pages of transcript. Depending on the nature of the interview, the transcript was produced in German or English language.[16] At a later stage these transcriptions were validated by the interview participants and a consent form was signed by them to ensure that the transcripts were a true and accurate record providing credibility and confirmability (face validity) of the data and enabled amendments and improvements to be made. Only one participant did not sign the form due to company regulations but made changes to the transcript. In order to protect the identity of the participants, all interviewees were granted anonymity, which is also a principle of the confirmability audits and member validations explained above (see Appendix D for consent form).

It is difficult to have a large sample size when employing interviews as these are very time consuming. Despite this fact and the constraint in access to managers, empirical insights were gained through a series of 28 semi-structured interviews with a sample of 31 managers in the German automotive industry covering 16 companies, i.e. 4 car manufacturers[17] and 12 supplier firms. This sample proved to be large enough for achieving theoretical saturation. An overview of the interview sample is given in Table 4.1:

[16] For the reasons of time and resource constraints, the German transcripts were not translated into English but kept in the original version for the later coding and analysis (cf. Chapter 5).
[17] One of the car manufacturers was based in UK but belongs to the brand group of a German car manufacturer.

| Company role | Company identifier | Position of interviewee | Management level |
|---|---|---|---|
| Car manufacturer (OEM) | 1 | General Manager Design Car Body | Senior |
| | | General Manager Central Quality Assurance | Senior |
| | | General Manager Purchasing Electronics | Senior |
| | 2 | General Manager Design Doors | Middle |
| | | Project Manager Purchasing | Junior |
| | | Head of Concept Development Project XY | Junior |
| | 3 | General Manager Design Car Body | Senior |
| | 4 | Head of Department Body and Trim | Senior |
| Systems supplier (Tier 1 and 2) | 5 | Sales Director | Senior |
| | | R&D Director | Senior |
| | 6 | Sales Manager | Middle |
| | | R&D Manager | Middle |
| | 7 | Managing Director R&D | Senior |
| | 8 | General Manager Customer Team | Senior |
| | | General Manager Integration and Logistics | Senior |
| | 9 | Vice President Regional Account Executive | Senior |
| | | Corporate Vice President Logistics | Senior |
| Module supplier (Tier 1 and 2) | 10 | General Manager Pneumatics | Senior |
| | | General Manager Mechatronic Drives | Senior |
| | | Manager Electronics Development | Middle |
| | | Chief Engineering Mechatronic Drives | Junior |
| | 11 | Sales Manager | Junior |
| | | R&D Director | Senior |
| | 12 | General Manager Sales and Marketing | Middle |
| | | Deputy General Manager Customer Team 3 | Middle |
| | 13 | Managing Director R&D | Senior |
| | | General Manager Piston Rods | Middle |
| Parts / component supplier (Tier 2) | 14 | General Manager Logistics | Senior |
| | | Managing Director | Top / Executive |
| Engineering service provider (Tier 1 and 2) | 15 | Project Manager | Junior |
| | 16 | Managing Branch Director | Top / Executive |

**Table 4.1: Basic characteristics of interview sample**

As can be seen form Table 4.1, in most cases, the interviewees were experienced middle, senior or top managers who are involved in issues of inter-firm R&D collaboration and were therefore qualified to provide strategic insights.

Even if it is possible to capture the 'how' and 'why' issues in terms of the important features of inter-firm R&D relationships, interviews bring certain limitations with them. They can be affected by social desirability, meaning that the interviewees may provide answers they believe the interviewer is looking for rather than giving accurate and honest answers (Leary, 2001). However, considering the sometimes very open and direct answers of most interviewees as well as provision of sensitive information on the subject, response bias seems very unlikely. Furthermore, the research aims were unknown to the participants, making it quite difficult, if not impossible, for them to meet them even if anticipated correctly.

### 4.3.3. Data coding and analysis phase

In this study, the coding and analysis procedure took place between June 2005 and November 2005 after spending two months (April and May) with the transcription of the conducted interviews. The main objective of the data analysis is to enable the generation of propositions concerning the 'how' and 'why' questions of the study thereby transforming data into findings (Patton, 2002). Hence it is obvious that the analysis part of the study is particularly important which is basically true for all qualitative research approaches (Miles and Huberman, 1994). Based on Eisenhardt (1989) the analysis phase should consist of two main parts, namely intra and inter case analysis.[18] Strauss (1987) describes these as follows:

*First,* each case (for this study interview) has to be analysed separately. The central idea is to become familiar with every single case on its own to identify unique patterns of inter-organisational collaboration before generalising patterns across cases. To avoid being overwhelmed by the data sets, the within-case analyses were focused around the already identified research objectives dealing with essential governance issues of inter-firm relationships (cf. section 5.1.1. in Chapter 5). *Second,* general conclusions about all cases (i.e. interviews) will be drawn. With cross-case techniques it is more likely to discover some novel findings that are incorporated in the data by looking at it in many different ways (Eisenhardt, 1989). In doing so, the findings are iteratively confronted with the cases to assess the fit with the observations, which is an important feature of the constant comparative method in Grounded Theory where observation is quickly accompanied by hypothesising: "as soon as researchers start forming provisional categories or abstractions from the data, comparison begins" (Locke, 1996). Beyond guiding the active search for evidence, these integrated propositions immediately provide a central core of theorising which leads to the analytic framework that forms the substantive theory, i.e. it is a continuous and interrelated process of data collection, proposition generation, empirical testing, and theory revision (Glaser and Strauss, 1971). This process of continuous 'theorising', which Glaser and Strauss (1967) termed 'theoretical sampling', is driven by the constantly evolving and underlying theories and goes on simultaneously as working through the within- and cross-case analysis.

[18] One of the major criticisms to this approach is Eisenhardt's positivist focus on comparison across organisational contexts, whereas classic qualitative researchers argue for comparison within the same organisational setting to gain a deep understanding of a particular social setting (Dyer Jr. and Wilkins, 1991).

Because it is difficult to identify patterns within the data intuitively, Grounded Theory uses theoretical coding as its structured coding paradigm to facilitate the development of conceptual complexity and density in the resulting theories (Glaser and Strauss, 1967). Strauss and Corbin (1998) complemented a hierarchical structure of coding levels to ensure conceptual density involving *open*, *axial* and *selective coding*. During the unrestricted and unprejudiced *open coding* of empirical indicators provisional codes and categories are identified that explain the empirical data, which is one of the key issues of constant comparison. During subsequent *axial coding* relationships of the developed categories are identified and data explaining their interrelation is extracted which then enables the refinement of any category that needs further development. It revolves around the 'axis' of one category at a time, hence the term (Strauss, 1987). *Selective coding* involves a systematic approach towards the development of core categories or abstract themes which explain all other categories and hence the data. The core categories are the basis for generalised theory via narratives and theoretical propositions and guide further theoretical sampling and data collection to ultimately reach theoretical saturation. Thus Strauss (2004) concludes:

> *"The excellence of the research rests in large part on the excellence of the coding..."* (p. 205).

The coding was done using the QSR NVivo 2.0™ software tool. NVivo is a computer assisted qualitative data analysis software (CAQDAS) designed as a toolkit to aid researchers in managing and organising qualitative data that is not easily reduced to numbers (Patton, 2002). NVivo enables researchers to deal with rich, complex and text-based data and its detailed analysis including sophisticated methods such as Grounded Theory or conceptual modelling (Richards, 2002). Based on formal logic and offering Boolean searching it can be seen as a form of theory-building software. NVivo is also capable of dealing with data that has been transcribed in a language other than English, which was particularly useful for this study since most interviews and transcripts were in German. Furthermore, NVivo is a relatively easy programme to learn and use. As soon as the basic concepts and functions of the software, such as nodes, memos, attributes, coding, searching, developing a graphical model, etc., were understood by the author by running dummy projects, the data coding and analysis process took place.

Ideally, each interview transcript should be coded by a second coder providing inter-rater reliability of the interview analysis (Bauer, 2000). Bearing in mind the amount of transcribed pages this kind of full inter-rater assessment was difficult to achieve because of time and resource availability. However, two measures were taken to improve the reliability of the coding and analysis. *First*, because the transcripts are in German whereas the coding was conducted in English, the examples taken from the interview transcripts that were used to represent the codes in the developed Coding Master Table (cf. section 5.1.4. in Chapter 5 and Appendix J) were back translated from English into German by a bilingual peer. The results were compared leading to minor changes in the translation until mutually agreed on. This procedure was also used for the questionnaire (cf. section 4.3.4.). *Second*, the Coding Master Table was evaluated by one bilingual industrial expert from the German automotive industry who was not involved in the interviews. This 'second coder' was asked to compare the given code examples from the Coding Master Table (English) and further text passages from the interview transcripts (German) with the developed code and code description in the Table for their unity. The author prepared the second coder by familiarising him with the nature of the data as well as the structure and characteristics of the Coding Master Table to enable him to understand the codes and categories and to apply them reliably. The second coder was informed only to rely on the Coding Master Table and not to consult any other source of information (apart from his practical expertise) as these may contain irrelevant, ambiguous or contradictory information.

The author would like to argue that this approach seems sufficient for the purpose of this thesis, keeping in mind that this study contains a second empirical stage consisting of the more 'objective' validation of the coding (in form of a set of derived propositions from the interviews) in a questionnaire survey (cf. section 5.2. in Chapter 5).

### 4.3.4. Data validation phase

The aim of doing qualitative research is to develop transferable theories, i.e. that the abstract patterns described by the emerging theory and its core categories are applicable to other research samples (Auerbach and Silverstein, 2003). Hence, theoretical concepts are not just discovered but also verified because their provisional character is validated with new data and coding controlled by the emerging theory (Glaser, 1978; Strauss, 1994). This implies that the inductive procedure of qualitative interviewing cannot be wholly satisfactory in itself and has to be supplemented by a validation exercise in order to unfold its full value to the research.

Therefore, the second and third empirical phase of this research focused on data validation via a questionnaire survey for the empirical quantification of the qualitative data and focus groups with industrial experts to validate the usability of the novel concept. Thereby, both validation steps strengthen the transferability, dependability and confirmability of the data in this research.

***Self-completion questionnaires***

Questionnaires, especially self-completion or self-administered questionnaires, are one of the main instruments in social survey design where the respondent completes the questionnaire on his or her own (Bryman, 2004). The most prominent form of the self-completion questionnaire is the postal questionnaire. However, in an era of increasing online communication the e-mail questionnaire is gaining ground.

Because there is no interviewer to facilitate the administration of the self-completion questionnaire, it has to be especially easy to follow and answer, e.g. fewer open questions or an easy-to-follow design (Bryman, 2004). The main advantage is a quick and easy administration, i.e. it is especially advantageous for targeting large samples that are geographically dispersed at the same time (Bryman, 2004). This way it is possible to reach a critical mass of respondents with relatively low resources which leads to a statistically representative sample that facilitates transferability and generalisability of the obtained results. Furthermore, interviewer effects, such as the described response bias of interviews, can be eliminated leading to more objectivity and hence dependability and transferability of the data. Finally, a self-completion questionnaire offers more convenience to the respondents because they can complete it when they want, where they want and at the speed they want (Bryman, 2004).

In his Total Design Method for postal questionnaire research, Dillman (1983) proposes to emphasise a layout that is easy on the eye and facilitates the answering of the questions rather than employing tactics to make the questionnaire appear shorter. Following this advice, the author developed a questionnaire as Microsoft Word document comprising 35 statements (tentative propositions based on interview data) serving as closed 'questions' (see Appendix E for questionnaire). No filter or open 'questions' were applied and each statement was numbered and emphasised by a box followed by a box highlighting the measurement scales leading to a non cramped presentation of five statements per page. Each respondent was asked to assess each statement regarding to two measures on a 5-point Likert scale: agreement, i.e. the strength of agreement or disagreement; and importance, i.e. the importance for daily business operations. Additionally, some demographic data, such as working experience, company type, responsibility level etc., was obtained to enable the comparability of the data. To improve the clarity, clear instructions and explanations on the provided measures and scales were given and an example for illustrating how to fill in the questionnaire was presented.

In order to increase the credibility and confirmability of the data, the questionnaire design was pilot-tested with six respondents (managers of two different German car manufacturers that were not involved in the interviews) at the beginning of December 2005. The number of six pilot-tester was considered sufficient as the aim of the author was to gain approximately 60 responses for the overall survey. Due to time and accessibility constraints, a percentage of 10% (6 out of 60) for a pilot study seemed appropriate.

Issues that were evaluated during the pilot-test included duration for processing, clarity of instructions and statements, general appearance, and the appropriateness of the measures and scales (see Appendix F for pilot test evaluation sheet). The time for completion of the questionnaire was 30 minutes on average with the unanimous opinion that by no means it should be any longer, which the author strictly adhered to. All test-respondents particularly liked the layout, and instructions were considered clear and understandable, so no amendments were made. Concerning the measures and scales some valuable comments were given which resulted in the alteration of the Likert scale for the measure 'Agreement'; the medium score 'neither agree nor disagree' was changed into 'neutral' because the former score was considered as misleading and not useful. The same is true for the statements (i.e. propositions) which were considered unclear and too theoretical in some instances and hence had to be re-phrased into more practical statements.

Since the focus of the study being on the German automotive industry, the questionnaire had to be translated into German, which was done by the author. For the purpose of achieving dependability and confirmability of the questionnaire instrument via internal triangulation, a back translation of the German questionnaire into English was performed by a bilingual peer as suggested by Litwin (2003). The original English version developed by the author and the back translated version were then reviewed for consistency. This resulted in very minor changes in some cases, e.g. re-phrasing single words, that were applied to the English and German version of the questionnaire after consultation with the peer translator.

The questionnaires were sent out as an email attachment to contacts of the author at the beginning of December 2005 after the pilot-tests were completed. Although a study by Dommermeyer and Moriarty (2000) revealed that the response rate of embedded questionnaires is higher than attached ones (37% vs. 8%), the author decided in favour of the second alternative for various reasons: (i) the readability and easiness for completion was valued higher than an easier return process, especially because the survey was targeting managers in the automotive industry; (ii) the convenience for the respondents is higher because they were able to save their changes in the questionnaire and could come back to finish it at a later stage; (iii) nowadays, more or less everyone is used to receiving, processing and sending emails containing attachments. Therefore, in the opinion of the author, an attached questionnaire does not decrease the response rate to an extent it might have in the past.

Similar to the semi-structured interviews, a combination of convenience and snowball sampling methods was used in so far as the questionnaire was mainly sent to the interview participants from the first empirical data collection stage with the kind request for forwarding it to further contacts. However, in order to gain a larger sample size the author also contacted practitioners in the German automotive industry via an internet-based networking platform called Open Business Club (www.openBC.com) in which the author is a member. The contacts were selected by the author based on their job position which had to be at the interface of inter-firm R&D collaboration (e.g. R&D, Purchasing, Quality Assurance, etc.). This way, another 146 potential respondents could be contacted.

The response rate is an important issue because it determines the representativeness of the achieved sample (Bryman, 2004). It is argued that for samples which are not selected on the basis of a probability sampling method, the response rate is less of an issue meaning that a low response rate is less significant because the sample is not considered representative of the population (Bryman, 2004). However, for this questionnaire survey a combination of convenience and snowball sampling was applied which (i) made the determination of an overall response rate impossible and (ii) increased the representativeness of the sample through the snowballing effect even if not every potential respondent of the population had the same chance to be selected (convenience aspect). Furthermore, the questionnaire survey was mainly used for validating purposes rather than large scale hypothesis-testing for generalising results to the population.

Nevertheless, certain leverages were applied to improve the number of valid responses. Firstly, following Bryman's (2004) suggestions a cover letter explaining the reasons and background of the research as well as the importance of participation and assuring confidentiality was included at the very beginning of the questionnaire. Secondly, a monetary incentive in form of an Amazon voucher over € 10 was provided to 20 selected interview participants which functioned as a first contact for distributing the questionnaire further in a snowballing manner. Thirdly, individuals out of the original interview sample who have not replied until mid of January (five weeks after first mailing including the Christmas vacation) were followed up by a second reminding mailing. This was only the case for seven of the interview participants. Fourthly, for incomplete questionnaires respondents were contacted and kindly asked to fill in the missing gaps. Only one respondent did not reply and was therefore excluded from the survey database. Finally, all participants of the questionnaire survey were offered to receive a summary of the survey results as well as a copy of the final thesis in case of interest (see Appendix G for brief summary of initial questionnaire survey results).

Until the end of February (around 12 weeks survey period) 79 valid response questionnaires were received through snowballing via the interview partners and the use of personal contacts of the author. Further 31 valid responses were gained through contacts of the openBC platform (response rate 21%). This total of 110 valid responses included respondents that were involved in the semi-structured interviews as well as respondents that have not been involved in the study before with an average of 11.27 years working experience in the automotive industry. The mean number of employees per company in the sample was 45,400 (114,700 for OEMs and 6,920 for supplier firms) and the mean turnover per company €44,550m (€45,050m for OEMs and €28,900m for supplier firms). An overview of the demographics of the questionnaire survey sample is given in Table 4.2:

| Company role | Responses | | Functional experience[19] | Responses | | Management level | Responses | |
|---|---|---|---|---|---|---|---|---|
| | No | % | | No. | % | | No. | % |
| Car manufacturer | 38 | 19.5 | R&D / Styling | 75 | 37.8 | Clerk[20] | 18 | 16.4 |
| Systems supplier | 52 | 26.7 | Purchasing | 15 | 7.5 | Junior Management | 27 | 24.5 |
| Module supplier | 33 | 17 | Quality assurance | 13 | 6.5 | Middle Management | 35 | 31.8 |
| Parts / component supplier | 30 | 15.4 | Production / manufacturing | 15 | 7.5 | Senior Management | 22 | 20 |
| Assembly service provider | 4 | 2 | Logistics | 7 | 3.5 | Top Management | 3 | 2.7 |
| Logistics service provider | 2 | 1 | Marketing / Sales | 36 | 18.1 | Other | 5 | 4.6 |
| Engineering service provider | 27 | 13.8 | Strategy / directorship | 25 | 12.6 | | | |
| Other | 9 | 4.6 | Other | 13 | 6.5 | | | |
| | $\Sigma = 195$ | 100 | | $\Sigma = 199$ | 100 | | $\Sigma = 110$ | 100 |

**Table 4.2: Basic characteristics of the questionnaire survey sample**

The questionnaire survey reached a far greater spread and variety in contributing companies (52 in total) than the 16 original companies of the semi-structured interviews which increases the representativeness of the sample to the population, i.e. the German automotive industry. Most respondents were experienced in functions such as R&D, Quality Assurance, Marketing/Sales and Strategy, particularly those responsibility areas that are involved in inter-firm R&D collaboration between car manufacturers and their suppliers. Similar to the interview participants, most respondents occupy management positions (55% junior and middle management; 25% senior and top management) and hence are experienced enough to provide a qualified evaluation and assessment of the statements. A surprisingly high number of interviewees also participated in the questionnaire survey (60%).

Same as interviews, the questionnaire method has limitations. One of the major problems with questionnaires is the difficulty in asking many questions which could lead to 'respondent fatigue' (Bryman, 2004; p. 135) very easily. Since the interviews revealed very complex data leading to a long list of tentative propositions, it was desirable to include more than 35 statements in the questionnaire which the author refrained from not only because of the pilot-test reviews. Furthermore, the researcher can never be sure who actually answered the questionnaire and what sort of intrusion and influence the respondent might have faced. This risk was minimised in this study with the fact that answering the questionnaire required a

[19] The number of responses for company role and functional experience is greater than the total number of respondents (110) because some respondents had experience of more than one company and function. The questionnaire allowed multiple entries by the respondents.
[20] Three respondents categorised themselves as 'consultants' which were counted as 'clerks'.

certain strategic or operative experience on the explored phenomenon of inter-firm R&D collaboration in automotive supply networks.

*Focus group / industrial workshop*

The focus group is a form of group interview that involves several participants to explore a specific topic relatively in depth (Bryman, 2004). In social sciences it proved particularly useful for exploratory research but also for following the analysis of a large-scale quantitative survey to facilitate the interpretation of the results in a confirmatory sense (Stewart and Shamdasani, 1990). In this research, the focus group method was basically used in the latter sense by validating the developed conceptual framework.

The focus group, generally used within qualitative research, shares its idea with the focused interview mentioned above in the sense that both aim for selecting and questioning people who are experts on the explored research topic (Merton *et al.*, 1956). However, as opposed to individual interviews the focus group method exerts more challenge onto the interviewees due to having more control in an open discourse debate. This might lead to a more realistic account of what the involved participants really think because there is more stimulus to surface issues that concern them (Bryman, 2004); which would increase the credibility and dependability of the results based on a form of internal triangulation. Furthermore, a focus group discussion of experts on the explored phenomenon enables the researcher to learn the 'native language', i.e. the terms and notions specific to the context that is studied, and to observe behaviour rather than just relying on what is said by interviewees, which is an important consideration in conducting qualitative research. A good overview of advantages of focus groups relative to individual interviews can be found in Stewart and Shamdasani (1990; p. 19).

Within the focus group or industrial workshop respectively the developed theoretical concept was presented to the participants for validation which acted as some sort of confirmability audit for the results of this research study. The focus group was conducted with practitioners of the German automotive industry in July 2006 lasting about three hours. Participants were gained through personal contacts of the author (mainly from the previous empirical phases such as interviews), again leading to a convenience sample. For reasons of accessibility to participants and difficulties in arranging the focus group, only one group could be recruited which obviously does not fulfil the requirements for theoretical saturation and representativeness. However, the researcher did not feel that the kind and range of views was likely to be affected by socio-demographic factors to such an extent that it cannot be dealt with by selecting diverse focus group participants (e.g. representatives of car manufacturers and suppliers) rather than having a large number of different groups.

Same as for the number of groups, the group size was influenced by convenience and availability issues. Although Morgan (1998) suggests a typical group size of six to ten members, he recommends smaller groups when participants are likely to have a lot to say on the research topic. This was the case for the conducted focus groups with managers that are all involved in inter-firm R&D collaboration in their daily operative business activities (i.e. functions such as R&D, Quality, Purchasing or Sales), which justifies the number of five[21] participants. The group can be characterised as some kind of semi-natural group in the sense that within the focus group some participants knew each other (e.g. working colleagues) and some did not. Some scholars might consider this problematic. But again, for reasons of accessibility, the author did not over-emphasise this issue too much. Nevertheless, the group worked well without any single dominant member among the participants, although the OEM fraction seemed to be slightly dominating the sub-group of suppliers on an aggregated level (2/3 vs. 1/3 of word count). One reason might be the unbalance of three to two participants, another the power distance and dependability of the suppliers on the OEMs. An overview of the focus group sample is given in Table 4.3:

| Company role | Position of participant | Management level | Interview participation | Questionnaire participation |
|---|---|---|---|---|
| Car manufacturer | Specialist Engineer Design Car Body | Clerk | No | Pilot study |
| Car manufacturer | Manager Design Car Body | Junior | No | Yes |
| Car manufacturer | Manager Project Integration | Junior | No | Pilot study |
| Systems supplier | Group Leader Design | Middle | No | Yes |
| Module supplier | R&D Director | Senior | Yes | Yes |

**Table 4.3: Basic characteristics of the focus group sample**

Following Bryman's (2004) advice, the session started with an introduction that explained the aims, background and outcomes of the research, the reasons for recording the session, and the format of the session. Furthermore, participants were asked to fill in a short form providing basic demographical data, such as company type, job position, etc. During the discussion the researcher, who in case of focus groups is called moderator or facilitator, allowed the discussion to flow freely, on the one hand, but also intervened to uncover important issues of

[21] Originally seven participants confirmed but two (one quality manager of an OEM and one sales manager of a supplier) cancelled in the last minute.

the investigated phenomenon, on the other hand (Stewart and Shamdasani, 1990). In the case of the conducted focus group, the discussion sometimes seemed to get caught up in technical details (maybe due to all participants being technical experts; cf. Table 4.3) and the moderator had to guide the discussion back onto the more abstract level of R&D collaboration and strategic sourcing between OEM and supplier.

The discussion was tape recorded and following common advice (e.g. Bryman, 2004; Stewart and Shamdasani, 1990) transcribed in order to facilitate the analysis process. However, since the focus group was basically used to validate the developed conceptual framework in the sense of Grounded Theory's theoretical sampling rather than collecting substantially new empirical data, during the analysis the author was less interested in the process of socially or collectively constructing meaning but more on the practical implications of the developed framework. Similarly to the semi-structured interviews above, the transcript and a consent form were sent to all focus group participants for validation and confirmation of the data (see Appendix H for consent form of focus group).

In addition to this industrial focus group the author also conducted a similar event with an academic audience during the early stages of theorising and conceptualising in February 2006. This took place in form of a one hour seminar that was given to about 15 members of the Operations Management Group of a fellow UK university in which the empirical results of the coding and analysis process and an early version of the conceptual framework were presented. The extensive feedback gained from these academic peers proved particularly useful for the further conceptualisation and development of the theoretical framework in this research.

Although the focus group method allows participants' perspective to be revealed in ways that are different from individual interviews (Bryman, 2004), it has some limitations. The obtained data are complex and difficult to analyse and hence were only used for fine tuning the developed theory based on the semi-structured interviews and the questionnaire survey. There are possible problems of group effects, i.e. dealing with renitent as well as intrusive participants. This was not encountered as a problem during the sessions, maybe due to the fact that the groups showed a semi-natural character. Furthermore, the focus group is very focused on a special setting and might not be representative if it does not show regular activities, which leads to the conclusion that the focus group as part of the triangulated research design of this study can only be seen as a complementary and data validating source.

## 4.4. Quality of this research

Research designs need to be 'objective' and 'universally applicable' which corresponds with the quality concepts of reliability and validity (for objectivity) as well as generalisability (for universality):

> *"Conducting empirical research without considering its reliability and validity is pointless, because the researcher will not be able to generalize from the results."* (Flynn *et al.*, 1990; p. 250)

Ellram (1996) and Yin (2003) outline four standard tests to establish the quality of any empirical research design: (1) construct validity by establishing a correct set of operational measures, (2) internal validity by establishing a causal relationship, i.e. correctly mapping the phenomenon under investigation, (3) external validity by establishing the domain to which a study's findings can be generalised, ideally to situations as they can be found in reality, and (4) reliability by demonstrating that the operation or results of a study can be repeated or reproduced by a different researcher or the same researcher on different occasions.

***The concept of trustworthiness***

However, when measuring the quality of the research design careful attention has to be paid to the nature of the basic research approach, i.e. a distinction has to be made between qualitative and quantitative research projects when looking at the quality of their design (Halldórson and Aastrup, 2003). Since reliability and validity as quality criteria mainly stem from a quantitative and positivistic domain and have proven difficult for qualitative researchers (Kirk and Miller, 1986) alternative criteria for determining the quality of the qualitative approach underlying this study need to be considered as well. An example is the framework of trustworthiness proposed by Lincoln and Guba (1985), who present four parallel criteria that are more consistent with the qualitative research paradigm: *credibility*, *transferability*, *dependability* and *confirmability*. Similar criteria can be found in Auerbach and Silverstein (2003) and Smith and Deemer (2000).[22]

Similar to internal validity, *credibility* is determined by establishing causal relationships in the data but focuses more on the match between the respondent's constructions of the phenomenon and the researcher's representation of it (Kirk and Miller, 1986). The second dimension, *transferability*, is more concerned with a contextualisation of the findings and their transferability to other contexts, i.e. it is measured by the extension of theoretical constructs beyond a particular sample, rather than generalisation like external validity (Auerbach and Silverstein, 2003). Apart from this fact it was already mentioned above that generalisation in the context of this study implies a generalisation to theoretical propositions (analytic generalisation) rather than a generalisation about a sample to its population (statistical generalisation). The third parallel quality dimension of *dependability* refers to the stability of the research process, i.e. the stability of the data and its explanations over time. Compared to reliability, dependability is not as strict on the condition of the stability and for this reason introduces the concept of trackability or transparency, i.e. the data, the questions, the theories underlying the interpretations must be documented for the purpose of reproducing understanding (Auerbach and Silverstein, 2003). For the final criterion, *confirmability*, the objectivity of the researcher in the naturalistic paradigm implies the demonstration how findings can be based on and confirmed through the data itself rather than the researcher's bias, i.e. conclusions, interpretations and recommendations must be able to be traced back to their sources in the data (Lincoln and Guba, 1985).

***Trustworthiness of this research***

In the context of this study the concern of validity, reliability and generalisability and the corresponding qualitative quality measures of trustworthiness will be addressed in several ways. It should be clear from the philosophical discussion above that this study does not claim to reflect any extreme ontological and epistemological position and hence both ways of measuring the research quality, i.e. qualitative and quantitative criteria, are considered in a complementary manner in this paragraph.

[22] Some qualitative purists, e.g. Marshall and Rossman (1995), argue that since social reality is constantly in motion it would make no sense to worry about the accuracy of the research instruments. But this rather relativistic view would make any systematic research process obsolete, since it does not accept any stable objects in the social world at all (Silverman, 2000). Hence, qualitative researchers agree with quantitative methodologists that certain standards for the evaluation of research designs and the justified and unjustified application of the researchers' subjectivity are essential (Auerbach and Silverstein, 2003).

The issue of *external validity* or *transferability* is dealt with during the design stage of the research when deciding on data collection techniques. In this research, the transferability is increased by studying multiple 'sites' and involving various participants which enable the analysis of comparative results and the verification of patterns through a 'within-case' analysis (search for patterns and meaning), on the one hand, and a 'cross-case' analysis (replication), on the other hand. This is supported through a quantitative validation of initial qualitative findings via a questionnaire based survey and a validation of the final concept via focus groups leading to a multi-method triangulation.

The aspect of *reliability* or *dependability* is addressed by adopting an auditing approach. This entails (1) the creation of a protocol and database in order to keep record of all phases of the empirical research in an accessible way (see Appendix B for research protocol) and (2) the review through auditors to establish whether proper procedures have been followed throughout the research study, e.g. using practical experts and academic peers for the validation of the codification of the interview data (inter-rater reliability) as well as performing 'forward and back translations' of the questionnaire, which was designed in English and German, with bilingual peers (Litwin, 2003). However, transcripts and memos do not just increase reliability, they are also useful for analytic reflection which leads to a process of implicit coding, i.e. thinking systematically about the data in accordance with its basic analytic categories (Glaser and Strauss, 1971), which is useful for establishing internal validity or credibility as well.

The issue of *internal validity* or *credibility* is handled by multiple iterations and follow-ups during the phase of data analysis by applying the coding techniques and the comparative method of Grounded Theory. In doing so it is possible to make proper inferences from the data by considering alternative explanations and relationships of the emerging (core) categories. A very important technique to ensure credibility of the results of the study is to submit the findings to the participating respondents of the research study to make sure that the investigator has correctly interpreted their perspectives on the explored phenomena. This is often referred to as 'respondent validation' or 'member validation' (Bryman, 2004) and has been applied in this study for example via the approval of the interview and focus group transcripts through the respective interviewees.

Given the possible lower precision of qualitative methods due to the information richness of qualitative data (Auerbach and Silverstein, 2003), multi-method or between-method triangulation was one of the most important means for increasing *construct validity* or *confirmability* of the study together with some kind of confirmability audits. Triangulation was not only used to examine the phenomenon from different perspectives with different data collection and validation techniques such as interviews, questionnaire and focus group, but also to enrich the understanding by allowing for new and deeper insights. The second important component of confirmability were confirmability audits for the clarification of a participant's intended meaning (Bauer, 2000) which works similar to the respondent validation mentioned above. Key informants reviewed the overall reports and theoretical narratives by verifying the facts for accuracy. Similarly, the questionnaires were evaluated by a few respondents in a pilot test. In the sense of multi-method triangulation, this questionnaire survey then functioned as an abstract form of quantitative confirmability audit for validating the tentative propositions gained from the qualitative interviews and hence facilitating the *reliability* of the coding.

## 4.5. Summary

The major aim of this research is to **develop a framework and practical guidelines on how to govern, i.e. design and manage, these inter-firm relationships in a sustainable way to create a competitive advantage for the whole relationship and its individual members.**

In this context, Grounded Theory was identified as a suitable research method that facilitates the analytic nature (what, why and how questions) of the study by extending the current literature via hypothesis-generation (cf. section 4.3.). The author embedded the method in the philosophical paradigm of 'constructive realism' (cf. section 4.1.), a compromise between extreme empiricism and complete relativism, and argued for a somewhat mixed method approach (triangulation) employing qualitative and quantitative epistemology that ensures credibility, transferability, dependability and confirmability of the research design and the data (cf. sections 4.2. and 4.4.). The resulting structure of the triangulated research design within the Grounded Theory method is illustrated in the Figure 4.3:

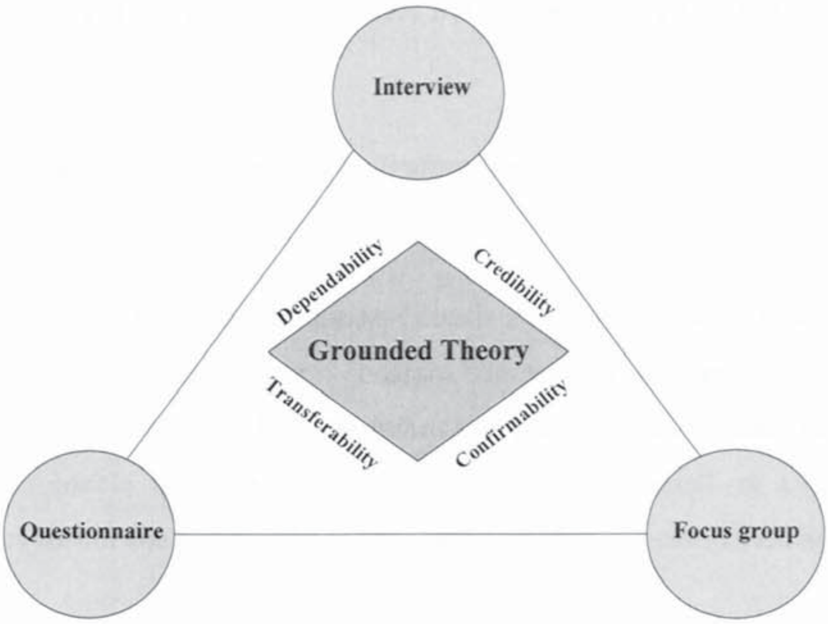


**Figure 4.3: Structure of the triangulated research design**

The related empirical research process of this study involved four main phases (cf. section 4.3.): design, data collection, data coding and analysis, and data validation. During the *design phase* research objectives were specified, data collection techniques and sample sites selected, and an interview guide for the semi-structured interviews constructed. *Data collection* in the field was deployed through a set of 28 semi-structured interviews with managers in the German automotive industry. Convenience and snowball sampling techniques were used to gain a sample of 31 participants who were taken through their experience with the investigated research topic using 'narrative interviews'. *Data coding and analysis* was performed through applying the key operations of Grounded Theory: constant comparison and theoretical sampling. In this, a hierarchy of coding levels (open, axial and selective) was used to reach the stage of hypotheses generation and theory building (cf. Chapter 5). During the first stage of *data validation* the developed tentative propositions were validated via a questionnaire survey (110 valid responses) assessing their importance for the studied research topic (cf. Chapter 5 ). Only then, the specific literature was reviewed and compared with the empirical findings (cf. Chapter 6) to develop a comprehensive conceptual framework based on theoretical and empirical perspectives (cf. Chapter 7). In the second stage of *data validation* this framework has been discussed with practitioners of the German automotive industry in a focus group workshop to evaluate the applicability of the framework and its potential for improving the competitiveness of inter-firm R&D relationships (cf. Chapter 8).

# 5. PRESENTATION AND VALIDATION OF EMPIRICAL FINDINGS

*"I criticize by creation, not by finding fault"* Cicero (106-43 B.C.)

As outlined in Chapter 4, this research concept consists of several phases to be consistent with the key operations of Grounded Theory: constant comparison and theoretical sampling. This chapter reports on the use of these key operations and provides information on the theoretical coding process to enable the reader to evaluate the research based on a full and detailed methodological report of the coding and the category creation (Locke, 1996; Suddaby, 2006).

The goal of this chapter is to gain a rich understanding of inter-firm R&D relationships in the automotive industry based on the analysis and validation of the collected data. In the first section 5.1. the data analysis procedure including coding and hypothesising will be described covering all related aspects from theoretical foundation to empirical application and results in form of theoretical narratives and tentative propositions. In section 5.2. the validation of these tentative propositions is discussed before the key aspects of this chapter are summarised in the final section 5.3.

## 5.1. Data coding and analysis

The central idea of coding is to draw a connection between the raw text and the research objectives in a step by step approach. An overview of the different levels of understanding in Grounded Theory and how it is used in this study is shown in Table 5.1.



**Table 5.1: Levels of understanding in Grounded Theory applied to this study (adapted from Auerbach and Silverstein, 2003)**

*"The coding system is a way of labelling certain aspects of your data and sorting the information into distinctive categories. It is an easy way of keeping track of your ideas.*

*Coding lets you use words, phrases, and ideas directly from the text and you can capture information about things and explore them further when you decide it's time"* (Walsh, 2002; p. 253-254).

The empirical process stages applied during the coding and analysis phase of this study are identified as:

Stage 1: Development of key template categories based on research objectives

Stage 2: Computerised textual codification and analysis of interviews using QSR NVivo 2.0™ software (open coding)

Stage 3: Clustering of codes into coherent categories (open coding)

Stage 4: Development of a Coding Master Table (axial and selective coding)

Stage 5: Formation of theoretical narratives and tentative propositions

Although these stages are presented in a chronological sequence, the coding procedure is not a linear approach from Stage 1 to Stage 5 but involves iterations between these stages and steps as the researcher becomes more familiar with the data (constant comparison).

### 5.1.1. Stage 1: Development of key template categories based on research objectives

In order to avoid being overwhelmed by the large amount of data and information and to facilitate the open coding process of the data set (i.e. 28 interviews) involving over 300[23] pages of transcript, the author decided to develop some basic and abstract *a priori* themes, an idea borrowed from the approach of thematic coding or template analysis (Crabtree and Miller, 1999b; King, 1994). This would provide some guidance during the coding but still allows for enough flexibility to produce insightful interpretations of the text (King, 1998). A theme refers to a pattern in the data that the researcher has identified as important to his or her interpretation, i.e. a way in which segments of text with similar meaning may be grouped together (King, 1998; Miles and Huberman, 1994). It can basically be derived either

[23] Other studies consider 50 pages of interview transcript as quite substantial already, e.g. Auerbach and Silverstein (2003).

inductively, i.e. during the process of coding and analysis, or deductively, i.e. based on theoretical considerations drawn from existing literature (Bauer, 2000). In this study, the derivation was rather based on the general research objectives outlined in Chapter 4 (section 4.3.1.) that were derived from the gaps identified in the basic literature review in Chapter 3 (sections 3.1. and 3.2.). This shows that Grounded Theory is not an excuse to ignore existing literature (Suddaby, 2006) because it is usually necessary to start the generation of a grounded formal theory from a substantive existing one (Glaser and Strauss, 1967).

Together with the overall research aim of exploring, understanding and improving the competitiveness of inter-firm R&D relationships in the German automotive industry, this led to the development of four basic themes related to their governance:

| | | |
|---|---|---|
| (i) | Relationship Status Quo: | Identification of current issues and practices associated with collaboration in inter-firm R&D relationships in the automotive industry |
| (ii) | Relationship Design: | Identification of issues related to the creation of inter-firm R&D relationships and their governance structure |
| (iii) | Relationship Management: | Identification of issues related to the management of inter-firm R&D relationships and their collaborative activities |
| (iv) | Relationship Success: | Identification of issues associated with the competitive success of inter-firm R&D relationships |

Instead of developing a full model in form of a tightly defined and largely predetermined list of *a priori* constructed codes (as in template analysis; King, 1998), the approach in this study was used more flexible and hence limited to the four basic themes identified above in order not to contradict with the inductive, theoretical and *in vivo* coding philosophy of Grounded Theory (Glaser and Strauss, 1967; Strauss and Corbin, 1998). Furthermore, the template categories were not directly derived from literature but based on the rather general research objectives that were derived from gaps in the literature (cf. Chapters 3 and 4). Hence, this research study remains within the domain of inductive grounded reasoning.

### 5.1.2. Stage 2: Computerised textual codification of interviews (open coding)

Open coding is the process in which data are initially conceptualised in an unprejudiced way (Locke, 1996). The emerging codes and categories are then considered as the basic building blocks of a Grounded Theory, i.e. theory is the description of relationships between patterns (abstract themes) that you find in the data (Auerbach and Silverstein, 2003). However, this process is also influenced by experiential data in form of the researchers' knowledge of the relevant literature which prevents from too literal an immersion in the empirical material and helps thinking in terms of more abstract concepts (Strauss, 1987).

Before the actual coding procedure was conducted, the author read through all transcripts to familiarise himself with the data (King, 1994). During this exercise, a basic qualitative template analysis guided by the *a priori* developed basic themes of Stage 1 was deployed where the initial template categories were applied in order to analyse the text but were themselves revised in the light of ongoing research. According to various scholars (e.g. Auerbach and Silverstein, 2003; Crabtree and Miller, 1999b; King, 1994 and 1998; Krippendorf, 2004), this includes some key elements that can be specified as: making, unifying, sampling, and recording relevant data.

*Firstly*, a decision needs to be made on what constitutes data. For this research study, each interview represented one datum.[24] *Secondly*, the text needs to be segmented or divided into separate thematic units referring to relevant passages of the text that express a distinct idea related to the research topic. In this study, each interview text was divided into units with different meaning guided by the template categories developed above. Each time a new idea was identified in the text, a new thematic unit began. This was done during the reading by highlighting relevant text passages in red and adding individual comments in form of short memos in blue in brackets after the relevant passage, sentence or single word. At the later stage of coding this filtering process proved to be very helpful as useful text units were pre-selected already and the comments provided support in relating the interview text to the research objectives reflected by the *a priori* developed template categories; thus simply making the text more manageable. An example is shown in Box 5.1 whereby the relevant text is shown in **bold** (originally red) and the memo in *italics* (originally blue):

[24] In the following the terms interview(s), case(s), or datum (data set) are used interchangeable.

| | |
|---|---|
| Interviewer: | Even if you are rebuilding competencies in-house can you imagine a future scenario where the OEM might reduce itself to the coordination of the network and is not engaged in the detailed design and development as well as production of the various systems and components. |
| Participant: | I think it could be one day, although I do not see that at the moment. There is an enormous amount of steps that it takes to get there. **I think the partnerships have to be in place first.** *Partnerships have to be designed – relationship design; collaboration is the basic key to a better future; the awareness for this needs to be created!* **And even then there cannot be a complete handover because the OEM has to maintain some level of responsibility and ownership for putting it all together to a coherent whole.** *Relationship management needs a leader that has enough own competencies to manage interfaces and partners.* |

**Box 5.1: Example of pre-selection of relevant text in thematic units (Source: Author)**

*Thirdly*, it is suggested to only use the relevant text or subgroups for further coding, especially if the set of data units is overwhelmingly big. However, the risk of missing out valuable data and content as basis for understanding the research topic was considered higher than the additional work effort. This seemed to be the right strategy since in retrospect useful and value adding codes also emerged from text passages that have not been pre-selected, on the one hand, and pre-selected passages did not prove useful in providing value adding codes, on the other hand. Nevertheless, the pre-selection and organisation of the text in thematic units provided a good guidance and helped in speeding up the coding process to a great extent. *Finally*, each thematic unit that is included must be coded and recorded, which means the description of that respective unit.

The coding was done using the QSR NVivo 2.0™ software tool (cf. Chapter 4). First, a new project named 'German automotive industry – coding' was created in NVivo. Next, the transcripts of all 28 interviews were imported into the project (in rich text format) creating a full document database that was managed, i.e. viewed, edited, explored, etc., via NVivo's document browser. Importantly, all the information in the transcripts (especially the highlighted relevant text in red colour and the memos in blue colour) was maintained. Each document was labelled with certain characteristics, such as company type, interview duration, and job title of interviewee, using NVivo's attribute feature which helped the author when referring to demographical characteristics of the data. In Figure 5.1 an overview of the document database of this study is given which details the name, the size and the number of codes for each of the 28 documents and when it was created and / or modified.

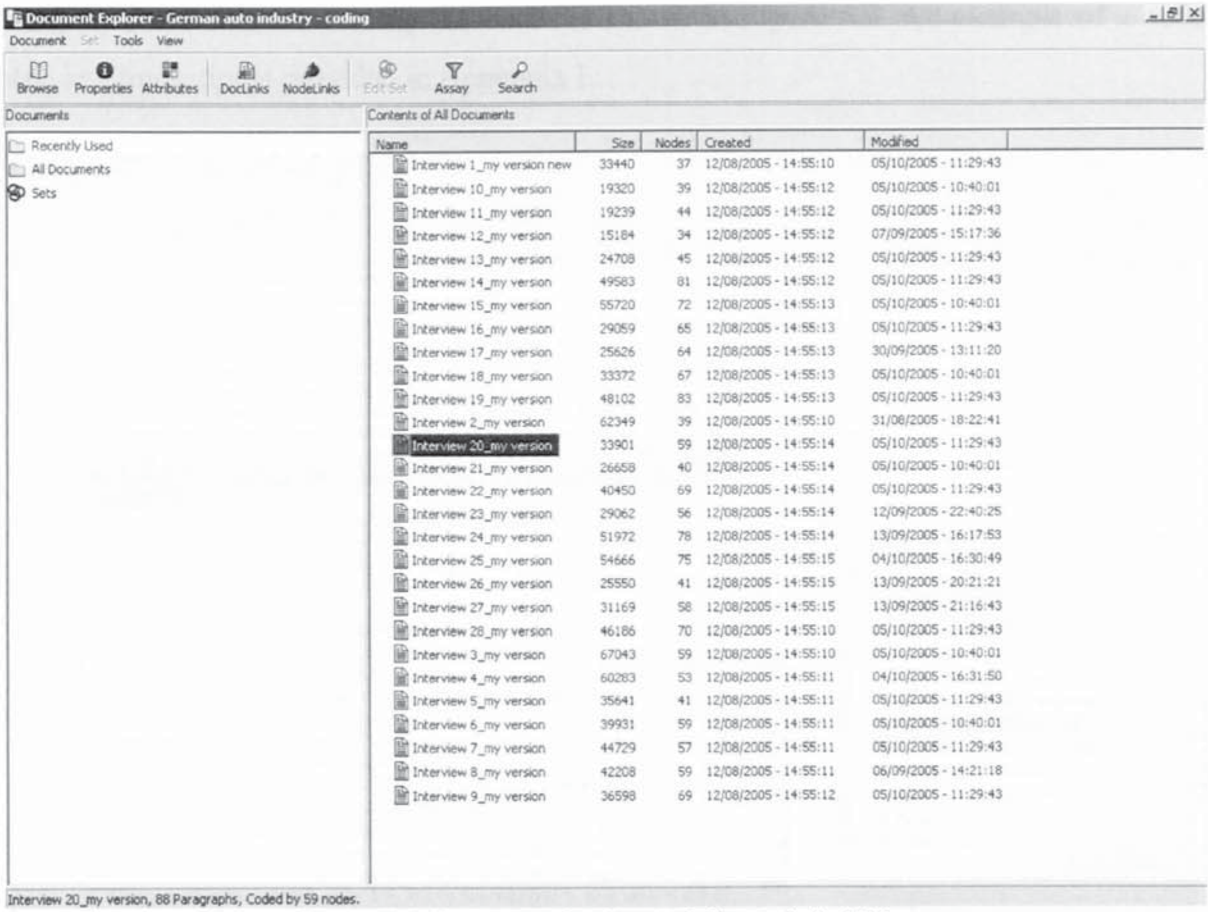

**Figure 5.1: Document database of this study in NVivo**

Going through the text line by line (with a primary focus on the pre-selected and highlighted relevant text) the author searched for words, phrases, sentences or even whole passages that expressed the same idea or meaning. These are referred to as codes or nodes, i.e. coded data related to the investigated research topic. According to the two-stage analysis process outlined in Chapter 4 (involving intra- and inter-case analysis), at this point codes were identified in each transcript separately. NVivo applies three options of codes: free nodes (coded but not categorised codes), tree nodes (codes in a hierarchical mode, mostly categorised) and case nodes (codes allocated to different cases). Similar to the *document browser* codes were managed via NVivo's *node browser*. In NVivo codes can either be developed *a priori* using the *node browser* to create free, tree or case nodes or *in vivo* based on the text.

The latter approach was applied in this study using 'speed coding' via the *NVivo coder* (a context menu that allows for quick and easy *in vivo* coding or un-coding of text passages). During the coding process, the relevant text expressing a valuable idea (a phrase, a single word or even a whole paragraph) was highlighted and then a title for a new code was entered into the node field of the *coder* (if it was a novel idea) or an existing node title was selected from the list of free nodes in the *coder* (if it was an already existing and coded idea). A coding example of one interview using the *coder* is shown in Figure 5.2. An example of a coded interview transcript is provided in Appendix I.

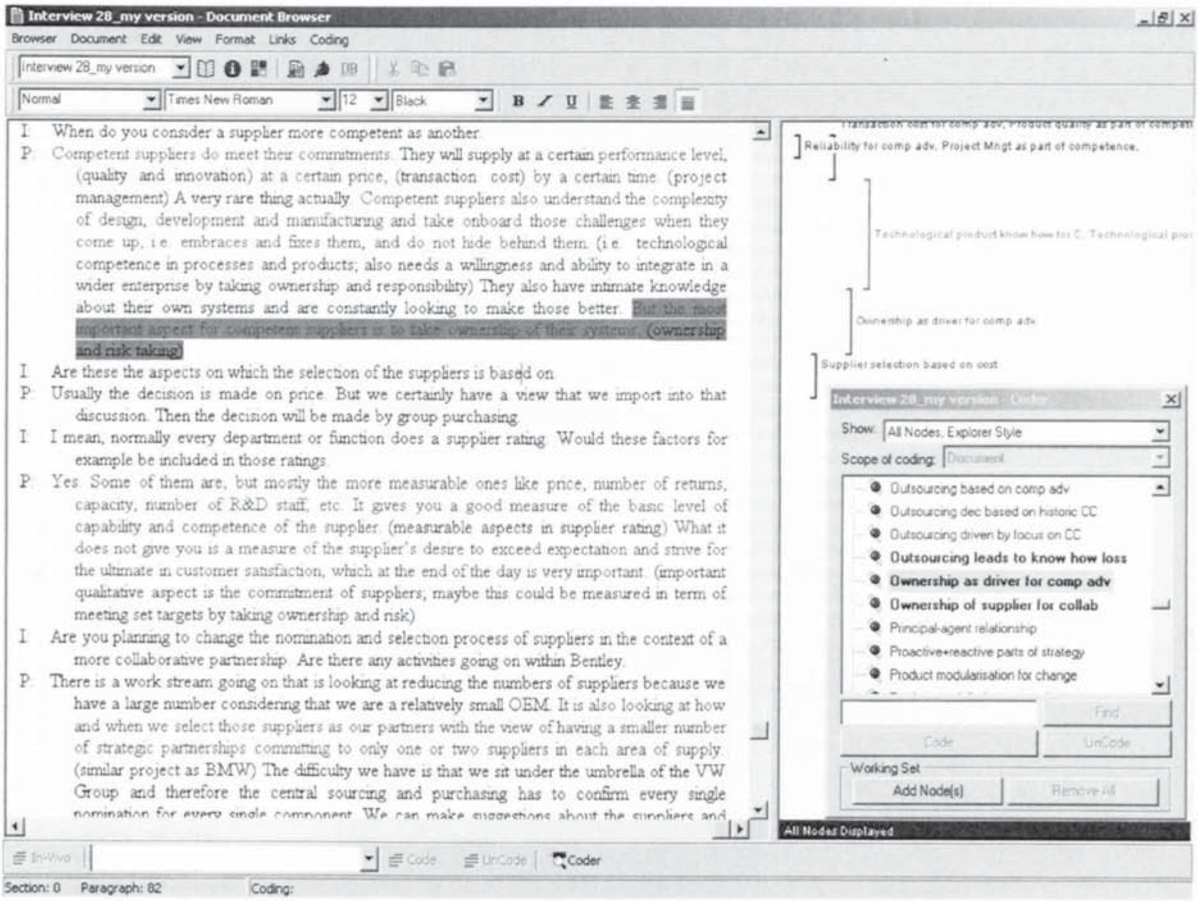


**Figure 5.2: Coding of text passages using NVivo's coder**

As far as it was practicable, the interviews were coded only within the remit of the description within them (guided by the *a priori* template categories developed in Stage 1 above) and without conscious and explicit reference to specific bodies of literature but with reliance on the subjective experience and the knowledge of the author. Furthermore, each code was briefly described reflecting the idea it was expressing which helped in allocating text passages with the same ideas to the respective codes; thereby speeding up the overall coding process. However, the code titles and descriptions changed several times during the progression of the coding as new and more evocative quotes were encountered through the constant comparison.

This dynamic was managed via *NVivo's coder* with minimal effort. At the beginning of this data coding and analysis process all the codes were in free node format since the relationships between them were not yet obvious and clear leading to a composite list of 237 provisional codes of the entire sample of 28 interviews. This is shown in the *node browser* in Figure 5.3. It illustrates an extract of the full list of 237 codes in alphabetical order (left hand column), its details, i.e. name, passages that have been coded, date and time of creation and / or modification (right hand column on top), and an example of a description for the code 'Definition of core business based on history' (right hand column on bottom).

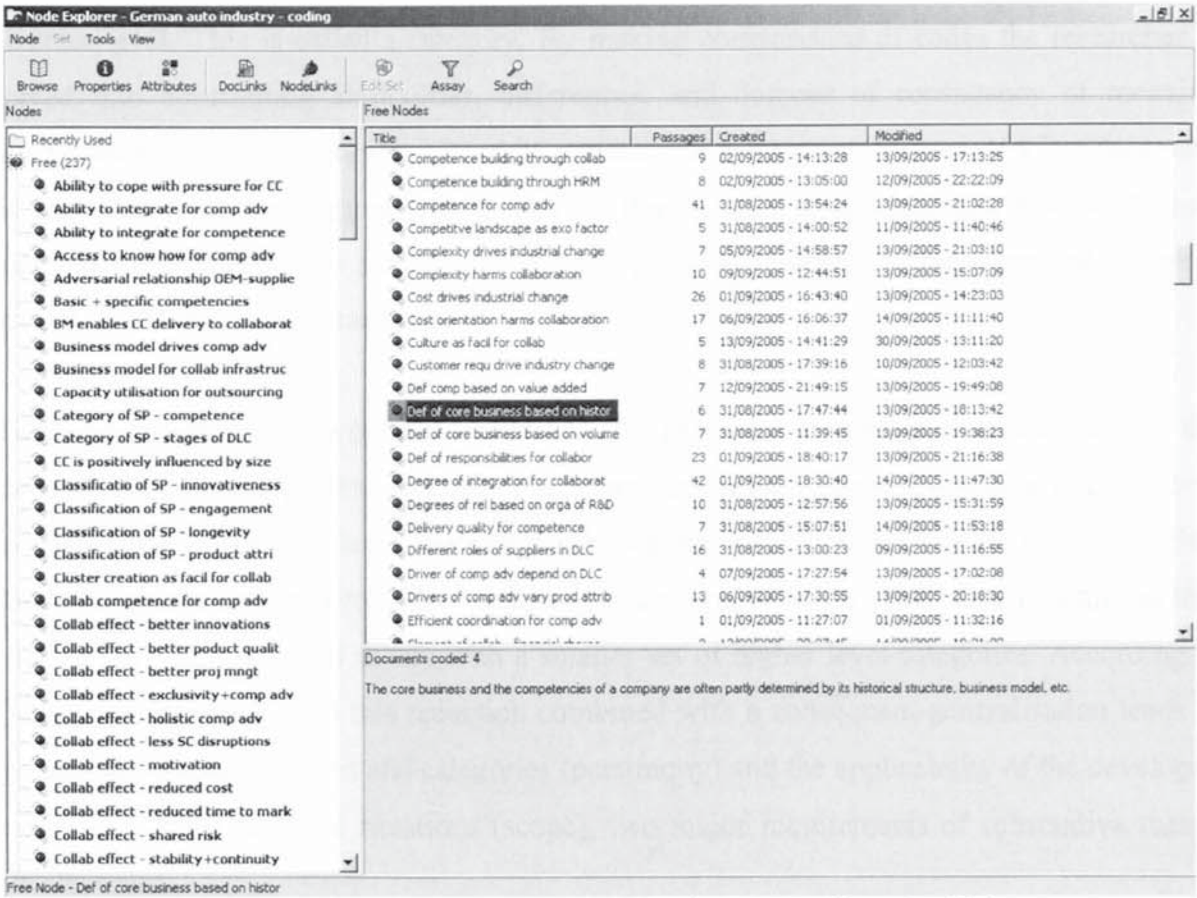

**Figure 5.3: Extract of code list and details after open coding using Nvivo**

It should be mentioned that the author did not only rely on this electronic method using the NVivo software but also applied a manual method using post-its in order to combine the best features of each approach. Because the overview of the codes in the *node browser* shown as a list (cf. Figure 5.3) was not considered as very clear and supportive for their further analysis, the author used post-its to visually organise the codes on a big flipchart, each code being represented by one post-it. This way it was very easy to group, cluster and organise codes which proved useful during further analysis and categorising (cf. section 5.1.3.). Although NVivo offers features such as creating node links, building node sets or developing graphical models (which were used by the author but not excessively), from the author's subjective point of view it does not provide sufficient *a priori* support in the difficult abstraction process from codes to categories to core categories in a good visual way; hence, the combination with the manual post-it method.

### 5.1.3. Stage 3: Clustering of open codes into coherent categories

The next stage involved the search for groups of codes that share the same meaning on a more abstract level. This is called a category. By making comparisons of codes the researcher is forced into confronting similarities, differences, and degrees of consistency of meaning among them which generates a uniformity resulting in a category (Strauss, 1987). Glaser and Strauss (1967) thereby suggest as basic rule for this constant comparison that while coding an incident for a category, to compare it with the previous incidents in the same and different groups coded in the same category.

This constant comparison of the identified codes generates theoretical characteristics of the categories, i.e. as the process progresses constant comparison moves from code to code level towards code to category level, thereby integrating the associated knowledge (Glaser, 1994). This is accompanied by a reduction process, i.e. uniformity in the coded data is achieved that enables the formulation of theory with a smaller set of higher level categories. According to Glaser and Strauss (1967) this reduction combined with a consequent generalisation leads to the minimalisation of codes and categories (parsimony) and the applicability of the developed theory to a wide range of situations (scope), two major requirements of substantive theory development.

During the comparison of codes across all interviews (cross-case analysis) the relationships between the codes became clearer and the author started to group codes with similar meaning into categories. This was done using a combination of the electronic NVivo software and the manual post-it method. First, the post-its (codes) were reviewed and re-arranged on the flipchart in a manual way to identify emerging patterns and relationships between them on an abstract level. Theses groups of codes were given a more abstract and comprehensive definition, now being formed into a category, reflecting the common meaning of the subordinate group of codes. These categories were represented on the flipchart with bigger post-its around which the groups of codes were clustered.

At the same time a thorough review of the text passages that were coded with the respective codes was undertaken in NVivo to complement the manual flipchart process by creating node and document links. Using the *node browser* of NVivo each code was explored individually and evaluated against other codes of the group as well as against the superior category by looking at the meaning that was reflected by the coded text of it. In the same way groups of codes were organised into categories and sub-categories, groups of categories were organised into larger and even more abstract but provisional core categories or abstract themes integrating the categories with each other. A rough conceptual overview of initially identified relationships between the provisional core categories, categories and their sub-categories based on the initial 237 grouped free nodes is shown in Figure 5.4.

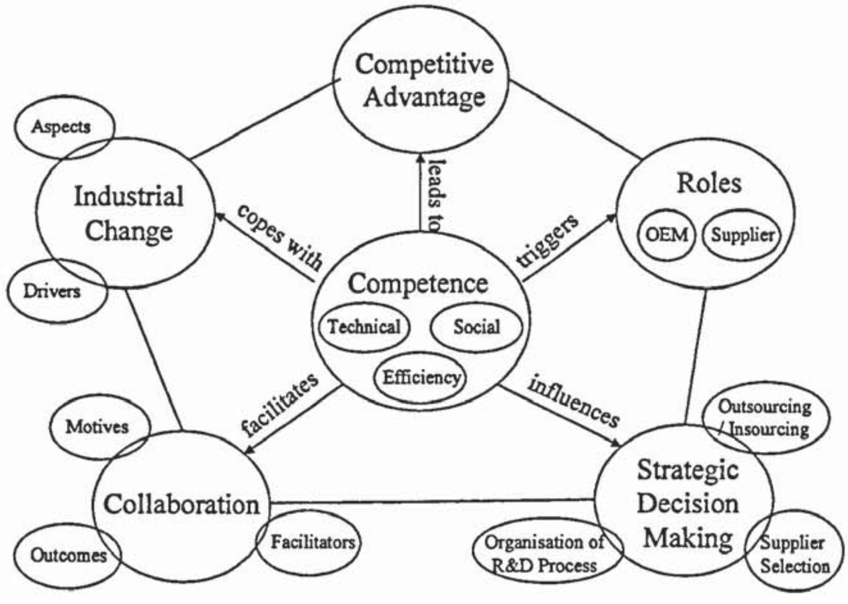


**Figure 5.4: Rough conceptual overview of initial category relationships**

At the same time, this process led to a re-organisation of codes from free nodes into tree nodes using the NVivo *node browser* in an easy drag and drop manner. Therefore, a new project named 'German automotive industry – analysis' was created in NVivo in order to be able to go back to the original project ('German automotive industry – coding') anytime during the research study. During the process of thoroughly reviewing each individual code for commonality with others and evaluating it against abstract categories to develop tree nodes, many of the original codes were merged or omitted due to being interdependent and overlapping. This led to a list of 158 codes now being tree nodes (out of originally 237 free nodes). This finer and more sophisticated re-organisation process using NVivo led to a refined and more advanced categorisation of the tree nodes into 16 analytical categories including 19 subcategories guided by the initial relationships that have been identified in Figure 5.4 above (although there is no explicit rule, a number of 10-20 categories seems suitable (Auerbach and Silverstein, 2003)). The result is shown in Figure 5.5.

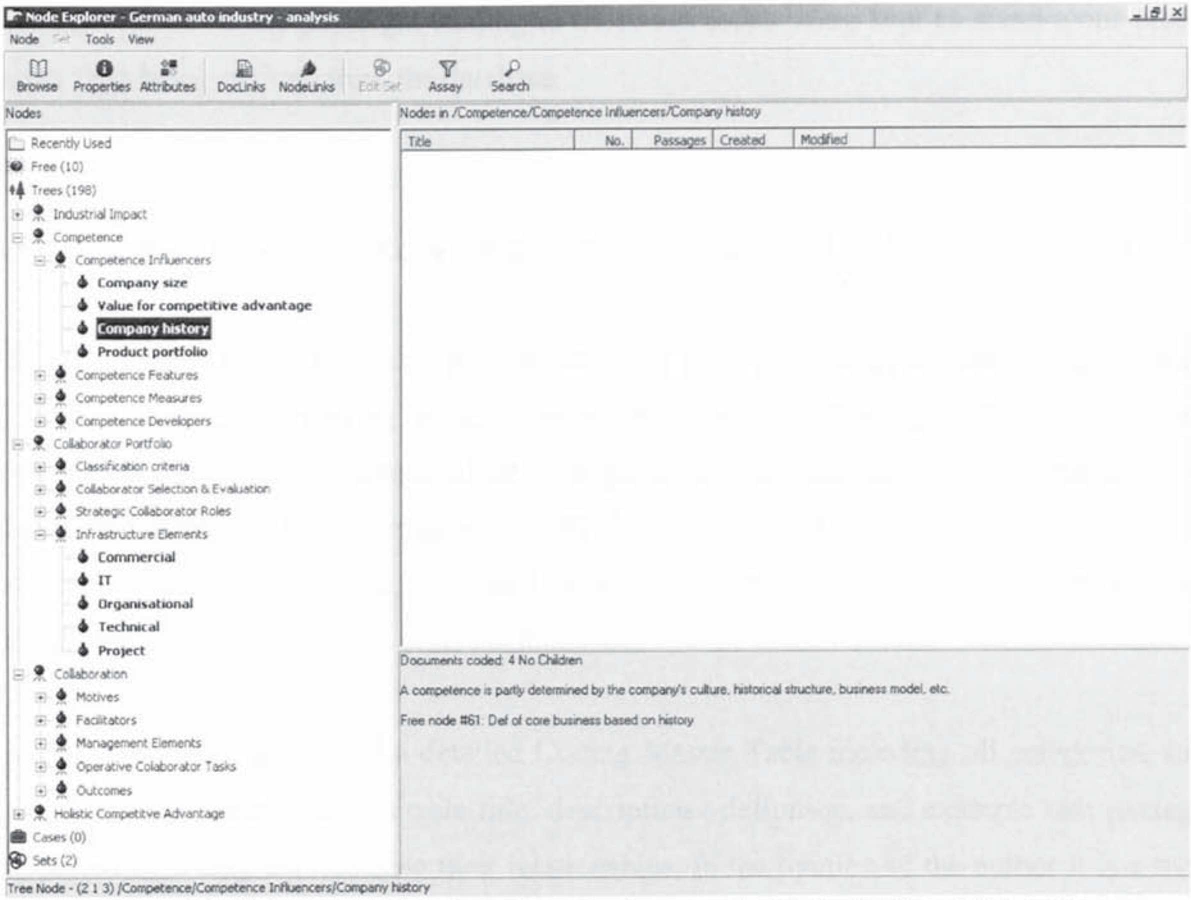

**Figure 5.5: Categories, sub-categories and codes organised in the NVivo node browser**

As can be seen in the left hand column of Figure 5.5 all categories, sub-categories and codes are now organised in trees. Similar to Figure 5.3 above the description for the code 'Company history' (now a tree node) is given in the bottom right hand column. It also points out that this tree node emerged from the former free node 'Definition of core business based on history' which enables to trace the tree nodes back to their former free nodes. Its tree can be seen in the left hand column or at the very bottom of the screen.

As can be seen from this example the code names were refined (compared to Figure 5.3 above). The goal was to choose a short quote that reflects the essence of each idea related to that code in a true and emotionally vivid way (Auerbach and Silverstein, 2003). Similarly, the categories' name should reflect the abstract patterns that pulled those codes together with a simple and easily understood phrase.

Although the categorisation process normally should continue until all codes are allocated to categories, ten 'orphan' codes, specified as free nodes in the left hand column in Figure 5.5, were not grouped into a category because no other codes with similar meaning could be found. However, since qualitative research is not focused on quantity, individuality has an important place in this paradigm leading to those ten codes being kept as stand alone pieces rather than being omitted from the database.

### 5.1.4. Stage 4: Development of a Coding Master Table (axial and selective coding)

The axial coding in this study was not carried out in strict accordance to Strauss and Corbin's (1998) coding procedure using 'logic diagrams' based on their Paradigm Model. This would have required specifying a sequential set of stages explaining each category in terms of: (i) its causal conditions, (ii) its phenomenon, (iii) the data context of its phenomenon, (iv) its intervening conditions, (v) the action and interaction strategies for its phenomenon, and (vi) the management consequences of its phenomenon.

Instead, the author developed a detailed Coding Master Table including all categories, sub-categories and codes with a suitable title, description / definition, and example text passages supported by a diagram outlining their relationships. In the opinion of the author it is a more pragmatic way of developing a 'miniframe' for each core category but nevertheless can be seen as a sufficient substitution of the axial coding process and its associated 'logic diagram' by providing an equivalent analysis process. This is supported by Suddaby (2006) who states that a common characteristic of Grounded Theory research is an overemphasis on coding which lacks the spark of creative insight upon which empirical research is based. Glaser (1978) described this tension with the term 'theoretical sensitivity'.

The Coding Master Table is consistent with the principles of coherence and transparency to ensure the quality of the coding (Bauer, 2000). According to Bauer (2000) coherence means that any coding scheme should be internally consistent in its organisation and that all codes should flow from a single principle, whereas transparency argues for the coding scheme to be reported and made explicit. In order to enable replicability, the coding scheme should include: code title, definition, and an illustrative example of representative text (Bauer, 2000). This last aspect of having an example is less trivial as it seems because it enables the researcher to support his/her interpretation with data so that other researchers can understand the way of analysing it. In this context Auerbach and Silverstein (2003) argue that "if your interpretation is supported by the data, then it is valid, even if there are other ways to interpret the same data" (p. 32). In Table 5.2 an example of the Coding Master Table is given for the category 'Competence influencers' that is also shown in Figure 5.5 above.

| Abstraction level | Code Title | Definition / Description | Empirical Example | Comments |
|---|---|---|---|---|
| Provisional core category | Competence | N/A | N/A | |
| Category | Competence Influencers | Factors that influence a competence | N/A | N/A |
| Code | Company size | A competence can be positively influenced by company size, at least for standard products and projects | Very often the big suppliers are the more competent ones, at least in projects that already gained a certain maturity | Link to roles of collaborators |
| Code | Company history | A competence is partly determined by the company's culture, historical structure, business model, etc. | In our company we have technologies that we consider as core technologies. This is based on a 100 year old company history and tradition | Influences transfer-ability of competence |
| Code | Product portfolio | A competence and a core business activity can be influenced by the product portfolio, in particular the volume | Within the product portfolio we decide on our core products which are mainly based on volume. High volumes indicate the mass market and hence our 'bread and butter' business | Link to 'product attribute' in sourcing |
| Code | Value for competitive advantage | A competence can be influenced by its value for the development of competitive advantage, e.g. the more value a certain know how adds to the competitive advantage of the company the more likely it will be considered as a core business activity or core competence | For our competitiveness the electronics area is getting so important for us that we cannot afford to outsource everything to suppliers but need to have certain competencies in that area on our own | Link to 'competence measures' |

**Table 5.2: Example of category 'Competence Influencers' of Coding Master Table**

The table shows the abstraction level of the code or category, its title, its description, a representative example from the interview text reflecting its meaning, and comments that helped in its further analysis. These comments were derived from using linking techniques within NVivo, such as node links, by writing little memos and annotations concerning certain pieces of data.

This process helped in identifying provisional core categories. These core categories are then the building blocks for a new theoretical framework which moves the data analysis from a descriptive to a more abstract and analytical level (Auerbach and Silverstein, 2003). Since a core category is the basis for theory development it needs to be constantly proven by its prevalent relationship to other categories. Glaser and Strauss (1967) identified several helpful criteria for selecting a core category:

- Centrality, i.e. related to many other categories
- Frequency, i.e. the meaning related to the core category must appear frequently in the data
- Relation, i.e. easily relatable to other categories
- Implications, i.e. showing clear implications for general theory
- Variation, i.e. building maximum variation into analysis

Considering these guidelines, five core categories or abstract themes were developed in this study that have been influenced by the *a priori* template categories derived from the basic research objectives in Stage 1 above. The result is shown in Table 5.3.

| Template category (a priori) | Objective | Core category (in vivo) | Definition / Description |
|---|---|---|---|
| Relationship Status Quo | Identification of current issues and practices associated with collaboration in inter-firm R&D relationships in the automotive industry | Industrial Impact | Factors that describe the role of the industrial environment and its influence on practices in the context of inter-firm R&D collaboration in the German automotive industry. Includes: Change Drivers, Change Aspects, and Coping Methods |
| Relationship Design | Identification of issues related to the creation of inter-firm R&D relationships and their governance structure | Collaborator Portfolio | Factors that are concerned with the design and development of an appropriate portfolio of collaborating companies in the context of inter-firm R&D collaboration in the German automotive industry. Includes: Collaborator Sourcing, Relationship Criteria, Strategic Collaborator Roles, and Relationship Interfaces |
| Relationship Management | Identification of issues related to the management of inter-firm R&D relationships and their collaborative activities | Collaboration | Factors that are concerned with the execution and management of collaborative activities between parties within the collaborator portfolio (enterprise portfolio) in the context of inter-firm R&D collaboration in the German automotive industry. Includes: Facilitators, Elements, Operative Collaborator Activities, and Outcomes |
| Relationship contingency | Not identified before | Competence | A competence can be considered as a bundle of skills and technologies that must be competitively unique (Hamel and Prahalad, 1994). Includes: Influencers, Features, Attributes, and Developers. |
| Relationship Success | Identification of issues associated with the competitive success of inter-firm R&D relationship | Holistic Competitive Advantage | Factors that consider the development of competitive advantage and business success for the overall collaborator portfolio in the context of inter-firm R&D collaboration in the German automotive industry |

**Table 5.3: Core categories of this research study**

Once the core categories were identified and developed, the author related the other categories to them gradually densifying the theory by beginning to think about a general theoretical framework for the governance of inter-firm relationships. At this point it was necessary to re-arrange codes, categories and sub-categories in the Coding Master Table as well as the trees in NVivo and even go back to further coding of the raw text in order to conform to the meaning the core categories reflect; thus underpinning the key operation of iteratively applied constant comparison of Grounded Theory. As opposed to 'orphan' codes it is less acceptable to have 'orphan' categories since all categories represent valuable codes that have been developed. The final code set resulting from this exercise is shown in NVivo's node browser in Figure 5.6.

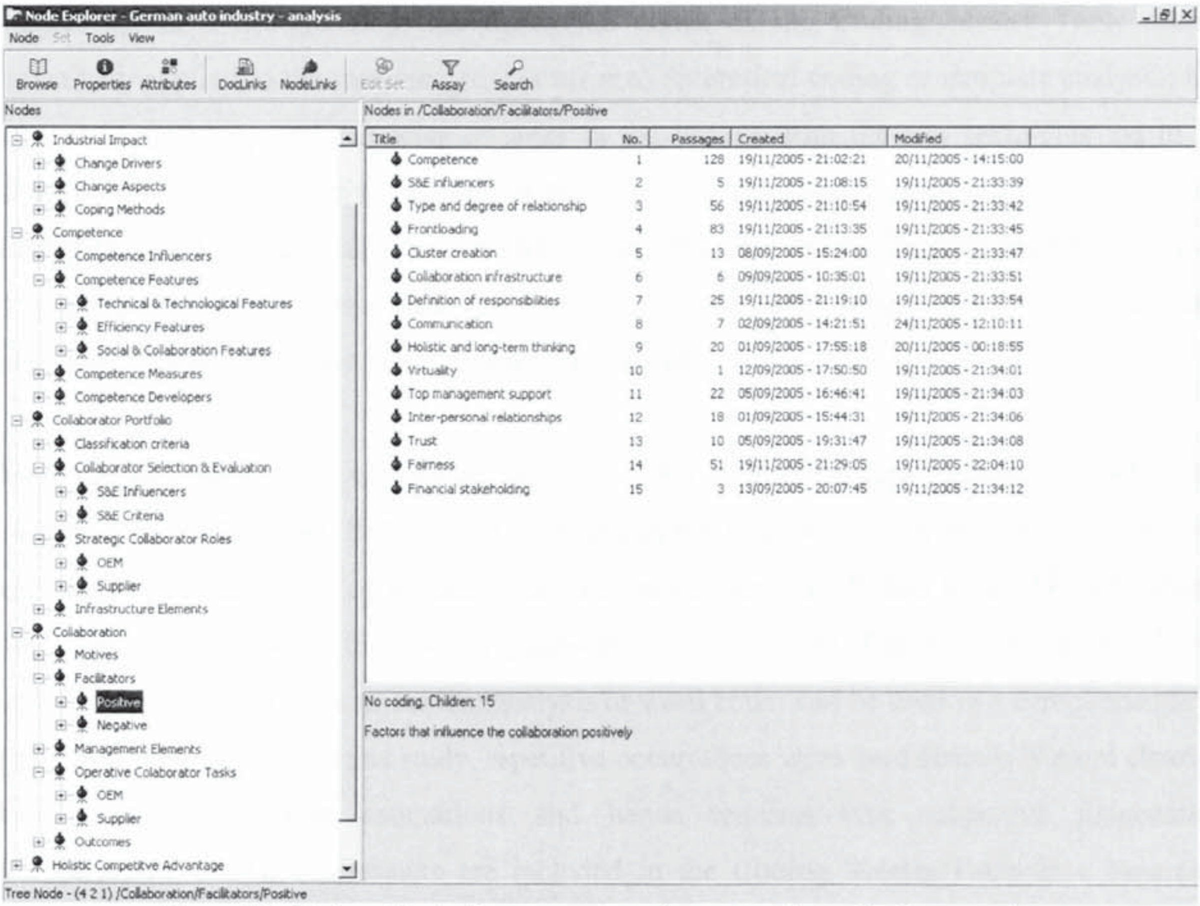

**Figure 5.6: Code set including core categories, categories and sub-categories**

In the left hand column of Figure 5.6 the code set including core categories, categories and sub-categories is shown. Due to space restriction on the screen not all trees could be opened completely, hence not all 16 categories and 19 sub-categories of the code set are shown here. Similar to Figure 5.5 above, in the top right hand column the details of a selected item from the left column (in this case the sub-category 'Positive Facilitators for Collaboration') are given. It is specified which codes belong to this sub-category (codes 1 to 15), how many passages have been coded with the respective code and when it was created and modified. In the bottom right column the description of the selected sub-category is given. This database represents the completed NVivo project 'German automotive industry – analysis' which, however, does not yet reflect the very final results of the coding due to a further re-coding process that took place in this study as part of the theoretical sampling element of Grounded Theory.

In the first step of re-coding, the developed coding scheme was discussed with several colleagues as well as one practitioner of the automotive industry who was not involved in the research project leading to minor changes and revisions, mainly in re-organisations of the codes and clarifications of the individual code descriptions / definitions (cf. section 4.3.3. in Chapter 4). In a second step, the developed codes of the Coding Master Table were deductively applied to the interview text (similar to theoretical coding or template analysis) in order to identify any redundancies or lacks in the coding from the raw text. This led to a subsequent refinement of the Coding Master Table: 11 new codes emerged, 15 codes were slightly renamed to better reflect its analytical category, and 2x2 codes were merged because of being interdependent; now leading to a set of 167 tree nodes within 19 sub-categories, 16 categories, 5 core categories and 8 'orphan' free nodes.

Once the re-coding was completed and all codes, sub-categories, categories and core categories were identified, defined and provided with a text example, a frequency count was conducted to indicate how often each code occurred in the overall data set of 28 interviews. This does not contradict the overall philosophy of Grounded Theory research in which positivistic techniques such as content analysis or word count can be used in a complementary sense (Suddaby, 2006). In this study, repetitive occurrences were used since it is more clearly defined than magnitude estimations and hence requires less subjective judgement (Krippendorff, 2004). The results are included in the Coding Master Table in a separate column stating the interview in which the code was observed and the number of passages it occurred in. The sum of all those passages led to an overall frequency figure provided in the lower right corner of the cell stating the code title. Using the same example as in Table 5.2 above (the core category 'competence'), the final design of the Coding Master Table is shown in the following Table 5.4.

| Category / Code | Definition / Description | Example [#interview:paragraph] | Coding |
|---|---|---|---|
| Competence | A competence can be considered as a bundle of skills and technologies that must be competitively unique (Hamel and Prahalad, 1994). Includes: Influencers, Features, Attributes, and Developers. | N/A | Referenced interview (number of passages therein), e.g. 2(3), 15(1) |
| Competence Influencers | Factors that influence a competence | N/A | N/A |
| Product portfolio 35 | The possession and development of a competence or a core business activity can be influenced by the current and future product portfolio | Within the product portfolio we decide on our core products which are mainly based on volume. High volumes indicate the mass market and hence our 'bread and butter' business [#1:27] | 1(3), 2(1), 3(1), 4(2), 5(3), 6(1), 7(1), 8(3), 9(4), 10(1), 13(1), 14(1), 16(1), 19(3), 20(4), 25(2), 26(3) |
| Value for competitiveness 28 | The possession and development of a competence can be influenced by its value for the development of competitive advantage for the company, e.g. the more value a certain know how adds to the competitiveness of the company the more likely it will be considered as a core business activity or core competence | For our competitiveness the electronics area is getting so important for us that we cannot afford to outsource everything to suppliers but need to have certain competencies in that area on our own [#25:55] | 1(2), 2(2), 4(2), 5(1), 6(1), 14(2), 18(2), 19(1), 20(2), 23(2), 25(6), 26(5) |
| Outsourcing 25 | The possession and development of a competence can be influenced by outsourcing activities which are based on strategic sourcing decisions | Outsourcing always holds the danger of giving away competencies [#6:85] | 2(2), 4(1), 5(2), 6(3), 7(2), 8(1), 9(1), 10(2), 12(1), 13(1), 15(2), 17(1), 18(1), 19(1), 22(1), 23(1), 25(1), 28(1) |
| Company size 16 | The possession and development of a competence can be influenced by company size | Very often the big suppliers are the more competent ones, at least in projects that already gained a certain maturity [#1:43]<br><br>Experience shows that most innovations come from SMEs [#2:85] | 1(2), 2(2), 3(1), 7(2), 8(1), 11(1), 17(1), 18(1), 20(2), 21(1), 22(1), 27(1) |
| Company history 9 | The possession and development of a competence is partly determined by the company's culture, historical structure, business model, etc. | In our company we have technologies that we consider as core technologies. This is based on a 100 year old company history and tradition [#19:23] | 2(2), 9(1), 16(3), 19(1), 24(1), 25(1) |

**Table 5.4: Final design of Coding Master Table**

As can be seen in comparison to Table 5.2 above, a new code termed 'outsourcing' has been added during the re-coding process. Furthermore, some of the code definitions have been refined. The column occupying the former comments has been replaced with the representation of the referenced interviews and passages which resulted in the frequency counts given for each code. The codes are now organised in accordance to their frequencies in a descending order in the Coding Master Table to better reflect their importance and impact.

Although this provides opportunities to assess the extent and severity of certain aspects (e.g. a code) and even allows to draw some tentative conclusions, frequencies only represent a summary of qualitative data and not a shift from qualitative to quantitative data (Auerbach and Silverstein, 2003). The full Coding Master Table is provided in Appendix J.

In the following, Figures 5.8 and 5.9 present the final hierarchical layout of the codes, sub-categories, categories and core categories of the Coding Master Table. The little grey boxes in the bottom right corner of each code indicate their frequency count. In order to facilitate the reader's understanding a more generic diagram based on earlier work (Binder and Clegg, 2006b) is presented upfront in Figure 5.7 which only depicts the grey shaded boxes from Figures 5.8 and 5.9 reflecting the top level core categories and their related categories and sub-categories. Subsequently, Coding Diagram A illustrates the full layout whereas Coding Diagram B presents a refinement of the middle part (i.e. relationship design, relationship management, and relationship contingency). It is advised that the Coding Master Table and the Coding Diagrams are read together in order to get a better understanding of the logic and meaning of the coding.

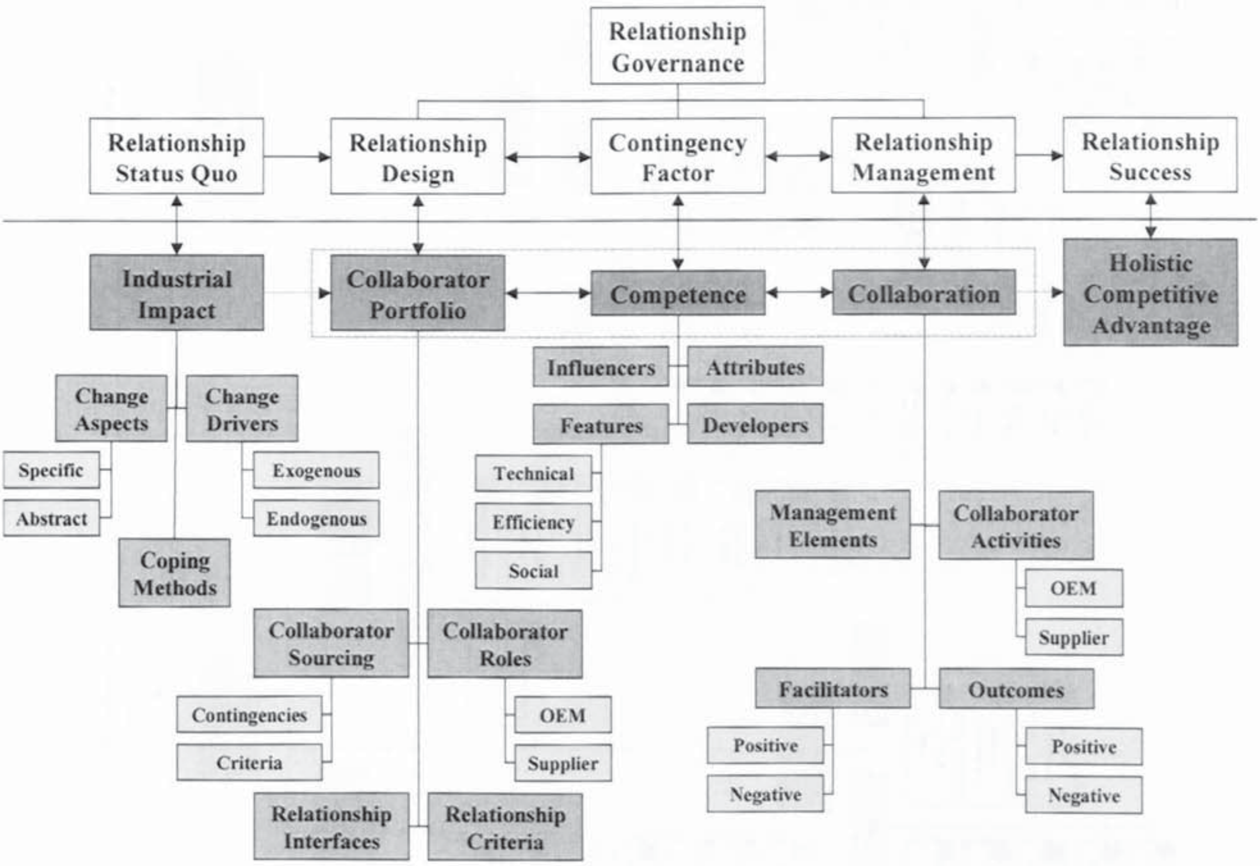


**Figure 5.7: Generic coding diagram**

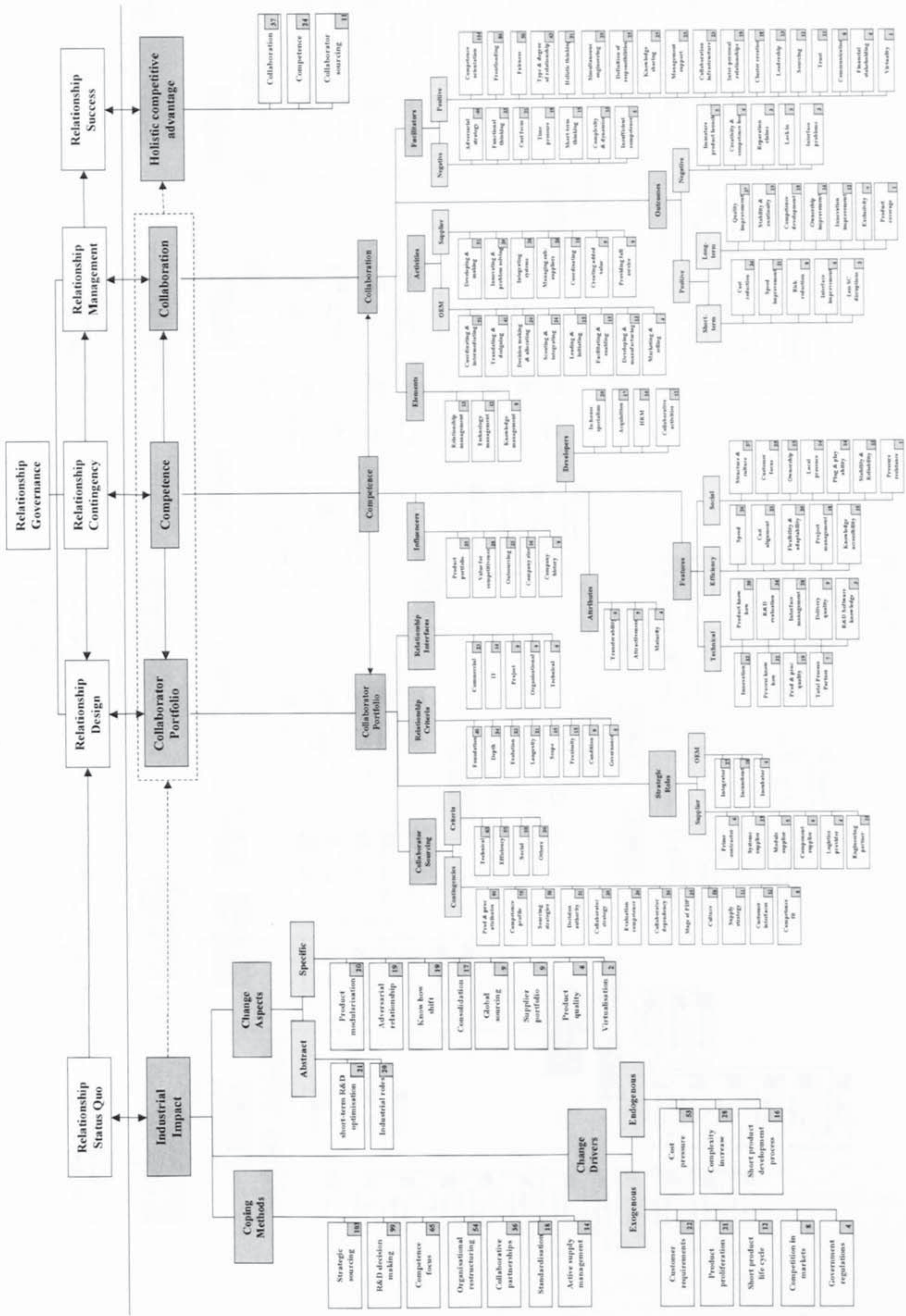


Figure 5.8: Coding diagram A

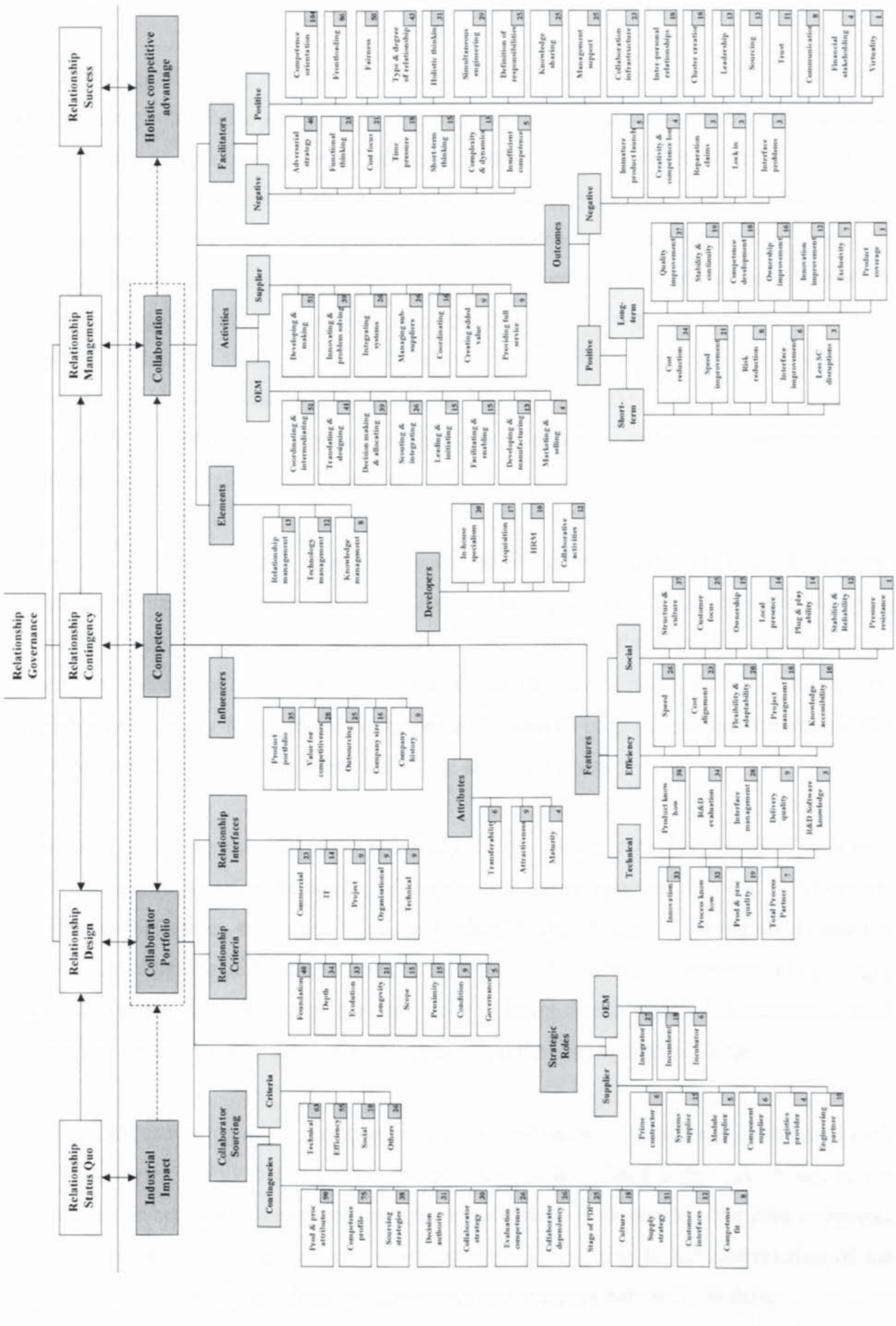


Figure 5.9: Coding diagram B

### 5.1.5. Stage 5: Formation of theoretical narratives and propositions

The final stage of coding involved the transformation of core categories or abstract themes with all their subordinate categories, sub-categories and codes into a theoretical narrative leading to the generation of a set of tentative propositions. A theoretical narrative (and the related propositions) explicates the story of a core category in relationship to the research problem using the subjective perspective of the research participant rather than academic parlance; thereby grounding the narrative in the data. It provides the abstract bridge between the research topic and objectives and the participants' subjective experience but also including experiential data in form of the researchers' theoretical background knowledge and experience within the narrative (Auerbach and Silverstein, 2003). Thereby, these narratives help to lift the data onto a conceptual level by abstracting subjective experiences into theoretical statements (Suddaby, 2006).

At this stage the frequency count conducted above proved useful as a guide towards evaluating the importance of the numerous codes. Although, none of the codes were generally omitted from the narratives because of a low frequency number, the propositions were mainly formed on the basis of codes with higher frequencies. In the following, the detailed storyline of each core category followed by the respectively derived propositions that summarise the key aspects of the narrative (as perceived by the author) is given.

In order to ensure transparency and traceability for the reader, at the beginning of each sub-section a diagram showing the coding of the respective core category is given. Furthermore, the relevant categories and codes from the Coding Master Table (cf. Appendix J) and the main coding diagrams in Figures 5.8 and 5.9 are put in brackets after relevant text passages during the narrative (*Category* in title case; *code* in lower case!). Hence, it is advised to read the narratives together with the Coding Diagrams and the Coding Master Table.

However, for clarity reasons it is also important to mention that although the narrative of each core category is mainly based on the relationships of its related codes (as shown in the diagram at the beginning of each section), there are various spillovers to other core categories and their subordinate categories and sub-categories. This is due to the interrelation of the various codes which emerges from the qualitative and complex nature of the data.

***Relationship Status quo - Industrial Impact***

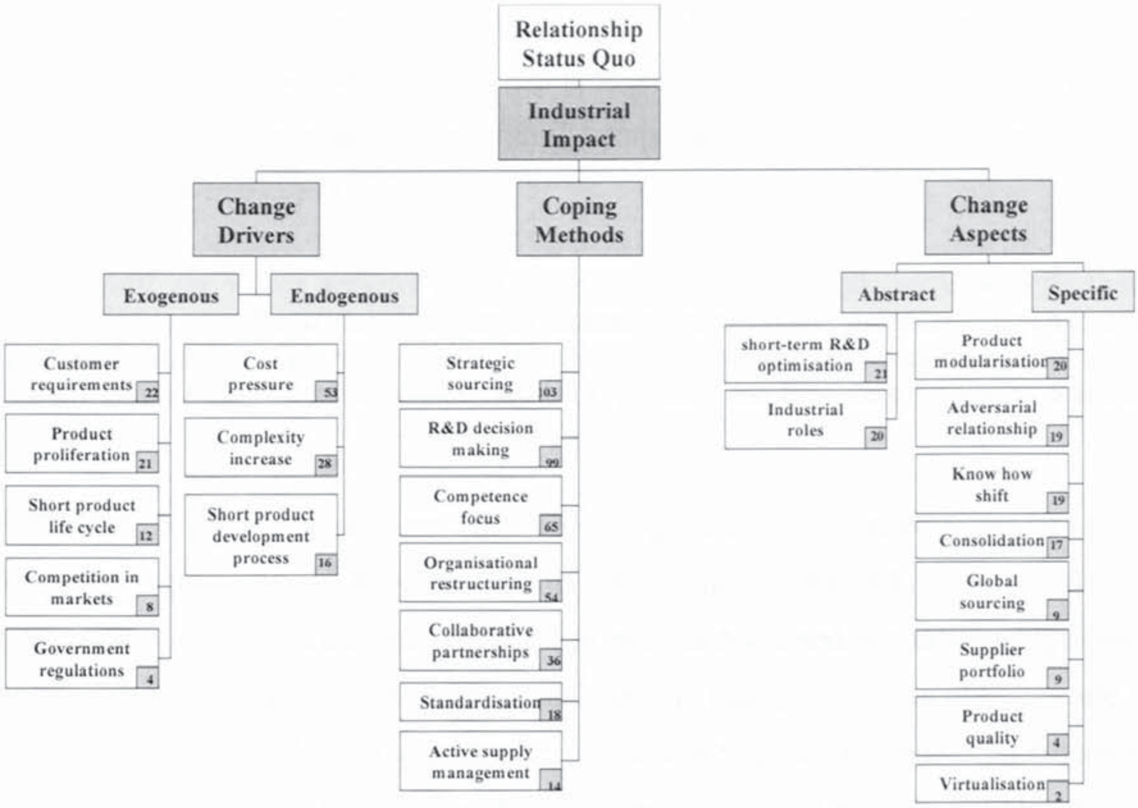


**Figure 5.10: Coding of the core category 'Relationship Status Quo'**

The consideration of ever more individualistic customer requirements and needs (*customer requirements*) is becoming a more important factor for competitive success in the automotive market that is characterised by increasing global competition (*competition in markets*), decreasing product life cycles (*short product life cycle*) and a greater variety of product segments (*product proliferation*). Customers strive for the best quality at the minimal cost which has direct impacts on the development and production of cars and their components (*cost pressure*). It means that companies need to produce a better quality at lower costs more quickly leading to automatisation, rationalisation, or technological changes to maintain the competitive success of the company and the supply chain it is embedded in (*short product development process*; *organisational restructuring*). Hence, "the requirements concerning the whole supply chain as well as the individual organisation within it increased" (General Manager Logistics, Component Supplier)*.

From a technical product perspective this is accompanied by increasing requirements in the areas of comfort, safety, electronics, etc.: "a couple of years ago airbags were a special feature, nowadays it is standard" (Managing Director R&D, Systems Supplier)*. That means, the higher built in functionality (e.g. through mechatronic features) and the resulting complex interdependencies between parts and components lead to an increase in overall product complexity (*complexity increase*). This leads not only to higher cost pressure (*cost pressure*) but also to more complex development and production processes (*complexity increase*) that ultimately cannot be handled by individual companies in the automotive industry alone (*collaborative partnerships*).

> *"Therefore, the whole network needs to be structured more efficiently and effectively (i.e. OEM to tier 1 and tier 1 to tier 2) because based on the increased dependencies and complexity of the relationships the quality requirements concerning the whole supply chain have increased drastically"* (Corporate Vice President Logistics, Systems Supplier).*

In addition to customer requirements, in every new product development or product upgrade, government regulations are important drivers for the automotive industry (e.g. safety, fuel consumption, emission values, etc.) that have to be considered and implemented (*government regulations*): "For example, in the area of safety we are facing constantly changing and more stricter government regulations that ultimately require new processes and technologies in car development" (Managing Branch Director, Engineering Service Provider)*. Although these drivers are considered crucial and the automotive players are conducting work in these directions themselves as well, they are generally not very well perceived amongst the OEMs and suppliers due to short development lead times that are allowed by the legislator. This results in an industry wide agreed but minimal fulfilment of the requirements (*standardisation*) due to shorter product development processes (*short product development process*) that are facing stiff cost competition (*cost pressure*). Furthermore, these enforced requirements are considered as a bottom up upgrade of product complexity (*complexity increase*) because, for example, "no cars without ABS or ESP are tolerated anymore" (Corporate Vice President Logistics, Systems Supplier)*.

The consideration of customer needs and desires (*customer requirements*) caused a stronger segmentation of the automotive industry. It led to larger product portfolios with more variety through the creation of more product segments over the last 10 years (*product proliferation*). "In the past we had a sedan and an estate car. In the meantime we have up to 20 derivates from Sports Utility Vehicles (SUVs), over Pickups, to Convertibles" (Managing Director R&D, Systems Supplier)*. Simultaneously, the volume per model is decreasing leading to the necessity of creating more and more segments and different models in order to maintain or increase the overall volume of car production and sales.

> *"10 years ago we had 2 basic models (each with sedan and estate car) that accounted for 70 to 80% of our overall volume. Today we only cover 50% with these models and the other 50% come from segment specific cars, such as SUV, Roadster, Coupe, Convertible, etc."* (General Manager Design Car Body, OEM).*

In a logical consequence, this creates higher cost per model because the development and production cost (including prototyping and tooling) have to be compensated by a much lower market volume so that economies of scale cannot be realised (*cost pressure*). This is accompanied by a reduction in development lead time (*short product development process*) and development budget of the OEMs because the market does not possess enough potential to cover the increased cost per model to the full extent.

In addition, there is a general tendency towards shorter product life cycles triggered by the success story of Japanese car manufacturers that started 10 to 15 years ago (*short product life cycle*): "10-15 years ago the life cycle of a car model was around 7-8 years. In the meantime, we launch a new model every three years" (Sales Manager, Module Supplier)*. This shorter life cycle is grounded in further developments of styling or technical features, a quicker saturation of the market segment, an increasing competition based on globalisation and overcapacities (*competition in markets*), or a wearing of production and manufacturing facilities. Together with the exogenous industrial forces mentioned above, namely increasing customer and government requirements and regulations (*customer requirements, government regulations*) as well as increasing product segmentation (*product proliferation*), the shorter product life cycles in the context of a competitive industrial environment (*short product life cycle, competition in markets*) causes further cost pressure, complexity increase and shorter development lead times within the whole supply chain (*cost pressure, complexity increase, short product development process*). Hence, the combination of these exogenous and endogenous aspects drove and still drives the changes in the automotive industry.

> *"Change is always dependent on the company situation, its strategies as well as external forces"* (General Manager Central Quality Assurance, OEM).*

These insights on industrial factors are summarised in the following proposition #1.

**Tentative proposition # 1:** *Change in the automotive industry is driven by a combination of general industrial forces and internal company issues*

The outlined exogenous and endogenous forces make it increasingly difficult for OEMs to perform the complex product development and production activities on their own leading to increased outsourcing activities (*short-term R&D optimisation*) and a change in roles of all players in the industry (*industrial roles*). In the past, the OEMs possessed a lot of specific product design and engineering know how in-house (*product know how, process know how*) and hence only bought smaller specific parts or components of external suppliers in an arms length relationship (*adversarial relationship*). However, in the context of higher cost (*cost pressure*), increased complexity (*complexity increase*), and the necessity for shorter development lead times (*short product development process*), OEMs started to aggregate individual parts and components to bigger modules and systems and purchased these more complex items, e.g. complete front modules including headlights, cowling, etc., on the market under the banner of outsourcing and modularisation (*product modularisation*). This was in order to reduce the complexity of product interfaces and process coordination and hence the overall product development cost (*interface improvement, cost reduction*) by dealing with fewer suppliers (*consolidation, supplier portfolio*). It also makes it easier to adapt to market changes via the greater supplier flexibility (*speed & flexibility improvement*).

On the one hand, this was and still is leading to a yearly increase of performance requirements from OEMs towards suppliers starting from specific parts and component know how (*product know how, innovativeness, developing & making*) up to the delivery of complex solutions for whole systems and modules including design, development and interface management (*interface management, total process partner, innovating & problem solving, integrating systems, managing sub-suppliers, coordinating*). On the other hand, the modularisation inevitably led to a transfer of specific technical knowledge from the OEMs to their suppliers (*know how shift*) with increased dependencies between all involved parties, i.e. form OEM to 1st tiers and from 1st tiers to 2nd tiers, etc. (*collaborator dependency, industrial roles*).

> *"I am in the company since 1986 now. At the beginning we only outsourced the production of parts based on engineering drawings. Then we adopted a modular thinking, i.e. product modularisation and focusing on core competencies with the transfer of more engineering performance towards the suppliers and a reduction of our own performance towards coordination. And now we even outsource complete small*

> *car series to specialised prime contractors that we are reliant on"* (Head of Concept Development Project XY, OEM).*

The OEMs became more and more reliant on the specific know how of the suppliers (*competence profile, collaborator dependency, Competence Features: Technical & Technological*) in order to cope with increased model variety as well as customer and government requirements (*customer requirements, government regulations, product proliferation*) and simultaneously be able to further reduce cost in the product development process in the future as "the supplier has the more detailed knowledge and cheaper workforce which makes it more efficient for the OEM to purchase this know how and innovation externally rather than building it in-house" (General Manager Mechatronic Drives, Module Supplier)*. The suppliers face a greater risk as it can have serious financial consequences for them to loose an order which often can account for 20-30% of their turnover due to bigger engineering performance packages that come with the product modularisation (*product & process attributes, collaborator dependency*). It also stimulates a consolidation and change process amongst the suppliers (*consolidation, organisational restructuring*) with the establishment of new suppliers from other fields or mergers and acquisition deals of existing suppliers, resulting in more negotiation power for the remaining bigger and stronger system and module suppliers that are able to fulfil the high performance requirements of the OEMs (*product modularisation*).

> *"The suppliers were either forced to grow and focus on certain products or integrated in bigger supplier conglomerates. In the worst case they just disappeared from the market. There are statistics that the number of suppliers 10 years ago was around 15,000, in the meantime it is around 7,000 and in another 5-10 years it will be around 2,500. I think this is realistic"* (General Manager Customer Team, Systems Supplier).*

The emergence of higher cost pressure in the automotive industry (*cost pressure*) created an increasing orientation of the OEMs towards prices and cost which have been a second priority after innovation and technology (*technical competence features, efficiency competence features*). This era began about 10-15 years ago with the rise of Julio Ignacio Lopez de Arriortua as Purchasing Chief of GM and later VW, who "initiated a movement which placed cost issues in the focus of not only the automotive industry but other industries as well. Hence, for the OEMs prices and costs were the main drivers for their outsourcing strategies over the last 15 years" (Vice President Regional Account Executive, System Supplier)* that led to cost savings for the OEMs at the expense of the supplier industry (*adversarial relationship*). This was implemented through radically cutting parts and component prices and increasingly outsourcing bigger performance packages based on modules and systems (*product modularisation*). The consequence for the OEMs was the loss of their specific technological knowledge (*know how shift, Competence Features: Technical & Technological*). Nevertheless, the OEMs increasingly carry out their outsourcing activities on a module and systems basis rather than a parts and component basis.

This is summarised in the following proposition #2.

**Tentative proposition # 2:** *Increasing complexity, cost pressure and shorter product development lead times have led to more inter-firm collaboration based on product modularisation.*

Together with a know how loss due to increasing product modularisation (*know how shift, product modularisation*), this move away from the former innovation and technology level (*technical competence features*) towards a cost and price level (*efficiency competence features*) resulted in a more 'hostile' atmosphere between OEMs and suppliers (*adversarial relationship*), thereby risking potential collaborative partnerships in the future (*adversarial strategy, cost focus, short-term thinking, insufficient competence*). Capacities and resources of OEMs that became idle through the product modularisation efforts were used to manage the shorter life cycles (*short product life cycle*) and the higher model variety (*product proliferation*) but also to develop specialists that can evaluate the suppliers regarding potential for further cost and lead time reductions (*R&D evaluation, adversarial relationship*). Therefore, suppliers are faced with the dilemma of realising yearly cost reductions between 3% to 5% over the whole product life cycle, despite increasing material and labour costs (*cost pressure*), but not being able to change their sub-suppliers without approval of the OEM who then will analyse the new situation with its cost analysis teams and in case of savings demands its share (*adversarial strategy, cost focus*).

> *"That adversarial relationship existed ever since to a greater or lesser degree. We view suppliers today as somebody we need to get as much out of as possible and we view the environment as a competitive environment. The talk about strategic alliances and partnerships with suppliers is driven out of necessity to get a piece of intellectual property but not out of fundamental desire. Otherwise it is a straightforward competitive sourcing discussion. It is the cheapest part for the best quality. And if you run the balance between cost and quality usually cost wins because of that adversarial relationship"* (Head of Department Body and Trim, OEM).

This adversarial pressure (*adversarial relationship, adversarial strategy*) is supported by the OEMs' competitive sourcing strategies which include global online auctions for order placing and supplier sourcing based on cost and price calculations (*global sourcing, cost focus*), forward sourcing strategies whereby the suppliers need to invest and commit resources to early stages of the R&D process without being officially nominated as supplier, and a general reduction of the OEMs' supply base (*supplier portfolio*) in order to reduce complexity, cost and time of product development. In combination with shorter development lead times (*short product development process*) and more complexity of product and processes (*complexity increase*) this adversarial behaviour (*adversarial relationship*) drives quality problems in the R&D process (*product quality, interface problems*) that ultimately can lead to product problems in the field (*immature product launch*).

> *"In order to retain their profit margins, the OEMs currently put the suppliers under great cost and time pressure. But due to the shorter development lead times sometimes products cannot be designed and developed to their full maturity which results in quality problems of the overall car at later stages"* (Sales Director, Systems Supplier).*

All these excessive outsourcing efforts that are orientated at the bottom line (*short-term R&D optimisation*) led to tensions between OEMs and suppliers with a vicious circle of more 'hostile' competition and less partnership collaboration (*adversarial strategy, functional thinking, cost focus, time pressure, short-term thinking*) with all its related aspects (*know how shift, consolidation, global sourcing, supplier portfolio, product quality, virtualisation, Collaboration Outcomes: Negative*). It also triggered a change of the roles of the industrial players (*industrial roles*). For instance, OEMs increasingly focused on core issues of R&D management with less product development and manufacturing content, especially for parts and components (*Strategic Collaborator Roles: OEM*). Their workforce changed to multi-project or product managers with focus on the coordination and calculation of product and projects (*project management, coordinating & intermediating, decision making & allocating*) rather than detailed innovative engineering activities (*innovativeness, translating & designing, leading & initiating*) that are increasingly outsourced to specialised suppliers (*strategic sourcing, collaborative partnerships*). In response, suppliers developed from parts and component suppliers into module and systems suppliers (*Strategic Collaborator Roles: Supplier*) with increasing product engineering knowledge and performance, competence of manufacturing small car series, and responsibility for managing sub-supplier networks (*Operative Collaborator Activities: Supplier*). This, however, creates challenges in the collaboration between OEMs and suppliers in the future requiring closer relationships and engineering processes based on fairness, trust and open communication and knowledge transfer in order to be beneficial for all parties (*frontloading, fairness, trust, communication, knowledge sharing, simultaneous engineering*).

In this respect, recent developments of a few players in the automotive industry show the adoption of more strategic sourcing policies based on long-term R&D decision making in order to cope with the emerging challenges of industrial change (*strategic sourcing, R&D decision making*). Other OEMs and big suppliers continue the trend of excessive outsourcing of ever larger performance packages to the next tier level in order to cut down R&D costs (*short-term R&D optimisation*).

One of the major characteristics of this strategic sourcing approach is a balance between insourcing and outsourcing activities (*strategic sourcing*). After the Lopez era some OEMs realised that through the increased product complexity (*complexity increase*) and the excessive outsourcing of whole modules and systems (*product modularisation, short-term R&D optimisation*) they lost too much of their relevant know how in the overall product development process of a car model (*know how shift, Competence Features: Technical & Technological*). In extreme cases the OEMs' engineering teams were not capable of evaluating the performance of the suppliers anymore (*R&D evaluation*) leading to interface and quality problems of different modules and systems within the car (*interface problems, product quality, immature product launch*). Hence, 5-10 years ago these OEMs started to re-gain necessary know how by insourcing and (re)building (new) areas of expertise in order to be able to define and manage the technical interfaces within a car (*interface management, translating & designing, decision making & allocating, incubator*) and coordinate, guide and evaluate the respective suppliers (*integrator, coordinating & intermediating, leading & initiating, R&D evaluation*), i.e. "the OEM needs to know what is feasible and how to implement it" (General Manager Purchasing Electronics, OEM)*.

> *"Nowadays, we do not have the know how to compete with suppliers on various topics. That means we cannot exactly evaluate the performance of the supplier anymore. Hence, 5 or 6 years ago the consideration emerged to build the know how inhouse again"* (General Manager Central Quality Assurance, OEM).*

In general, insourcing and building of technical knowledge were focused on the concept stage of the R&D process (*stage of PDP*) in order to define the basic characteristics and specifications of each main car model (*translating & designing*) that serves as basis for the detailed component design or the development of derivate models such as SUVs, convertibles, etc. (*developing & manufacturing*). However, due to an increasing product variety (*product proliferation*) and the related increase in R&D projects, the OEMs will not be able to cover all these projects with their own engineering capacity (*product portfolio*). This opens ground for independent engineering partners and prime contractors (*engineering service provider, prime contractor*) that have the competence in managing the development process of a complex system or even a whole derivate model (*coordinating, integrating systems, managing sub-suppliers*).

Nevertheless, there are cases where OEMs also re-integrated detailed component design and manufacturing activities. This happened in the case of seats whereby two of the four interviewed OEMs confirmed to consider the manufacturing of seats inhouse again, but at least engage in more detailed design and development activities (*developing & manufacturing*) because of a dissatisfactory quality of their suppliers (*product quality*). It also serves to decrease the dependency on the big systems suppliers and prime contractors (*system supplier, prime contractor*) that in some cases became bigger than the OEMs themselves (in terms of turnover and manpower) and thereby limit their negotiation power (*collaborator dependency*). In times of high unemployment the OEMs also try to utilise their internal capacities first before outsouring to external suppliers (*R&D decision making*), thereby showing social responsibility and sustainable behaviour, increasingly important topics in modern economies and societies. Furthermore, in increasingly competitive markets (*competition in markets*) with lower volumes per model due to a greater model variety (*product proliferation*) the OEMs cannot afford to outsource the manufacturing of the majority of their derivate models anymore because these models are becoming an increasing source for their added value (*value for competitiveness, product portfolio*). Nevertheless, these recent activities of some OEMs are received positively in the supplier sector:

> *"Many OEMs that have been in engaged in excessive outsourcing three or four years ago are now on the way to more own manufacturing in order to utilise their capacities and cover important derivate models themselves. However, the complexity of the cars and their interfaces also require the OEMs to extend their competencies to survive on the market, on the one hand, but also rely more on specific competencies of the suppliers, on the other hand. In this respect, I support the insourcing and building of competencies of the OEMs but do not see any danger to the suppliers at the same time"* (General Manager Customer Team, System Supplier).*

In correspondence to the insourcing tendencies, OEMs also show a more strategic and long-term orientated approach towards outsourcing (*strategic sourcing, R&D decision making*). Whereas outsourcing was mainly driven by costs and prices in the past due to the adversarial movement initiated by Lopez (*efficiency competence features, adversarial relationship*), it now seems to be increasingly based on general competence and know how issues again (*competence focus & development, competence orientation*), such as quality or innovation (*technical competence features*). This refocusing on "buying competencies" (General Manager Design Car Body, OEM)* has an important impact on the selection and evaluation of suppliers (*competence profile, competence fit, sourcing strategies & activities*) leading to increased collaborative efforts between OEMs and suppliers (*collaborative partnerships*). In this context, some OEMs are engaging in more pro-active management of their supply base (*active supply management*) by deciding which partnerships can provide them with a strategic advantage on the market (*collaborator strategy, collaborator sourcing*).

This involves a stronger linkage with these suppliers in a strategic R&D relationship not only for derivate models but on an increasing level also for the basic volume models of an OEM (*product & process attributes, type & degree of relationship, proximity, depth*). This process is facilitated by an increasing standardisation of car models and its sub-systems based on common platforms and standardised parts (*standardisation*) that enable to outsource larger amounts of the product portfolio to external suppliers (*product portfolio coverage*) thereby serving competitive markets (*competition in markets*) with a great product variety (*product proliferation*) at low cost (*cost reduction*).

This, however, requires an adaptation of the organisational features of the R&D process of all involved parties (*organisational restructuring*), i.e. OEMs and suppliers alike, to facilitate increased collaboration (*collaborative partnerships*). The internal simultaneous engineering (SE) processes of the OEMs were and have to be extended across their company boundaries towards the suppliers in order to establish a suitable collaboration infrastructure that provide improved links between OEMs and their suppliers for know how exchange (*simultaneous engineering, collaboration infrastructure, knowledge sharing, Relationship Interfaces*). Internally the OEMs adapted to the increasing product variety (*product proliferation*) and modularisation (*product modularisation*) by increasingly aligning their R&D structure, i.e. product development and production, according to their product portfolio and modules / systems.

Suppliers, on the other hand, restructure their organisations into OEM specific key accounts or customer teams in order to be responsive to the increased collaborative interfaces in the SE process (*organisational restructuring, customer focus, organisational structure, culture & business model*). In addition, these suppliers are extending their know how and competencies in order to deal with the increased requirements and larger performance packages that are outsourced by the OEMs (*competence focus & development*), e.g. from the development and manufacturing of parts to systems or from systems to whole car models (*integrating systems, coordinating, managing sub-suppliers, providing full service, developing & making*). This knowledge is often institutionalised in the suppliers' organisational structure through the formation of special teams or departments such as concept development (*inhouse specialism*) or exploited in virtual partnerships with other suppliers (*collaborative activities*) in order to offer a greater value added to the OEMs (*innovating & problem solving, creating added value*).

All these R&D and sourcing decisions of the OEMs (i.e. insourcing and outsourcing) are increasingly carried out on the technical rather than the price and cost level (*technical competence features, efficiency competence features*). Hence, the challenge emerging from these collaborative partnerships in the context of increasingly competitive markets (*collaborative partnerships, competition in markets*) is to realise competitive prices for the whole product development without actually having price competition. This requires clear decisions on which competencies have to be developed and maintained inhouse and what can and should be outsourced to suppliers (*competence focus & development, R&D decision making, strategic sourcing*). Thereby, it is important to define ones own competencies and capabilities before engaging in cross-boundary collaboration. Hence, a stronger focus on competencies across products, product segments, processes or business units, is necessary for the development of collaborative strategies and structures (*competence focus & development, competence orientation*). This is partly influenced by historically grown issues and economic factors (*company history, company size*) as well as market and sourcing strategies of the decision makers (*sourcing strategies & activities, collaborator strategy, decision authority within buyer*) but also requires the possession of sufficient know how to make a qualified sourcing decision (*R&D evaluation, evaluation competence*).

*"You have to focus on competences in order to be successful. Thereby it is important not to decide on the basis of the currently existing competencies but the necessary ones in the future"* (R&D Director, Module Supplier).*

*"If you conducted a consequent evaluation of your core business activities, then you got the right foundation for cross-boundary collaborative activities"* (Project Manager Purchasing, OEM).*

The above discussion on the status quo of inter-firm relationships and its related challenges in the German car industry is summarised in the following propositions #3 to #5:

**Tentative proposition # 3:** *Car manufacturer are changing their adversarial pricing policies in supplier selection towards more strategic sourcing policies*

**Tentative proposition # 4:** *The challenge for a collaborative supply network is to maintain competitiveness without applying adversarial forces*

**Tentative proposition # 5:** *Focusing on core competencies is becoming increasingly important in order to drive the development and management of inter-firm collaboration in the supply network*

***Relationship Design - Collaborator Portfolio***

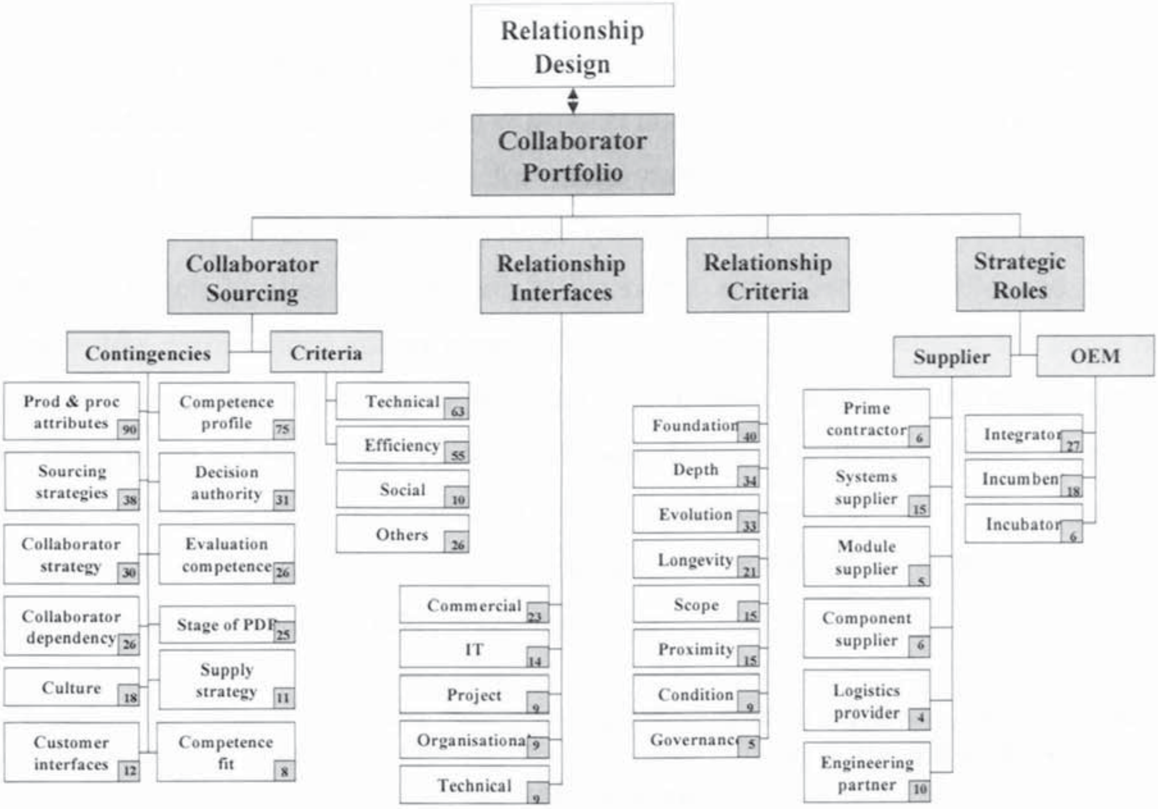


**Figure 5.11: Coding of core category 'Relationship Design'**

Ultimately, these industrial impact factors mean a change in the process of supplier selection and evaluation as the OEMs would reduce the price competition amongst the suppliers (*cost focus, adversarial strategy, short-term thinking, efficiency competence features*) and commit to certain suppliers at an earlier stage and for a longer period based on their technical value contribution (*frontloading, longevity, competence profile, competence orientation, technical competence features*). For this reason, the sourcing strategy of the OEMs needs to change from a bottom line based orientation (*cost focus, time pressure, short-term thinking, adversarial strategy*) to a more strategic sourcing orientation (*competence orientation, frontloading, holistic & long-term thinking*) by including other aspects, such as competence, innovativeness, the ability to manage sub-suppliers, etc., in the supplier selection decision (*technical competence features, social competence features*). A good practice example is the project 'Managing Partner Networks' of one interviewed OEM that aims at the utilisation of synergies in the R&D process through increased collaboration with suppliers (*collaborative partnerships*) which also can involve a closer integration in a local sense, e.g. in form of supplier parks (*cluster creation, local presence*).

However, this strategic sourcing process within the supply network is greatly influenced by the OEMs' culture and strategies (*culture, sourcing strategies & activities, collaborative supply strategy*) that are partly dependent on the characteristics of the product, the product portfolio and the R&D process (*product & process attributes, stage of PDP*). Synergies in the R&D process are particularly seen for more complex and innovative products and performances, such as modules and systems (*product modularisation, product & process attributes*), which justifies an increased collaborative effort between OEM and supplier (*collaborative partnerships*) and an increased focus on technical competence and know how issues likewise (*technical competence features*). That means "the simpler the component, the more focus is put on cost issues" (General Manager Design Car Body, OEM)*. Hence, for complex products driven by the increasing product modularisation (*product modularisation*), it is important to establish close relationships with suppliers early in the product development process (*frontloading, stage of PDP, proximity, scope*).

> *"If potentials for cost reduction during product development are low, then it does not make much sense to integrate the supplier very early in the process. But if the potential is high, which is mostly the case for complex systems, then it is sensible to integrate the supplier early and more closely in the development process"* (General Manager Design Car Body, OEM).*

This is equally true for innovative topics where OEMs are increasingly collaborating with innovative suppliers outside their traditional supply base (*integrator, scouting & integrating*) that add value and increase the network's competitiveness with their specific competencies and know how (*creating added value, competence profile*); which they built and gained based on the OEMs' outsourcing activities (*know how shift, outsourcing*). This is supported by the fact that nowadays OEMs are willing to pay more for know how and innovation that they do not possess themselves (*competence fit*) because they need unique selling points (USP) to differentiate themselves from market competitors (*competence*), especially in the premium car segment (*product & process attributes, customer interfaces, value for competitiveness*). In these cases of aiming for innovation leadership on the market (*attractiveness & deployment*), good strategic collaboration with competent suppliers is inevitable for success (*collaboration, collaborator sourcing*). However, as soon as the innovation matures (*maturity & sustainability*), or in situations where the OEMs pursue a follower strategy in terms of the product profile (*sourcing strategies & activities*), cost and price issues are emphasised to realise economies of scale (*efficiency competence features*).

> *"In general, the commitment towards strategic supplier selection and evaluation increases with the attractiveness of the innovation or technology"* (R&D Director, Module Supplier).*

Similarly, the willingness of OEMs to increase their collaborative efforts with suppliers is higher for derivate models due to their lower volume (*product proliferation, product & process attributes*) which did not use to be the OEMs' core business for a long time (*value for competitiveness, product portfolio*). Only recently this attitude has been changing due to increasing competition and cost pressure in the automotive industry (*competition in markets, cost pressure*) and the resulting necessity to utilise the existing inhouse manufacturing capacities and resources (*R&D decision making*). Therefore, OEMs are also applying strategies of insourcing the manufacturing of certain components and systems (*sourcing strategies, R&D decision making, developing & manufacturing*) that are considered as core business (*value for competitiveness, product portfolio*) in order to reduce the dependency on suppliers (*collaborator dependency*). This is especially true for the utilisation of facilities that require high investments such as wind channels, test stands, etc. In these cases the OEMs normally do not have traditional module, systems or parts suppliers anymore that will take over the development of the part (*part & component supplier, module supplier, systems supplier*) and hence are forced to carry out design and develop activities themselves (*translating & designing, incumbent*) or rely on specialised and independent engineering partners (*engineering service provider, incubator*); which ultimately triggers a further focus on competencies and core business activities that are necessary for future competitiveness (*competence focus & development, outsourcing*). For parts and component suppliers this could imply that they move up the tier ladder from 2$^{nd}$ tier to 1$^{st}$ tier due to direct interaction with the OEMs.

> *"I think there will be two tendencies depending on the product characteristics. On the one hand, the OEM will develop inhouse but outsource the manufacturing. In this case suppliers need to focus on their process and manufacturing competencies. On the other hand, the OEM will also manufacture inhouse. In this case the suppliers need to focus on innovations and intellectual property and compete with internal R&D teams of the OEM."* (General Manager Pneumatics, Module Supplier).*

Nevertheless, the OEMs do not want to tie too much of their R&D capacity and resources for derivate models and therefore outsource larger performance packages to suitable suppliers, e.g. prime contractors or big systems suppliers, (*product modularisation, Strategic Collaborator Roles: Supplier, integrator*) that only modify the basic models designed and developed by the OEMs' inhouse R&D teams (*translating & designing*). These collaborative partnerships (*collaborative partnerships*) are a distinct strategy of some OEMs (*strategic sourcing, R&D decision making, collaborator strategy, collaborative supply strategy*) to build a third pillar beside development and manufacturing to improve their competitiveness via suppliers' know how (*competence fit, collaboration, collaborator sourcing*) and cover all important customer segments (*product portfolio coverage*). But it requires a sufficient level of expertise of the OEMs to make a qualified sourcing decision based on the evaluation of know how and competence rather than price and cost (*evaluation competence, scouting & integrating, technical competence features*) and to communicate with suppliers on an advanced technical level (*active supply management, communication, knowledge sharing*).

> *"It is advantageous to have a competent OEM as partner because he can assess which supplier is competent and which is not"* (General Manager Customer Team, Systems Supplier).*

The sourcing strategies of the OEMs are also influenced by the decision making parties within the OEM organisation (*decision authority within buyer*). In the context of R&D projects four main areas with different focus are participating in the decision making process: purchasing, R&D, quality assurance and logistics. Purchasing selects and evaluates suppliers based on price and cost issues (*cost alignment, efficiency competence features*), R&D based on technical know how and competencies for product development (*innovativeness, product know how, software knowledge, interface management, technical competence features*), quality assurance based on general quality and maturity of products and manufacturing processes (*process know how, product & process quality, technical competence features*), and logistics based on delivery criteria (*delivery quality*). Often this causes tensions in the collaboration with suppliers (*functional thinking & organisation*) due to the influence of the purchasing areas being increased at the cost of the technical R&D areas during the Lopez era, reflecting a basic adversarial philosophical tenor (*culture, adversarial relationship, adversarial strategy*). However, increased product complexity due to modularisation (*product modularisation*) and an orientation towards collaboration of some OEMs (*collaborative supply strategy*) equalised this tendency so that an increasing focus is put on technical issues in the selection and evaluation process (*technical competence issues*), now reflecting an increasing attitude towards collaborative partnerships with suppliers (*collaborative partnerships*).

> *"We try to view the suppliers as partners more strongly than in the past. We learned that a change in suppliers especially for complex parts, like our locks, causes big problems in the process. Hence, from a strategic point of view we try to collaborate*

*with the suppliers in the longer term now"* (General Manager Design Car Body, OEM).*

These issues on forming inter-firm relationships are summarised in the following propositions #6 and #7.

**Tentative proposition # 6:** *Structure of the supply network is determined by the strategy of the car manufacturer*

**Tentative proposition # 7:** *Product modularisation affects how a supply network is structured*

Within the supply network the OEMs engage in a multiplicity of differing collaborative partnerships and relationships with their suppliers in order to reduce dependency on only one or a few suppliers (*collaborator dependency*). Especially for the lead models with high volumes the OEMs are collaborating with more than one established supplier for each part and system in order to split the overall volume between them. This emphasises a more adversarial pricing strategy based on control and cost (*adversarial relationship, efficiency competence features*) leading to little degrees of freedom for the suppliers (*incumbent, foundation*). For parts and systems of derivate models that normally have lower volumes the OEMs are more willing to experiment with new suppliers and new ways of collaboration (*product & process attributes, sourcing strategies & activities*) often leading to sourcing scenarios that are more focused on technical issues (*technical competence features*) with more autonomy and responsibility for the suppliers (*integrator, incubator, foundation, governance*). The same is true in the context of innovation or special product features such as sliding roofs, etc.

*"For some products the collaboration will be more intense, for some less intense, depending on the strategy of the OEM"* (R&D Director, Module Supplier).*

Ultimately this leads to a spectrum of OEM-supplier relationships within the supply network involving different degrees of autonomy, involvement and responsibilities of the partners (*Relationship Criteria*). Based on the ABC supplier ratings of the involved decision areas (*evaluation competence, decision authority within buyer*) the OEMs are aiming for a balanced supply base with small and medium sized companies for parts and components that are specialised in certain technologies and innovations (*part & component supplier, engineering service provider, innovating & problem solving*), bigger systems and module suppliers that are able to handle the industrialisation of complex modules and systems (*systems supplier, module supplier, developing & making, integrating systems, coordinating, managing sub-suppliers*) and prime contractors that can coordinate R&D activities and their suppliers for a whole car (*prime contractor, managing sub-suppliers, coordinating*). Depending on these roles (*Strategic Collaborator Roles: OEM, Strategic Collaborator Roles: Supplier, type & degree of relationship*), the relationships between OEMs and suppliers show different characteristics in terms of their involvement in the product development process (*depth, longevity, scope, proximity, governance*).

> *"It is possible that a supplier collaborates with us during the concept stage already and then takes responsibility for a full derivate model during the series development. But it is also possible that a supplier collaborates with us during concept development for a lead model and then also takes over parts of the series development of this lead model"* (Project Manager Purchasing, OEM).*

The biggest responsibility for a part or system lies with the system supplier (*system supplier*). Hence, it should be the aim of OEMs that follow collaborative strategies (*collaborative partnerships, collaborative supply strategy*) to collaborate closer and longer-term with system suppliers (*longevity, proximity*) by involving them more intensely in the R&D process (*depth, scope*) because their broad and well established competencies and know how for managing complex performance packages are significant for the success of the supply network (*integrating systems, managing sub-suppliers, coordinating, Holistic Competitive Advantage*). Therefore, the thinking of the OEMs has to change from getting parts at the cheapest price towards finding and developing future partnerships that are going to benefit the business (*integrator, strategic sourcing, collaborator sourcing*). Hence, it is essential to manage the trade-off between a good supplier management (*coordinating & intermediating, scouting & integrating, facilitating & enabling*) and the retention of enough own competencies (*translating & designing, developing & manufacturing*) to make qualified decisions (*decision making & allocating, leading & initiating*), i.e. "nowadays the OEM needs to be the interface between its own core business and the systems business of the suppliers" (Sales Director, System Supplier)*.

The module suppliers have a limited responsibility as they only need to assemble components in the required quality but are not much involved in the design and development process upfront (*module supplier, developing & making*). Hence, the involvement of the module suppliers in the R&D process is limited to the later stages of the R&D process (*scope*) which often softens the necessity for close and long-term integration and collaboration (*proximity, longevity*). This is supported by the fact that based on OEMs' instructions module suppliers often have to rely on specialised component suppliers (so called imposed suppliers) for parts that they do not have enough expertise in themselves (*decision making & allocating, integrator*). In the context of increasing insourcing activities of the OEMs (*strategic sourcing, R&D decision making*) module suppliers are becoming increasingly important as they cover systems and modules similar to systems suppliers but without the active management of the sub-suppliers which OEMs increasingly see as their core business again due to quality problems in the past (*integrator, coordinating & intermediating, product quality*).

The component or part suppliers are only responsible for their individual part (*part & component supplier*) which leads to limited direct interfaces and interaction with the OEM during the R&D process (*proximity, scope, depth*) since component suppliers are often integrated in the sub-supply network of a bigger system suppliers in a 2$^{nd}$ tier position. Although, sourcing and R&D strategies of OEMs towards more insourcing are sometimes reversing this fact (*strategic sourcing, R&D decision making*), in this relationship scenario OEMs control the intellectual property of the products in most cases (*incumbent*) since the concept design and development is often done inhouse (*translating & designing*) and the component suppliers are often only used as arms length suppliers for series development and manufacturing (*developing & making*). Nevertheless, in cases of highly innovative products the OEMs can also act as managers and coordinators of activities by pairing innovative component suppliers with bigger systems and module suppliers (*incubator, integrator, coordinating & intermediating, scouting & integrating*).

Independent engineering partners (*engineering service provider*) mainly focus on the earlier stages of product development (*innovating & problem solving, stage of PDP*), such as concept and pre-series design, due to their lack of manufacturing competence. However, in the context of industrial change (*short-term R&D optimisation, know how shift, product modularisation*) these companies extended their know how towards the design and development of innovations, complex systems and even whole car models (*innovating & problem solving, coordinating*). Thereby they are acting as prime contractors for design and development by coordinating all involved parties in the R&D process on behalf of the OEMs (*prime contractor, coordination, managing sub-suppliers*). However, in the context of more strategic R&D decision making (*strategic sourcing, R&D decision making*) the OEMs realised that innovations also need to be initiated by themselves (*incubator, leading & initiating*) in order to stay competitive (*value for competitiveness*) and to be able to manage their supply networks appropriately (*R&D evaluation, evaluation competence, interface management, coordinating & intermediating*).

In general, the occupation of a certain role within a supply relationship depends on the type of competence (*competence profile, technical competence feature, efficiency competence feature, social competence feature*) and its characteristics (*transferability & embeddedness, attractiveness & deployment, maturity & sustainability*) that are in the focus of the decision maker. This is often influenced by features of the R&D process (*product & process attributes, stage of PDP*) and the decision maker's strategy in general (*Collaborator Sourcing: Contingencies*; also see tentative propositions # 6 and # 7 above). In this context, the OEMs distinguish between two basic dimensions. Either they are looking for technical know how in terms of product and production processes (*product know how, process know how*) as in most cases of part or component suppliers or they are focusing on know how that lies within the project execution and management (*project management, interface management, R&D evaluation*) as in most cases of module and system suppliers. In the case of module or system suppliers, the product knowledge only plays a secondary role as they are only producing a small amount of the overall system themselves and have to outsource specific parts and components to sub-suppliers which requires different competencies (*integrating systems, coordinating, managing sub-suppliers*). Nevertheless, every company within a supply network needs to possess some task relevant knowledge along the steps of the product development process (*attractiveness & deployment*) in order to participate actively in the collaboration (*condition*).

> *"You need a certain amount of basic competencies in order to cover most of the basic requirements of the customer. But in addition you also need peak competencies that enable you to deliver special performance in order to differentiate from competitors"* (Managing Branch Director, Engineering Service Provider).*

Similarly, the potential to create a competitive advantage through the complementation of other partners' competencies in the supply network is important (*competence fit, competence, collaborator sourcing*). Hence, it is often not so much the question whether one supplier has a more sophisticated competence as another in absolute terms but whose competencies complement the know how of the OEM in the best way because the OEMs are only interested in "buying suitable competencies" (General Manager Design Car Body, OEM)*.

> *"There is of course a mix of roles and relationships. It very much depends on your own competence base and the competencies of the partners, e.g. does the supplier have the evaluation competence for a certain part or module. If he has the competence, it is possible that we outsource this task to him"* (General Manager Design Doors, OEM).*

Related to this is the consideration of the stages of the R&D process, i.e. product development process, which can basically be broken down into product planning, concept design, pre-series design and series design that finishes with the start of production (SOP) (*stage of PDP*). All these phases have different characteristics and performance requirements and hence require different competencies and roles within the supply network (*Collaborator Sourcing: Criteria*). Whereas at the earlier stages innovative ideas and solutions and product know how are more important (*product know how*, *innovativeness*, *R&D evaluation*), at the later stages efficiency competencies are in the focus (*speed, cost alignment, process know how, flexibility & adaptability*).

This not only leads to different types of relationships in the supply network, where for example a module or system supplier (*module supplier, systems supplier*) can act as supplier for an engineering service provider (*engineering service provider*) that has the responsibility for a certain car model (*prime contractor*) or where suppliers are increasingly involved in the development of volume models at early stages of product development. It also accelerates changes of the industrial players as described in the section on industrial impact (*industrial roles*) because "in order to remain in direct supply position to the OEMs you have to become a system supplier because nowadays OEMs increasingly outsource complete performance packages" (Sales Manager, Module Supplier)*.

> *"The commodity supplier is pretty much dead. He only does not know it yet. Nowadays, the supplier is in the focus, who does not only understand the system to realise synergies, but also takes over responsibility for the system, i.e. responsibility for functionality and quality of the system across the whole supply chain and development process. The system supplier also participates in the learning process."* (Sales Director, System Supplier).*

Moreover, in order to be adaptive to changing exogenous performance requirements (*customer requirements*, *government regulations*, *short-product life cycle*), relationships within the supply network need to be flexible and able to change leading to a dynamic supply base (*evolution*). Although the OEMs' supply base remains the same for the development of most of the core products, new suppliers with specific know how and technologies have to be included (*collaborator sourcing, competence profile, competence fit*) especially to cover unknown technological terrain (*creating added value, innovating & problem solving*) that leads to a competitive advantage (*Holistic Competitive Advantage*). This does not automatically imply that suppliers are omitted from the supply base but more that they move to an un-engaged state (*condition*) or are moved to a lower tier level (*Strategic Collaborator Roles: Supplier*) and more suitable suppliers become engaged instead. However, combined with a general reduction of suppliers in the supply network (*supplier portfolio*) it implies that the remaining suppliers are involved in more projects within the supply network (*Relationship Criteria*) and have better prospects for long-term relationships with the OEMs, thereby differentiating themselves from other suppliers.

> *"If you do not constantly develop further, i.e. if you do not deliver new ideas, knowledge, innovations or solution, it is possible that you will be demoted to the 2nd tier level and hence have to supply your parts to a bigger system supplier on the 1st tier level"* (Sales Manager, Module Supplier).*

The insights gained from the discussion on issues of inter-firm relationship formation and governance are summarised in the following propositions #8 to #12.

**Tentative proposition # 8:** *Different relationships and collaborative practices exist for different inter-company (car manufacturer and supplier) projects in the supply network*

**Tentative proposition # 9:** *The role of an organisation in the supply network is mainly determined by what competencies are offered by it*

**Tentative proposition # 10:** *The role of an organisation in the supply network is partly determined by the stages of the product development process*

**Tentative proposition # 11:** *Relationships between companies in the supply network change over time*

**Tentative proposition # 12:** *An individual company can collaborate in more than one project within the supply network at the same time*

Because of more strategically orientated decision making of the OEMs (*strategic sourcing, R&D decision making, competence focus & development*) which is increasingly based on quality and innovation issues (*technical competence features*) rather than cost and price issues (*efficiency competence features*) technical know how and competencies are more and more becoming the focus of inter-organisational R&D collaboration between OEMs and suppliers (*competence orientation*). This is also a sign for increasing partnership orientation (*collaborative partnerships*).

> *"Fair partnership is only possible based on competencies"* (General Manager Customer Team, System Supplier).*

This necessity is intensified by the increasing modularisation of parts and components (*product modularisation*) which requires an understanding of more complex systems of both OEMs and suppliers in order to be able to manage the interfaces and carry out collaborative activities effectively (*interface management, relationship management*). Thereby OEMs do not necessarily need to fully integrate systems themselves, i.e. design, develop and make (*developing & making, incumbent*), but get a more detailed understanding of it, acting as a technical integrator of customer desires into system specifications (*integrator, incubator, translating & designing*). The suppliers are then taking over the responsibility for the development and industrialisation of the system based on the given specifications including the management and coordination of the involved 2$^{nd}$ and 3$^{rd}$ tier suppliers (*developing & making, integrating systems, managing sub-suppliers*). Due to the increasing product variety and the related number of R&D projects the OEMs cannot develop all technological innovations themselves (*product proliferation*).

> *"I think, that the detailed know how about parts, components and systems still lies within the suppliers and that the basic interface knowledge lies and has to lie within the OEMs"* (Sales Director, Systems Supplier).*

This, however, is leading to earlier discussions in the development process on an increasing basis whereby specifications, requirements, technical circumstances and feasible concepts are now identified and specified by the OEMs together with their suppliers in a close collaborative process (*frontloading, simultaneous engineering, knowledge sharing, knowledge management*). Hence, a certain competence level of all involved parties is important (*competence focus & development, competence orientation*) because it enables a sound discussion on an advanced technical level leading to a higher quality of the collaboration in general (*relationship management, knowledge management*). This is especially true for the day to day business between representatives of OEMs and suppliers whereby suppliers are not purely seen as arms length suppliers anymore (*simultaneous engineering, type & degree of relationship*).

> *"In a true sense, a good collaboration is facilitated by technical competencies, i.e. both parties possess know how in the respective issue of the project"* (General Manager Logistics, Module Supplier).*

> *"In R&D it is important that you have a common basis on which you can base sound decisions"* (R&D Director, Module Supplier).*

In the past, the efficiency and effectiveness of collaborative R&D activities was often lacking due to insufficient competencies of the OEMs based on their excessive outsourcing activities (*know how shift, short-term R&D optimisation*). This was especially crucial when problems at the interfaces of two or more parts or systems of different suppliers occurred (*interface management, interface problems*). In these cases, many OEMs were not able to make qualified decision anymore due to a lack of detailed technological understanding and know how (*decision making & allocating, evaluation competence, R&D evaluation*) leading to inefficiencies in their project management and hence more pressure on the collaboration in the context of shorter development lead times (*time pressure, insufficient competence, project management, short product development process*). Ultimately, this resulted in quality problems and recalls of immature cars from the market (*product quality, immature product launch*).

This situation is currently improving based on a more strategic sourcing approach of some OEMs (*strategic sourcing, R&D decision making, competence focus & development*). Other OEMs, mainly the U.S. owned manufacturers that are more dominated by shareholder value than their European counterparts, have a far less technical penetration and know how (*evaluation competence, R&D evaluation*) and therefore mainly apply standard operating procedures based on competitive sourcing in order to reduce cost (*cost focus, adversarial strategy, short-term thinking*). This goes at the expense of long term benefits such as quality and innovation improvements (*quality improvement, innovation & maturity improvement*). Therefore, it is inevitable that the OEMs are engaging in technical issues in more detail again (*translating & designing, leading & initiating*).

> *"It is beneficial to have a competent OEM as partner because he can assess which supplier is competent and which not. This reduces effort for the suppliers because you can collaborate with the OEM on a much higher technical level instead of explaining everything in very much detail and underpinning it with relevant data"* (General Manager Customer Team, System Supplier).*

As mentioned above, in this context it is less important for the OEMs to engage in details of parts and systems development and manufacturing (*developing & manufacturing*) but concentrate on the understanding of the functionality of those parts and systems in order to be able to manage the interfaces within the overall car (*coordinating & intermediating, R&D evaluation, interface management*): "This coordination and management of the interfaces is one of the most crucial issues in car development which requires a competent coordinator, most likely an OEM" (General Manager Central Quality Assurance, OEM)*. Hence, it is important that the OEMs develop a better understanding of their outsourced parts, components, modules and systems in form of a interface-competence (*evaluation competence, R&D evaluation, product know how*) in order to take the lead within the product development (*translating & designing, leading & initiating, leadership, innovation*), to make qualified decisions on supplier selection and evaluation (*scouting & integrating*), to be able to communicate with those partners on a sophisticated technical level (*competence orientation, knowledge sharing, facilitating & enabling*) and to manage the interfaces between them (*interface management, coordinating & intermediating, simultaneous engineering*). All this is necessary to ensure innovation and quality and hence competitiveness for the supply network (*quality improvement, innovation & maturity improvement, interface management improvement*).

> *"The OEMs certainly have to have the capability to interrogate the design and development processes. They need to understand the overall system 'car', no matter which components and systems thereof are outsourced"* (Managing Director R&D, System Supplier).*

One of the most important challenges that emerges in this context of increased collaborative interaction between multiple parties in a R&D project is to integrate their individual competencies and related parts or modules into a coherent whole (*collaborative partnerships, interface management, relationship management, knowledge management*), thereby linking the product architecture with an inter-organisational project architecture (*collaboration infrastructure*). This means, that despite efforts of rebuilding knowledge inhouse (*strategic sourcing, R&D decision making*) OEMs need to involve a network of competent suppliers in the product development process of a car for various tasks (*collaborative partnerships,* *relationship management*). They need to encourage those suppliers to share their ideas, innovations and know how with other partners in the supply network (*knowledge sharing, simultaneous engineering, knowledge management, integrator*). However, there can never be a complete handover because the OEM has to maintain some level of responsibility and ownership for putting it all together to a coherent whole (*incumbent, Operative Collaborator Activities: OEM*). Hence, the coordinator has to manage the dilemma of granting enough freedom to the suppliers to participate with their specific competencies but also keep a sufficient level of competencies for himself in order to be able to manage the interfaces effectively. This, however, requires the OEM to forego on applying an absolute power authority in a close relationship with its suppliers and focuse on open know how transfers in form of simultaneous engineering in a cross-boundary project team instead (*fairness, knowledge sharing, simultaneous engineering*). This enables the OEM to be constantly involved in the product development process and hence retain a sufficient level of know how for qualified decision making at the meta-level (*R&D evaluation, product know how, innovation, decision making & allocating*). On the other hand, it enables the suppliers to keep the value of their know how by not transferring it completely.

> *"The most important aspect of this simultaneous engineering approach is not only that all the different businesses within the OEM are working together but they need to work together with the suppliers as well. Because only very few parts in the cars are made by the OEMs themselves. Most of the OEMs are just assembly lines that take in parts at a very high level. And the performance characteristics of a car are really defined by those parts and systems"* (Head of Department Body and Trim, OEM).

Because in the past the integration of parts and systems into the overall car faced many difficulties due to complex inter-organisational structures of R&D projects (*complexity increase, product quality, functional thinking & organisation*), OEMs are increasingly trying to identify interface points in the process where they can achieve better internal links between involved functions as well as external links with their suppliers to enable a better exchange of technical know how in the context of simultaneous engineering (*relationship management, knowledge management, simultaneous engineering*). This means a better management of the transition between product architecture and inter-organisational project architecture and the knowledge flows between the participating partners (*relationship management, knowledge management, knowledge sharing*). This involves the development of a suitable environment in form of a collaboration infrastructure with interfaces across all involved functions of OEMs and suppliers (*collaboration infrastructure, Relationship Interfaces*) that facilitates collaborative transactions across inter-organisational R&D projects in all related aspects (*commercial, IT, project, organisational, technical*), whereas e.g. purchasing executes the interface management for all commercial issues, R&D for technical issues, project management for project issues, etc.

> *"Summarising you could say that it is necessary to build a structure which enables the fulfilment of set targets in a collaborative process"* (Head of Concept Development Project XY, OEM).*

> *"In car development it is crucial to install and organise the transition between the network and the project. Thereby, the network has to be built as early as possible"* (Project Manager, Engineering Service Provider).*

> *"Of course you can have the attitude that it is not the supplier's business but nowadays we realised that these links are beneficial"* (General Manager Design Doors, OEM).*

These aspects on governing inter-firm collaboration are summarised in the following propositions #13 to #16.

**Tentative proposition # 13:** *An inter-firm collaboration in the supply network needs to be formed on the basis of technical competencies and mutual exchange of knowledge*

**Tentative proposition # 14:** *There is the need for a coordinator and leader within the supply network that has the competence to evaluate and manage the interfaces in a collaboration*

**Tentative proposition # 15:** *The co-ordinator of the supply network should have its own core competencies and encourage those of other organisations to participate*

**Tentative proposition # 16:** *Competencies of separate organisations participating in a collaboration within the supply network need to be linked via cross-company project infrastructures*

***Relationship Management – Collaboration***

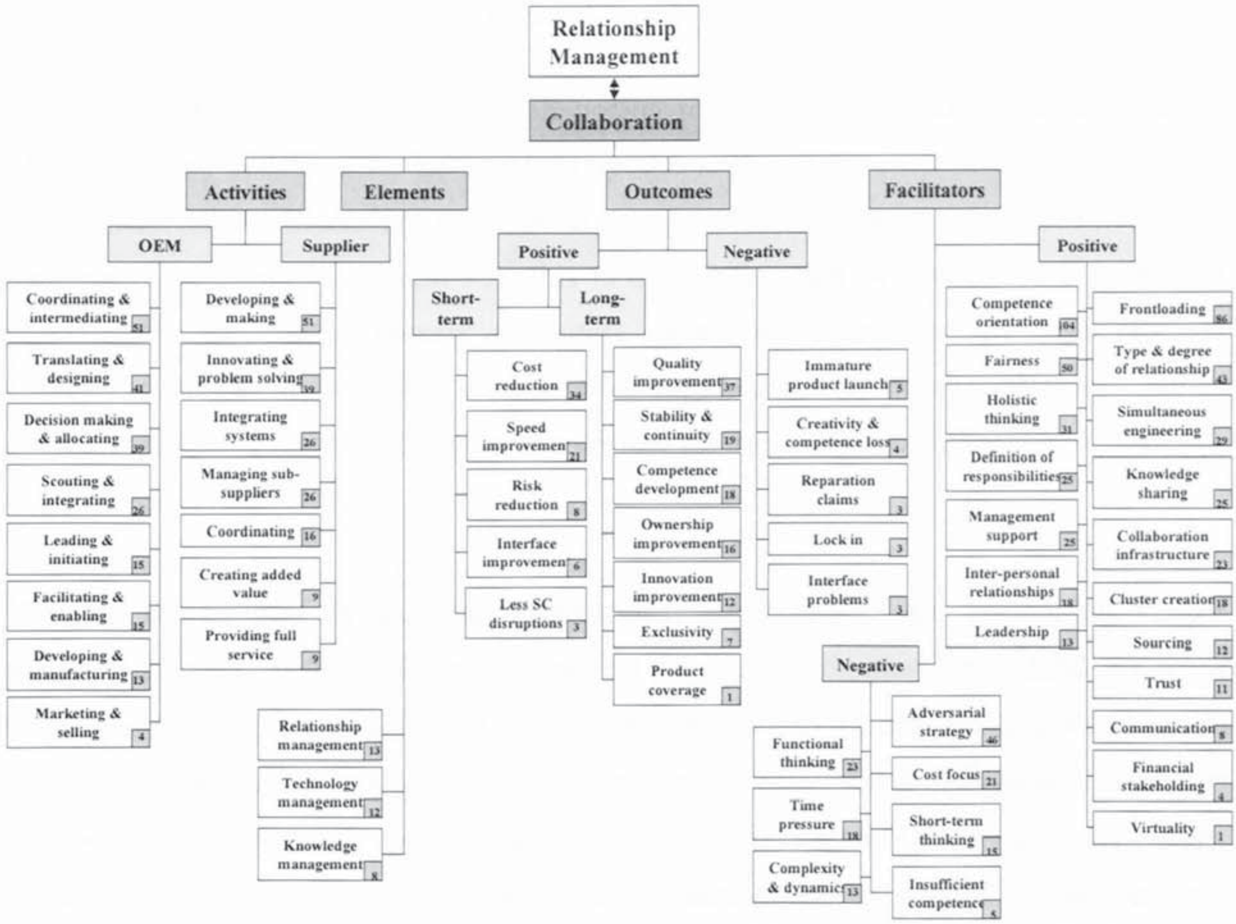


**Figure 5.12: Coding of the core category 'Relationship Management' (Source: Auhtor)**

Facilitated by the various dimensions of an appropriate collaboration infrastructure and its related relationship interfaces (*commercial*, *IT*, *project*, *organisational*, *technical*), each of these inter-organisational R&D projects within a supply network has to be managed differently depending on the type of relationship between OEM and supplier (*type & degree of relationship, Relationship Criteria*) that is ultimately influenced by the competencies and their attributes on which the project is grounded (*transferability & embeddedness*, *attractiveness & deployment*, *maturity & sustainability*).

For example, highly specific and embedded competencies and processes of a partner can lead to low transferability of this know how within the inter-organisational project (*transferability & embeddedness*) and hence a less stable and long-term orientated collaborative activity with a lower degree of integration of the partner in the R&D project (*longevity*, *depth*, *scope*, *proximity*) in order to minimise transaction costs (*efficiency competence features, cost alignment*).

> *"That means, that instead of opposing all your processes onto the supplier, you have to allow for his own processes, because there are people with specific know how and competencies behind it"* (Head of Concept Development Project XY, OEM).*

Furthermore, the characteristics of the collaborator sourcing implicitly affect the management of the resulting collaboration leading to a spectrum of collaboration activities from arms length hierarchical relationships to temporary cooperative ventures. As described above (cf. tentative propositions #6, #8 and #9), this is often influenced by factors, such as product characteristics (*product & process attributes*), culture and strategy of the buyer (*culture, sourcing strategies & activities, collaborative supply strategy, decision authority within buyer*), competence situation (*competence profile, competence fit, collaborator dependency, Competence Attributes*), etc.

Thereby, the partners in an inter-organisational R&D project are performing various management tasks. At the beginning of a project the coordinator, mostly the OEM or a prime contractor, has to focus on the integration of the partners into the collaborative R&D project (*scouting & integrating, coordinating & intermediating, relationship management*) based on the various elements for an appropriate collaboration infrastructure (*commercial, IT, project, organisational, technical*). For example, collaborative contracts need to be designed (*commercial*), communication interfaces via CAD systems for the exchange of detailed know how in form of drawings need to be installed (*IT, technology management, knowledge management*), an effective project management needs to be established in order to gain development efficiencies within the project (*project, project management*), and inter-organisational structures in form of cross-boundary project teams that link the competencies of all individual partners has to be designed and implemented (*organisational, technical*).

> *"The project 'Management of Partner Networks' focuses on the initial and concept stages of the product development process. In this context we want to define the relationship with the suppliers, i.e. which contracts need to be made, how do we coordinate the R&D process, how do we evaluate the performance of the suppliers at these stages, etc."* (Project Manager Purchasing, OEM).*

In these early project scenarios, the suppliers are mostly involved in the R&D projects based on their very specific competence, guided and supported by the coordinator's expertise and experience (*facilitating & enabling*). The suppliers for example take over the detailed component development and manufacturing (*developing & making*) or the development of innovative concept ideas in the concept stage of the product development process (*innovating*

*& problem solving*). As products and innovations are maturing, the suppliers can be integrated more deeply and given more responsibility in the product development (*integrating systems, managing sub-suppliers*), eventually guided by the OEM to other areas of innovation (*leading & initiating*). However, there are cases where the OEMs handed over major parts of the development process to prime contractors and big systems suppliers for new projects in newly established relationships already. In these situations, the OEMs often only remain involved with a small core team in the R&D process in order to ensure an appropriate information flow within the inter-organisational project that enables them to make qualified decisions (*decision making & allocating*). However, as mentioned above already, different OEMs show different attitudes towards collaboration with suppliers.

> *"For example, AUDI and VW have different approaches even if they are all under the same umbrella. AUDI has a much more strategic approach to supplier partnerships. Volkswagen has a much more adversarial approach to supplier partnerships. Volkswagen will issue a specification for a part, will treat this part as a commodity and will find the cheapest possible supplier for this part. AUDI will engage suppliers as partners and will try to use the same suppliers over again to build longer-term partnerships. There is a distinct difference within the group. But in my opinion the right model for the future is partnerships between the OEMs and the suppliers"* (Head of Department Body and Trim, OEM).

Although, there seems to be a tendency towards more strategic sourcing and closer integration of the suppliers in the R&D process of the OEMs (*strategic sourcing, sourcing strategies & activities*), especially for complex and innovative products (*product & process attributes*), the opinion on the degree of collaboration seems to be controversial. Some representatives of OEMs argue that the key for successful product development are long-term and stable collaborative activities (*longevity, proximity*) because they lead to the development of specific know how (*mutual competence development, knowledge accessibility*).

> *"Toyota shows how to do it. They have very stable and long-term partnerships with their suppliers. And their success proves them right"* (R&D Director, System Supplier).*

Others argue that this attempt for long-term and stable relationships between OEM and supplier creates a certain lock-in situation because "partnerships tend to stagnate over a period of time, e.g. if a supplier comes along with a new technology or innovation the OEM's current supplier does not have, then the OEM would be locked in his partnership with the supplier and would need to break this partnership first before he can access the new technology" (Head of Department Body and Trim, OEM) (*lock in, creativity & competence* *loss, flexibility & adaptability*). Hence, they postulate that new relationships open space for creativity and innovativeness in the R&D process (*innovation & maturity improvement*).

> *"An indicator for partnership is loyalty towards suppliers and hence we consider OEMs reliable if they stick to their suppliers. On the other hand, we are aware that in order to cope with market dynamics it is important to vary the supply base by giving small and medium size companies, that possess a lot of specific know how, a chance"* (Managing Director R&D, Systems Supplier).*

Similarly, suppliers argue that in close relationships it is more difficult to maintain unique selling points in form of product and process know how because you become more transparent and dependent (*collaborator dependency, competence profile*).

> *"The fear is that continuity and stability destroy creativity"* (General Manager Integration and Logistics, Systems Supplier).*

These issues on the management of inter-firm relationships are summarised in the following propositions #17 to #19.

**Tentative proposition # 17:** *Different projects in the supply network have to be managed differently*

**Tentative proposition # 18:** *Overly stable relationships between companies in the supply network can lead to a loss of innovativeness*

**Tentative proposition # 19:** *New inter-firm collaborations produce innovative solutions*

However, in order for an inter-organisational collaboration to run effectively and efficiently, one partner needs to possess the ultimate responsibility for the management of the supply network (cf. tentative propositions #14 and #15).

> *"I think that these strategic or virtual cooperations only function if they are real joint ventures whereby a couple of firms invest in a new organisation. Or one of the partners really has the leading role, who then organises regular meetings with all partners at the interface to discuss problems and find solutions. He then really has to make decisions"* (Managing Director R&D, Module Supplier).*

It seems that this management role is often occupied by the OEMs because the ultimate responsibility for purchasing, finance, marketing and sales within the supply network remains with them (*decision making & allocating, marketing & selling, incumbent*). This means that the OEMs make final decisions in the product development process of a car (*decision making & allocating*), including the management and approval of purchased components and systems, and are also responsible for selling the cars on the market via their distribution channels (*marketing & selling*). Due to increasing product segments (*product proliferation*), shorter development times (*short product development process*) and price competition (*cost pressure, competition in markets*), the OEMs often only focused on the whole car perspective and its management and outsourced details to their suppliers (*coordinating & intermediating*).

> *"The responsibility for the whole product needs to lie with the OEM, i.e. product planning and whole vehicle development has to stay inhouse. The responsibility for the system can be shifted to a lower tier level"* (Deputy General Manager Customer Team 3, Module Supplier).*

However, due to arising quality problems in the past (*product quality*) based on increasing modularisation of parts and components (*product modularisation*) the OEMs are increasingly engaging in detailed concept development activities again in order to define and describe the parts and systems and their functionality more thoroughly up front (*translating & designing*). In this context it is less important for the OEMs to perform details of parts and systems development and manufacturing (*developing & manufacturing*) but concentrate on the understanding and definition of the functionality of those parts and systems on the meta-level in order to be able to manage the interfaces within the overall car (*translating & designing, coordinating & intermediating, R&D evaluation, interface management*). Hence, the OEM specifies the general conditions (meta-level) in which the supplier can provide his system and implement the technical details together with the OEM (*leading & initiating, integrator, incubator*). The suppliers are then taking over the responsibility for the development and industrialisation of the parts and systems based on the given specifications (*developing & making, integrating systems*).

> *"We can say that especially at the early stages the OEM has the leading role because he needs to define who does what, when and how in the process. He needs to specify the vehicle trough the concept development and needs to determine the conditions of collaboration. Then I see each vehicle as a cake which the OEM can allocate to his network over the whole product development process. And the OEM himself is part of that network on a meta-level. He then can decide which parts of the cake he will do himself and what slices he will outsource, e.g. including the project coordination, etc.*

> *His scope of action is completely open from 0 to 100%"* (Project Manager, Engineering Service Provider).*

Nevertheless, the lasting model segmentation (*product proliferation*) and modularisation of parts and components (*product modularisation*) led to the change of arms length parts suppliers towards innovative system and module suppliers in many cases (*system supplier, module supplier, part & component supplier, evolution*) (cf. tentative proposition #11). This enabled many of these suppliers to gain more or bigger pieces of the vehicle 'cake' (*creating added value*) by not only taking over responsibility for specific parts development and manufacturing (*developing & making*) but also contributing to the problem solving at the concept stage (*innovating & problem solving*), over the responsibility for whole systems (*integrating systems*) towards the management of projects including the coordination of the related sub-suppliers (*coordinating, managing sub-suppliers*). This can even go as far as supporting the OEMs with the selling of the system the supplier is responsible for (*providing full service*).

> *"In the context of competition, as commodity supplier you tried to differentiate yourself from competitors and thereby create more added value for the OEM. Hence, you became more and more an integrator into the car; partly due to your own drive, but the OEM has seen advantages in this as well"* (Sales Director, System Supplier).*

Because nowadays OEMs are mainly outsourcing whole system performance, suppliers need to develop towards system suppliers if they want to stay on the 1st tier level (*evolution*). In this change process, some OEMs require their bigger system suppliers and prime contractors (*prime contractor, system supplier*) to integrate smaller and medium sized suppliers into their processes (*coordinating, managing sub-suppliers*) thereby not only improving the coordination and management skills of the bigger suppliers (*interface management, R&D evaluation, project management*) but also the adaptation capabilities of the SMEs (*plug & play ability, flexibility & adaptability*). Only then it can be assured that the suppliers will stay in an engaged and closely integrated supply condition within the supply network (*condition, proximity*) and even increase their responsibility and contribution within the collaboration (*scope, depth, evolution*).

> *"We want to avoid being the referee all the time but really want the big supplier to integrate the small supplier in his processes. Then, when the suppliers have developed the necessary competencies, it is even possible to outsource bigger performance packages of the volume models"* (Project Manager Purchasing, OEM).*

Through the simultaneous engineering activities based on the inter-organisational network infrastructure (*simultaneous engineering, collaboration infrastructure, Relationship Interfaces*) the OEMs stay involved in the product development process on the meta-level at all times via their R&D, production, quality assurance and purchasing functions. This ensures that the OEMs remain their competencies in whole vehicle coordination and interface management for complex inter-organisational R&D projects in the supply network (*coordinating & intermediating, interface management, R&D evaluation*).

These aspects on the power position in inter-firm relationships are summarised in propositions #20 and #21.

**Tentative proposition # 20:** *Car manufacturers still retain overall responsibility for the management of the whole supply network*

**Tentative proposition # 21:** *To become more influential in the supply network a company must take responsibility for integrating other companies and their products*

This improvement of the suppliers' management competencies (*project management, R&D evaluation, interface management*) and the related increase of their responsibilities (*integrating systems, managing sub-suppliers, coordinating*) enables their earlier and closer integration into R&D projects within the OEMs' supply network (*frontloading*) due to the increased value contribution they can make (*creating added value, value for competitiveness*).

> *"In the best case, the supplier will be integrated in the concept phase already, if he provides certain technologies and management skills"* (General Manager Design Car Body, OEM).*

This leads to the establishment of a more advanced relationship and collaboration infrastructure with all its elements (*type & degree of relationship, collaboration infrastructure, Relationship Interfaces*) up to the stage that common processes are defined within the supply network, facilitating a better inter-organisational collaboration (*simultaneous engineering, knowledge sharing*) that ultimately results in the successful delivery of inter-organisational R&D projects (*Collaboration Outcomes: Positive, Holistic Competitive Advantage*). This not only involves the building of the collaboration infrastructure as early as possible (*collaboration infrastructure*, *frontloading*) but also granting the suppliers more conceptional freedom (*creating added value*). It implies an active integration not only in the implementation steps of the later R&D stages (*developing & making*) but also in the decision steps of the earlier stages (*innovating & problem solving*) for all vehicles including the volume models to improve the competitiveness of the supply network and its members (*Positive Collaboration Outcomes).*

> *"Suppliers tend to be involved earlier in the development process now, they tend to be asked to confirm the feasibility of certain designs of components rather than just being handed the drawing and carrying out the production. There is no doubt that they are generally more and earlier involved in the process and that there are more constructive dialogues. But nothing like as much as it should be"* (Head of Department Body and Trim, OEM).

This stronger integration of suppliers and partners especially at the early stages of R&D projects should reveal synergy potentials in form of cost and time to market (*cost reduction, speed & flexibility improvement*) as well as technical functions (*innovativeness, product & process quality, interface management, product know how, process know how*) because in most cases the suppliers are the specialists for the detailed configuration of components and systems (*developing & making*). In addition, suppliers will always develop parts in alignment with their manufacturing competence in order to have less effort and hence provide the best quality at the lowest possible cost (*product know how, process know how, product & process quality, ownership*). If, however, the supplier is not integrated early enough (e.g. from concept development onwards) or supplier switches occur during the product development process, problems in terms of quality, cost and time to market can arise due to necessary change processes which reduce the competitiveness of the project and the overall supply network (*collaboration*).

This is especially true in R&D projects for complex and innovative parts and systems where it is essential that the partners contribute with their technical knowledge and innovativeness at early stages already (*product & process attributes, competence profile, innovativeness, product know how*). Only then it can be assured that highly mature and robust products will emerge through an mutually extended development lead time and a smooth linkage of interfaces (*quality improvement, innovation & maturity improvement, interface management improvement, speed & flexibility improvement*) resulting from early, intense and open collaboration (*frontloading, fairness, trust*).

> *"We have situations, where it does not make any sense to leave the decision open as long as possible but where it is sensible to source a supplier early because this way you can save cost in the development"* (General Manager Purchasing Electronics, OEM).*

> *"The earlier you will be integrated, the more you can influence the specifications and tailor your system to them, and the cheaper and more innovative the application will get at the end"* (General Manager Mechatronic Drives, Module Supplier).*

However, it is difficult to assess what effect early and intense integration in the concept phase has on the later series development stage in terms of cost, time and quality potentials (*quality improvement, speed & flexibility improvement, cost reduction, innovation & maturity improvement*). Although it reflects good collaboration practice (*frontloading, fairness, trust, communication*), it is difficult to draw a direct monetary causality because a variety of other factors are involved. This is particularly true as at these early stages of collaboration it is hard to base any sourcing and nomination decision for collaboration partners in the supply network on price and cost issues (*efficiency competence features*) because detailed specifications and required functionalities are not yet existent which makes it difficult to define a price target for the part or system.

> *"The suppliers will only commit when they are nominated and they will only be nominated when prices are agreed and the price will only be agreed fairly late in the development process because you cannot agree on a price without a fairly mature design. Hence, the problem for the OEM at these early stages is that he does not know whether he gets the best technology at the lowest price. That is why he takes the developed drawing and goes into a global sourcing process"* (General Manager Marketing and Sales, Module Supplier).*

A certain benchmark in terms of price and technology is always justified, but early and intense collaboration does not mean integration at the expenses of the partners (*adversarial strategy, cost focus*). In order not to destroy the collaborative spirit of the supply network, the OEMs need to manage this paradox between making the commitment early and knowing enough details to be able to commit to a price (cf. tentative proposition #4). For some OEMs the answer to this sourcing dilemma lies within the evaluation of the technological competencies of their partners (*technical competence features*) and their willingness and capability to collaborate in inter-organisational projects within a supply network (*social competence features*). This implies the move away from adversarial cost pressure in global sourcing procedures (*adversarial strategy, cost focus*) towards technical integration of competent partners at early stages of the project collaboration (*competence orientation,* *frontloading*) because until that paradox is broken there will always only be a limited engagement and involvement of the suppliers.

> *"It is not beneficial for us, if all our good suppliers for the concept and series development will die, because we are always sourcing the manufacturing to other cheaper suppliers"* (Project Manager Purchasing, OEM).*

This leads to a fair and strategic sourcing procedure (*strategic sourcing, sourcing strategies & activities, collaborative supply strategy*) where the most competent partners that provide the innovation and product know how (*problem solving & innovating, technical competence features, competence orientation*) are nominated early in the process by the decision makers of the OEM (*decision authority within buyer*) and the partners commit to deliver a specified functionality and performance at the targeted price that includes an agreed profit margin for all involved partners (*ownership, fairness, frontloading*).

> *"This means to apply a strategic sourcing and purchasing role by selecting a supplier at day one of a new project and then making the decision on this supplier even before we know the exact details, specifications and cost of the component. We will select the supplier based on its capability and competence and nominate him at day one as the partner for this vehicle which will comprise the development and the production"* (Head of Department Body and Trim, OEM).

The discussed issues of early integration are summarised in propositions #22 and #23.

**Tentative proposition # 22:** *Early and intense integration of strategic collaborators facilitates the successful delivery of a project within the supply network*

**Tentative proposition # 23:** *At early stages of the collaboration process technical and social rather than monetary aspects have to be measured and compared*

However, in the short-term this might appear inefficient for the OEMs because it looks like the prices they are paying are higher than the competition which does not conform with their general motivation for collaboration that aims at the improvement of their competitive position in the market. But

> *"when you take a step back and take a holistic and long-term view of the real overall cost of the part in terms of warranty returns, cost of failure in the market place, cost of customer not being satisfied and not coming back and also cost of not having a coherent and consistent brand identity, this will look differently. It is difficult to quantify that in terms of monetary value but it is a long-term decline of the brand if those core product values are not maintained. And you see that with Volvo. They have been very successful in maintaining their core brand values by having a supplier base that understands this"* (Head of Department Body and Trim, OEM).

Hence, in these inter-organisational R&D projects within the supply network it is important to identify an equilibrium of mutual agreement (*holistic & long-term thinking, fairness, trust*), i.e. a price target which the OEM considers as competitive and the partners can make a profit with (cf. tentative proposition #4). Only then it is possible to optimise the total supply network rather than its individual parts and deliver a successful inter-organisational R&D project (*holistic & long-term thinking*). This requires an open book process of information exchange (*fairness, trust, communication, knowledge sharing*), i.e. a common planning of a resource economising R&D process (*cost reduction, speed & flexibility improvement*), a mutual identification of cost potentials in the process (*cost reduction*), an agreement on related price and cost targets and a development and manufacturing process based on jointly defined specifications and functionalities (*quality improvement, mutual competence development, innovation & maturity improvement, interface management improvement, simultaneous engineering*).

> *"In this kind of relationships the customer is not king anymore because he makes himself transparent"* (General Manager Integration and Logistics, System Supplier).*

Because in inter-organisational supply networks a company can only survive through the information of its collaborating partners (*knowledge sharing, simultaneous engineering*), the existing 'firm centric' supply chain models where every partner focuses on his own optimisation have to change towards 'net centric' models where the whole supply network is in the focus of optimisation (*holistic & long-term thinking*). Thereby, OEMs need to move away from their adversarial relationship strategies (*adversarial strategy*) and short-term orientated bottom line thinking driven by shareholder value (*cost focus, time pressure, short-term thinking*) and accept short-term hits on the bottom line for a long-term growth and benefit (*holistic & long-term thinking, Collaboration Outcomes: Positive*). Suppliers need to overcome their short-term orientation and commit to more ownership by investing in the necessary resources (*ownership improvement*) with the long-term benefit of getting return business because of better quality and higher innovativeness (*stability & continuity*).

> *"Unfortunately, the orientation at shareholder value is so strong that it does not allow an extra Cent in favour of partnership at the cost of the shareholder"* (Corporate Vice President Logistics, System Supplier).*

If product and/or process changes are necessary during the R&D process of these inter-organisational projects both parties need to engage in discussing and implementing the change in the most efficient and effective way in order to try to produce the parts and systems at their cost target (*communication, trust, knowledge sharing*). This means that effectively the risk is shared (*risk reduction*) in a win-win situation rather than forcing all the risk onto one or the other partner (*holisitic & long-term thinking*). A good practice example is the project 'Collaborative Process Optimisation' of one OEM and its suppliers with the aim of reducing costs for changes and warranties in the overall process. If cost reductions are achieved, these are split 50 / 50 in a win-win relationship.

> *"It needs to be recognised that we need to learn from each other, because overall this collaborative process helps in optimising the whole system"* (Managing Branch Director, Engineering Service Provider).*

This need for taking a holistic and long-term view is summarised in proposition #24.

**Tentative proposition # 24:** *Strategic and long term thinking for the whole supply network increases the chance of successful inter-firm collaboration*

However, in the past the desired success was often not achieved, because "over the duration of the project relationship every partner tried to gain more value for himself" (Managing Director R&D, Module Supplier)*. Hence, the success of inter-organisational R&D projects based on early and close collaboration (*frontloading*) that leads to the optimisation of the whole supply network (*holistic & long-term thinking, Holistic Competitive Advantage*) is closely related to the definition of the conditions and circumstances of these relationships and projects (*type & degree of relationship, sourcing contingencies, Collaborator Sourcing: Contingencies*). This includes the determination of clear responsibilities of each involved partner in the cross-boundary project (*definition of responsibilities*) in alignment with the establishment of an appropriate collaboration infrastructure (*collaboration infrastructure, Relationship Interfaces*)

*"A critical aspect is the definition of boundaries of responsibilities and performances. Who does what and when and who is responsible for what. This is absolutely crucial. The network has to be built and integrated as early as possible"* (Project Manager, Engineering Service Provider).*

In this context it is inevitable for the involved partners to clearly define their own core competencies first (*Competence Influencers, Competence Features*) before entering cross-boundary collaboration projects. Only then it is possible to clearly identify which partner takes over responsibilities for what tasks and performances within the product development process of inter-organisational R&D projects (*definition of responsibilities*). This ultimately enables an efficient and effective management of the interfaces between the partners in the collaboration and hence the delivery of a successful project within the supply network (*Collaboration Outcomes: Positive*).

Due to more complex collaborative relationship constellations within inter-organisational R&D projects (*complexity & dynamics*), e.g. a conflict area between OEM, prime contractor and parts suppliers, in many cases the interfaces were not defined and managed properly (*interface problem*). This led to "an incredible coordination effort with a waste of resources that was supported by the mistrust between the collaborating parties. As a result, the time for product development became shorter leading to an increasing pressure on the relationship" (General Manager Pneumatics, Module Supplier)* (*adversarial strategy, time pressure, cost focus*). Therefore it is important to clearly define interfaces and responsibilities in order to be successful in a trusting inter-organisational project collaboration (*definition of responsibilities, fairness, trust*).

*"Eventually, the creation of new interfaces always leads to a higher coordination effort. However, it is necessary to clearly define these interfaces up front. If you do not do this, the effort will increase and you will ask yourself why you integrated an external partner in the first place"* (Head of Concept Development Project XY, OEM).*

This need for the identification of clear responsibilities is summarised in propositon #25.

**Tentative proposition # 25:** *The boundaries of responsibilities between collaborating parties need to be clearly defined to deliver a successful inter-firm project within the supply network*

The strategic, holistic and long-term thinking in terms of the supply network (*holistic & long-term thinking*) based on the definition of clear responsibilities and interfaces (*definition of responsibilities*) and an early, intense and open collaboration in inter-organisational projects (*frontloading, fairness, trust*) can be negatively influenced by short-term orientated and functional thinking of the involved partners (*short-term thinking, functional thinking & organisation*). This is often rooted in authority and competence conflicts of internal decision making (*sourcing contingencies, decision authority within buyer*) based on a functional organisation and power structure (*functional thinking & organisation*) of the individual company, such as functional departments and business units, leading to a complex and inefficient project management and R&D process (*interface problems, simultaneous engineering, knowledge sharing*).

> *"There is hardly any communication along the process chain. The recognition that you are a service provider for the following stages does not exist"* (General Manager Design Doors, OEM).*

This is especially true in the cases of OEMs as coordinators and leaders of their supply network (*Strategic Collaborator Roles: OEM, coordinating & intermediating, initiating & leading*), whereby "internal conflicts between R&D, Production, Quality Assurance and Purchasing are often carried out on the back of the suppliers that have to function as communication interface" (General Manager Piston Rods, Module Supplier)*.

> *"Another reason for unsuccessful collaboration is the way the OEMs are structured, i.e. discrete and distinct departments like engineering, logistics, manufacturing, purchasing. That means it is not necessarily holistic in its approach. The key measure of any purchasing department is the cost for commodity purchasing. That is true for all the OEMs. They look at the price of a part, benchmark it against other prices and look for the lowest possible price. The R&D department requires suppliers that are innovative and can industrialise ideas and concepts"* (Vice President Regional Account Executive, System Supplier).*

The resulting thinking in terms of the bottom line increases the pressure on the relationships between OEM and suppliers in the supply network (*functional thinking & organisation, adversarial strategy, cost focus, time pressure, short-term thinking*) because suppliers have to deliver a specified functionality and are only selected by the OEM if they are the cheapest amongst their competitors. This dominance of purchasing authority has negative implications on the success of inter-organisational projects in the long-term (*Holistic Competitive Advantage, Collaboration Outcomes: Negative*).

*"I have the feeling that nowadays only the short-term success is crucial, which, however, harms good medium to long-term strategies and trusting collaborative partnerships"* (Sales Manager, System Supplier).*

Hence, collaboration and collaborative behaviour needs to be defined and supported by the management in order to overcome short-term orientated thinking and functional conflicts within the organisation and the whole supply network (*top management support, short-term thinking, functional thinking & organisation*). It is thereby necessary to improve the internal and external simultaneous engineering activities in the R&D process between all partners through the establishment of autonomous cross-functional project teams reflecting the product structure (*simultaneous engineering, knowledge sharing*). This will lead to an appropriate inter-organisational collaboration infrastructure (*collaboration infrastructure*) for collaborative product development.

*"You probably can break down a car in 20 different performance characteristic areas which are cross functional but really carry the coherence, e.g. design, safety, durability, strength, etc. A number of different systems and their suppliers, internal and external, will contribute to the performance characteristics which asks for a cross-functional and coherent approach that has to be handled by the OEM"* (Head of Department Body and Trim, OEM).

"Currently, the suppliers are only linked to distinct technical areas within the architecture of the car" (General Manager Piston Rods, Module Supplier)*, but the challenge in the context of these cross-functional teams is to reflect all functions that are needed to carry out a coherent inter-organisational R&D collaboration in the involved project unit of the individual partner.

*"We created project and business units that deal with the whole environment of a product by merging sales, purchasing and R&D into customer teams. That means we gave the company organisation a market structure. In doing so, often very small project units emerged. Thereby the difficulty arises to reflect all functions in the smaller project units that we have in the larger business units per se"* (Managing Director R&D, Module Supplier).*

However, it not only requires the redesign and restructuring of the individual organisations to enable improved collaboration in the supply network (*knowledge sharing, communication, simultaneous engineering, organisational restructuring*) but also a change in their culture and thinking (*culture, Collaboration Facilitators: Positive*). The internal R&D and production functions have to be included as 'internal suppliers' based on their competencies similar to external ones (*competence orientation, technical competence features*). Purchasing departments have to change their thinking from getting parts at the cheapest price (*efficiency competence features*) towards finding and developing future partnerships that are going to benefit the business in a strategic sourcing manner (*competence orientation, strategic sourcing, collaborative partnerships, technical competence features, social competence features*). Then they have to hand over these partnerships within the project team to the functions that are effectively delivering the products (*active supply management, R&D decision making*).

> *"That is a step on which both sides have to work because if you want to remain in the market then it needs to be possible to collaborate free from company characteristics"* (Sales Director, System supplier).*

These insights on overcoming limitations to inter-firm collaboration are summarised in propositions #26 and #27.

**Tentative proposition # 26:** *Functional and short-term thinking within an organisation produces sub-optimisation for the supply network*

**Tentative proposition # 27:** *The existence of cross-functional units that can act autonomously from other parts of the same company facilitate inter-firm collaboration*

***Relationship Contingency - Competence***

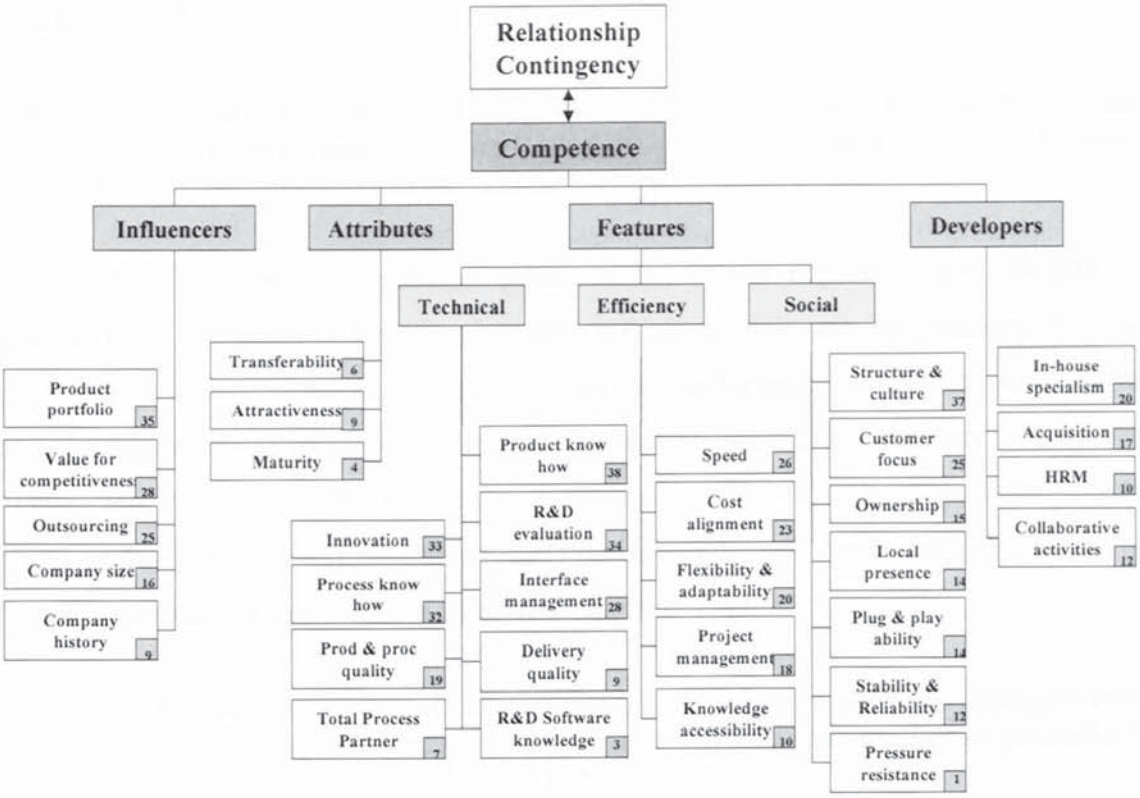


**Figure 5.13: Coding of the core category 'Relationship Contingency'**

The autonomy of these cross-functional parts of an organisation (cf. tentative proposition #27) is closely related to the existence of relevant and sufficient know how on a meta-level, i.e. reflection of all functions and competencies that are necessary in the context of inter-organisational R&D collaboration.

> *"If you want to be flexible in a collaboration with the OEM you need all functions in a key account unit including the design competence. Thereby, thinking in distinct departments was not beneficial. Today we have all functions included in the key accounts, from sales over R&D to purchasing"* (General Manager Marketing and Sales, Module Supplier).*

This not only involves innovative capacity (*innovativeness*), specific technical knowledge about parts and systems and their production (*product know how, process know how, product & process quality*) and the understanding of their complex interfaces and interaction with other parts and systems in the overall architecture of a car (*interface management*). It also involves the management skills and social characteristics that are necessary to link with other partners in an inter-organisational R&D project to produce a coherent product and deliver a successful project (*project management, customer focus, ownership, plug & play ability,* *stability & reliability, pressure resistance*). That means, "the whole construct needs to be coherent, involving logistics, quality assurance, purchasing, sales, and R&D" (Sales Manager, System supplier)*.

> *"On the one hand a certain degree of specialisation is necessary. On the other hand, you need to be able to understand and offer the global aspects of a part or system"* (Sales Director, System Supplier).*

For the OEMs this implies a stronger segmentation of the organisational structure in alignment with the product portfolio because not all models can be managed by the organisation in a central manner (*organisational restructuring*). In addition, a focus on crucial competencies from design over coordination to selling is necessary (*Operative Collaboration Activities: OEM*) which will enable the OEMs to manage their supply networks and related inter-organisational R&D projects more efficiently and effectively via their various strategic roles (*Strategic Collaborator Roles: OEM*).

> *"A part of the R&D workforce will be relocated in our new project house that can work on derivate models for niche markets in a leaner way than the mother organisation"* (General Manager Design Car Body, OEM).*

For the suppliers this implies a knowledge extension from part specific development and manufacturing know how (*developing & making*) towards an increased value creation through complex system or full vehicle integration including an increased responsibility in problem solving as well as project coordination (*creating added value, innovating & problem solving, integrating systems, coordinating, managing sub-suppliers*). This is accompanied by a change from supplying at the parts level (*part & component supplier, logistics & assembly service provider*) towards supplying at the module, system or vehicle level (*prime contractor, system supplier, module supplier*). Related to this is the restructuring of the supplier organisation into key accounts or matrix structures (*organisational restructuring*) in order to facilitate the process of cross-functional knowledge extension and development of value adding competencies (*competence focus & development*). This ultimately improves the capability for inter-organisational collaboration in supply networks due to improved know how exchange via a better collaboration infrastructure (*knowledge sharing, simultaneous engineering, collaboration infrastructure*).

> *"Via our key accounts we have built a bridge to ensure a know how transfer from our internal competence centres towards the OEMs, especially in R&D"* (General Manager Marketing and Sales, Module Supplier).*

These competence issues are summarised in proposition #28.

**Tentative proposition # 28:** *To operate autonomously within the organisation and to integrate in the supply network cross-functional units must have both unique resources and interface capabilities*

Even if suppliers with a key account structure are able to provide a good customer specific service, the assigned responsibilities of a company within an inter-organisational R&D project mainly depend on the type and level of its competence (cf. tentative propositions #11 and #21). More specifically, the perception of the required competence in respect to the existing one (*competence profile, competence fit*). Hence, the more unique, advanced and suitable the cross-functional knowledge and the competencies of a project partner are, the more responsibility he will be given within the project (*scope, depth*) because the more value this creates for the successful delivery of the project and hence the competitiveness of the whole supply network (*Holistic Competitive Advantage*). This requires "a certain degree of specialisation to differentiate from other partners in the supply network" (Managing Branch Director, Engineering Service Provider)* but also the competence to "cover the risk, the problems and the work that can emerge related to your product in the wider context of the vehicle" (Sales Manager, Module Supplier)*.

> *"In addition to the traditional R&D topics in the areas body, interior, powertrain, etc. we also developed the areas testing, prototyping and tooling. That way we tried to cover the whole process of car development, i.e. from concept design and definition of vehicles to the start of production"* (Managing Branch Director, Engineering Service Provider).*

Hence, the maximisation of the project involvement (cf. tentative proposition #10) within the network is a basic objective for each partner, especially the suppliers (*stability & continuity*). This needs to be based on the sophistication of the required competencies for inter-organisational R&D collaboration (*technical competence features, efficiency competence features, social competence features, competence orientation*) as characterised by their attributes: attractiveness, maturity and transferability (*attractiveness & embeddedness, maturity & sustainability, transferability & deployment*). This then ultimately improves the competitiveness of the whole supply network as long as a strategic sourcing approach is applied (*competence orientation, strategic sourcing, collaborative partnerships*).

> *"If we in the case of our hinges are confronted with a better price of a competitor then we still got the chance to offer a whole package consisting of drive mechanism, maybe convertible roof and hinges at a certain price. This structure makes it difficult for a hinge supplier because our value added is much higher for the OEM"* (General Manager Customer Team, System Supplier).*

These aspects of value proposition are summarised in the following proposition #29.

**Tentative proposition # 29:** *The more mature, attractive and transferable a competence is the more potential value it can create for the supply network*

As a consequence, the "competencies of the suppliers needed to increase drastically in order to be able to address system solutions on the meta-level" (Manager Electronics Development, Module Supplier)*. However, it is obvious that many suppliers could not and cannot develop these necessary competencies completely on their own (*in-house specialism*, *acquisition*, *human resource management*), e.g. due to financial constraints, a lack of experience or the characteristics of their products (*company size*, *company history*, *product portfolio*). Hence, they were and still are dependent on the cooperation and interaction with others, i.e. suppliers and OEMs, in inter-organisational R&D projects within the supply network (*collaborative activities*).

> *"We are a medium sized family owned company and therefore cannot afford to do everything ourselves like Bosch or Siemens. Hence, we looked for complementing competencies of innovative external cooperation partners and then founded development partnerships and networks with these in order to appear as one cluster in front of the OEM"* (Deputy General Manager Customer Team 3, Module Supplier).*

With increasing maturity of R&D projects further development tasks and performances are more and more sourced to the suppliers "which automatically improves the competencies and know how of the suppliers through more involvement in the topic" (R&D Director, System Supplier)* (*collaborative activities*).

> *"If you outsource performance to a supplier you automatically enable him to do things. It is of course true that we qualify partners, but we qualify the seat supplier, the cockpit supplier, etc. Generally, we qualify everyone but each of the OEMs does that in a similar way"* (General Manager Design Doors, OEM).*

However, the suppliers will solve problems and support the OEM with their specialised parts and systems knowledge during the product development process via their cooperative competence clusters (*cluster creation, innovating & problem solving, developing & making, system integration, innovativeness, product know how*). The OEM will thereby improve his own competencies (*collaborative activities, mutual competence development*) and benefit from the suppliers' know how as long as the OEM stays actively involved in the management of the R&D process (*active supply management, R&D decision making, Operative Collaboration Activities: OEM*) through mutual simultaneous engineering work and know how exchange (*simultaneous engineering, knowledge sharing*). In this context it is crucial that limitations of one partner within the inter-organisational R&D project are compensated by the other partners leading to a mutual improvement of competencies and know how through collaboration based on know how sharing (*collaborative activities, knowledge sharing, simultaneous engineering, mutual competence development*).

> *"If the OEM had linked more intensely with his suppliers, many problems would not have happened because the experience of the suppliers is always integrated in the product leading to mutual benefits"* (General Manager Pneumatic, Module Supplier).*

The discussed issues of competence deployment in inter-firm collaboration are summarised in proposition #30.

**Tentative proposition # 30:** *Competencies can be developed and deployed through collaboration with other companies in the supply network*

***Relationship Success - Holistic Competitive Advantage***

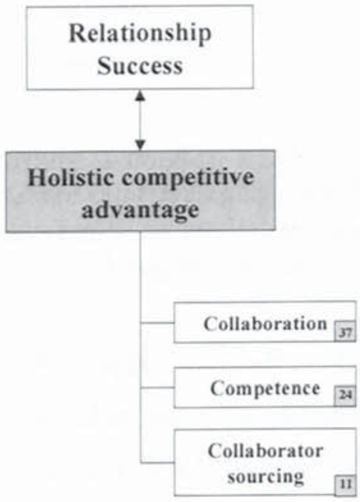


**Figure 5.14: Coding of the core category 'Relationship Success'**

In order to ensure an efficient and effective competence development and deployment throughout the supply network (*collaborative activities*), for each of these inter-organisational R&D projects an appropriate supply base has to be selected and managed. Especially in a highly complex and innovative product development context (*product & process attributes*), the selection and management of suitable collaboration partners can facilitate the improvement of the competitiveness of the whole supply network (*collaborator sourcing*).

> *"A key part of any new product that is designed, developed or launched is the selection of suppliers for the components of this new product. Most of the OEMs are just assembly lines that take in parts at a very high level. And the performance characteristics of a car are really defined by those parts and systems that come from the suppliers"* (Head of Department Body and Trim, OEM).

Hence, it is important to evaluate the competencies, i.e. technical know how as well as social management skills (*technical competence features, social competence features*), of the partners in the network (*R&D evaluation, evaluation competencies, Competence Attributes*) in respect to the performance tasks that need to be carried out in an inter-organisational R&D project (*competence fit, competence profile, competence orientation, product & process attributes, stage of PDP*). Based on this competence evaluation, the most suitable partner for each discrete activity in the project should be selected and managed in form of an integrated partnership by the collaborator or leader of the supply network in a strategic sourcing approach (*scouting & integrating, strategic sourcing, collaborative partnerships*). The earlier in the product development process of the project this occurs (cf. tentative propositions #22 and #23) and the clearer the responsibilities of the involved partners are defined and distinguished (cf. tentative proposition #25), the higher the benefits in terms of competitiveness improvement through effective collaboration (*collaborator sourcing, collaboration, frontloading, definition of responsibilities*).

> *"We want to focus more on our sourcing strategies, i.e. we deliberately want to select certain suppliers for specific performance packages and identify which kind of networks and contracts we need. This is necessary in order to stay competitive and gain advantage over our competitors"* (Project Manager Purchasing, OEM).*

That means, a competitive advantage for the supply network is created through the delivery of competencies (*competence*) of the most suitable network partners (*collaborator sourcing*) to the relevant task within the inter-organisational R&D project. This is the case because the establishment of these kind of partnerships stimulates collaboration within the supply network (*collaborator sourcing, collaboration, type & degree of relationship*) leading to a certain stability and continuity of activities (*stability & continuity*) that allows for more strategic and long-term thinking in terms of the whole network (*holistic & long-term thinking, strategic sourcing*).

> *"The collaboration with our suppliers is very important for us and definitely contributes to our success. Our products are only successful because we implement good ideas. But this implementation is really the contribution of the suppliers. Thereby we need to manage the challenge of achieving competitive prices with the suppliers without having a real price competition. Our answer for this is a collaborative partnership approach"* (Project Manager Purchasing, OEM).*

The underlying know how sharing and simultaneous engineering process (*knowledge sharing, simultaneous engineering*) facilitates the improvement of competencies and hence the management of the interfaces between the partners in the project (*mutual competence development, interface management improvement*). This ultimately leads to improvements in product quality, maturity, and innovation (*quality improvement, innovation & maturity improvement*) as well as to reductions in time to market and development costs (*cost reduction, speed & flexibility improvement*) making good collaboration practice an "important element for business success" (General Manager Mechatronic Drives, Module Supplier)*.

> *"Detailed information is de facto exchanged within a project. If such trust constellations exist, then communication opens and many things are dealt with in an open way. This obviously contributes to improvements in product quality and hence success"* (R&D Director, System Supplier).*

Moreover, closer and better collaborative partnerships increase the motivation of the collaborating partners leading to more ownership and willingness to take risk within the inter-organisational project (*motivation & ownership improvement, risk reduction*). This involves long-term commitment of the OEMs towards their supplier (*holistic & long-term thinking*), i.e. continuous sourcing of components and systems from these suppliers, an appropriate price including agreed profit margins for all partners (*fairness*), and mutual effort to meet targets and decrease costs. Those suppliers that are involved and engaged in repeat long-term business with the OEM will be able and willing to invest in their people, facilities, equipment and infrastructure (*mutual competence development*) "knowing that their own success and the success of the OEM are linked together" (Head of Department Body and Trim, OEM). Hence, the suppliers in return take real ownership of the complete aspects of the performance of their parts and systems (*motivation & ownership improvement*) thereby reducing the effort and risk for the OEM (*risk reduction*). It would also lead to a potential exclusivity of supplier innovations for these OEMs based on a better identification of the suppliers with their OEMs (*exclusivity*) and ultimately the creation of unique sales points and added value for the end customer via the exploitation of these supplier innovations.

> *"If we had long-term partnerships, then it would be easier for us to guarantee exclusivity. This would ultimately lead to a competitive advantage for the OEM. But then you need completely different sourcing strategies. If you work with many different suppliers then you give away lots of your exclusivity to other OEMs"* (General Manager Piston Rods, Module Supplier).*

This would facilitate the OEMs and their supply networks in the differentiation from competitors because "cars are sold as design products or technical innovations" (General Manager Purchasing Electronics, OEM)*. Hence, an appropriate collaborative partnership can facilitate the creation of added value for the customer as well as for the own company (*collaboration, collaborator sourcing*).

> *"Thereby the differentiating factor is the quality of the collaboration. Those companies that collaborate well will continue to be profitable and continue to grow. And those that do not will continue to retract and shrink until eventually they will die. I think Ford and GM are the ones in trouble. You can see those differences emerging in the market place now. Those big OEMs are struggling, in terms of quality, quality perception in the market, warranty issues, etc. So I think, the next 10 years will reveal huge structural changes"* (Sales Director, System Supplier).*

Consequently, there is a positive correlation between a collaborative approach to partner sourcing and supply management and overall business success of the individual partners as well as the holistic network. However, as mentioned above it implies an active integration of suppliers not only in the implementation steps of the later R&D stages (*developing & making*) but also in the decision steps of the earlier stages (*innovating & problem solving*) for all vehicles including the volume models to improve the competitiveness of the supply network and its members (*Positive Collaboration Outcomes*).

> *"If you manage to work together in a good collaborative fashion and forward the gained benefits to your team then you will automatically receive a certain added value in return"* (Project Manager, Engineering Service Provider).*

Securing this win-win situation and establishing a causality between partnership approach and business success is actually very difficult. However, "if you look at the long-term success of automotive businesses and correlate that to their type of approach towards their suppliers then you will gain a clear answer" (Corporate Vice President Logistics, System Supplier)*. For the OEM the advantage would be a supplier that supplies innovative and quality components and that invests the right level of commitment at the right time to deliver the best possible job (*quality improvement, innovation & maturity improvement, motivation & ownership improvement, cost reduction, risk reduction*) enabling a quick and flexible adjustment to market dynamism (*speed & flexibility improvement*). The supplier gets the opportunity to invest in the future and gets the guarantee to survive in business and not constantly have to drive down cost in the short term to maintain business (*stability & continuity*).

> *"At the end of the day a car is just a series of parts that are put together. Some cars are successful and some cars are not. Then you can take any individual component in a successful car and compare it to an individual component in an unsuccessful car and not really find any difference in that component. But somehow or another when these components come together the total is more than the sum of its parts if it is a successful car and is less than the sum of its parts when it is an unsuccessful car. So the performance is determined by those parts and the relationship of those parts to each other. If you then sub-contract a complete system to a supplier and just go for the cheapest one, then this supplier will develop that system with little coherence to the other systems of the car. Sooner or later that system will be more or less the same across all car companies that hire that supplier to design, develop and produce this system which of course means a loss in brand identity and competitive advantage. In the long-term those products will converge to mediocre whereas any product that has maintained a very clear and strong identity and has been developed as a coherent whole will succeed and stand out. In this respect it is absolutely vital that the supplier partnerships are built up and maintained in a way that this brand and product identity exists throughout the whole process, i.e. that it is inherited by the suppliers as well"* (Head of Department Body and Trim, OEM).

These aspects of relationship success through inter-firm collaboration are summarised in the following propositions #31 to #35.

**Tentative proposition # 31:** *For each new inter-firm project a new appropriate supply base has to be selected and managed*

**Tentative proposition # 32:** *There is a positive correlation between the extent of inter-firm collaboration and the sustainable success of the supply network and its individual companies*

**Tentative proposition # 33:** *Establishing inter-firm collaboration is an effective way of improving quality and innovation of products as well as reducing development lead-times and cost in a supply network*

**Tentative proposition # 34:** *The short term success of inter-firm collaboration in the supply network is related to cost and lead time reduction*

**Tentative proposition # 35:** *The long term success of inter-firm collaboration in the supply network is related to quality and innovation improvement*

## 5.2. Data validation

The aim of this data validation is to verify and validate the researcher's developed understanding and interpretation of inter-firm R&D relationships in the German automotive industry (that resulted in the above set of tentative propositions) in order to build a sufficient empirical basis for the comparison with relevant extant literature (Chapter 6) and the development of a novel concept (Chapter 7). This conforms with Grounded Theory practice which uses ongoing observations to validate tentative ideas and conceptual structures (Suddaby, 2006).

The validation exercise was based on a self administered questionnaire survey enabling an empirical quantification of the qualitative data through a more objective research technique (see Appendix E for questionnaire). It was the aim of this validation exercise to base the qualitative findings on a broader empirical foundation within the German automotive industry (research population). In the opinion of the author this was achieved through a questionnaire survey sample representing 110 industrial experts from 52 different companies, i.e. OEMs and suppliers, as opposed to an interview sample consisting of 31 participants from 16 companies (cf. Chapter 4).

The validation of the 35 tentative propositions through the questionnaire survey implicitly validated the relevant and coded text of the interviews and its related codes, categories and abstract themes on which the propositions are based. In other words this means that the evaluation of the propositions through industrial experts in the survey provided feedback on the quality and adequacy of the data coding and analysis which enables a further conceptual development and inductive theory building (Glaser, 1978). In this context every respondent was asked to assess each tentative proposition on two dimensions of perception:

- Agreement - *whether they agreed or disagreed with the proposition*
- Importance - *the importance of the proposition for their daily business activities*

Thereby, this exercise established whether respondents agreed with the researcher's analysis and interpretation of the raw interview data and whether they thought the observations were important enough to warrant building into a consolidated conceptual framework. The respondents ranked their perceptions on the two dimensions in interval levels using a 5-point Likert scale as follows:

- *Agreement* (strongly agree =2, agree =1, neutral = 0, disagree = -1, strongly disagree = -2); Positive scores indicate agreement and negative scores indicate disagreement.
- *Importance* (very high = 5, high = 4, medium = 3, low = 2, very low = 1); All positive scores were used as this was a weighting factor.

This numerical codification of the two dimensions enabled a descriptive analysis of the data through the calculation of measures of central tendency (modus, median, mean) for each tentative proposition in order to represent their characteristics (Blaikie, 2003). Even though the numerical values of the scales of the dimensions *Agreement* and *Importance* were coded differently (-2 to 2 vs. 1 to 5) their interval lengths were the same (i.e. 5-point scale). This made a differentiation of the ratings comparable. The quantitative analysis of the data was pursued using the SPSS for Windows 13.0™ software. The results are shown in Table 5.5.

| Core category | No. | Proposition | Mean A | Mean I |
|---|---|---|---|---|
| Relationship Status Quo (Industrial Impact) | # 1 | Change in the automotive industry is driven by a combination of general industrial forces and internal company issues | 1.24 | 4.01 |
| | # 2 | Increasing complexity, cost pressure and shorter product development lead times have led to more inter-firm collaboration based on product modularisation | 1.15 | 4.21 |
| | # 3 | Car manufacturer are changing their adversarial pricing policies in supplier selection towards more strategic sourcing policies | -0.38 | 4.10 |
| | # 4 | The challenge for a collaborative supply network is to maintain competitiveness without applying adversarial forces | 0.70 | 3.94 |
| | # 5 | Focusing on core competencies is becoming increasingly important in order to drive the development and management of inter-firm collaboration in the supply network | 0.90 | 3.82 |
| Relationship Design (Collaborator Portfolio) | # 6 | Structure of the supply network is determined by the strategy of the car manufacturer | 0.98 | 3.71 |
| | # 7 | Product modularisation affects how a supply network is structured | 1.18 | 3.94 |
| | # 8 | Different relationships and collaborative practices exist for different inter-company (car manufacturer and supplier) projects in the supply network | 1.21 | 3.47 |
| | # 9 | The role of an organisation in the supply network is mainly determined by what competencies are offered by it | 1.23 | 4.21 |
| | # 10 | The role of an organisation in the supply network is partly determined by the stages of the product development process | 0.91 | 3.60 |
| | # 11 | Relationships between companies in the supply network change over time | 1.18 | 3.68 |
| | # 12 | An individual company can collaborate in more than one project within the supply network at the same time | 1.37 | 3.54 |
| | # 13 | An inter-firm collaboration in the supply network needs to be formed on the basis of technical competencies and mutual exchange of knowledge | 0.87 | 3.76 |
| | # 14 | There is the need for a coordinator and leader within the supply network that has the competence to evaluate and manage the interfaces in a collaboration | 1.30 | 4.13 |
| | # 15 | The co-ordinator of the supply network should have its own core competencies and encourage those of other organisations to participate | 1.37 | 4.08 |
| | # 16 | Competencies of separate organisations participating in a collaboration within the supply network need to be linked via cross-company project infrastructures | 0.80 | 3.75 |
| Relationship Management (Collaboration) | # 17 | Different projects in the supply network have to be managed differently | 1.00 | 3.62 |
| | # 18 | Overly stable relationships between companies in the supply network can lead to a loss of innovativeness | -0.31 | 3.31 |
| | # 19 | New inter-firm collaborations produce innovative solutions | 0.84 | 3.77 |
| | # 20 | Car manufacturers still retain overall responsibility for the management of the whole supply network | 0.30 | 3.76 |
| | # 21 | To become more influential in the supply network a company must take responsibility for integrating other companies and their products | 0.90 | 3.70 |
| | # 22 | Early and intense integration of strategic collaborators facilitates the successful delivery of a project within the supply network | 1.64 | 4.28 |
| | # 23 | At early stages of the collaboration process technical and social rather than monetary aspects have to be measured and compared | 1.06 | 4.13 |
| | # 24 | Strategic and long term thinking for the whole supply network increases the chance of successful inter-firm collaboration | 1.42 | 4.19 |
| | # 25 | The boundaries of responsibilities between collaborating parties need to be clearly defined to deliver a successful inter-firm project within the supply network | 1.69 | 4.51 |
| | # 26 | Functional and short-term thinking within an organisation produces sub-optimisation for the supply network | 0.96 | 3.71 |
| | # 27 | The existence of cross-functional units that can act autonomously from other parts of the same company facilitate inter-firm collaboration | 0.30 | 3.55 |
| Relationship Contingency (Competence) | # 28 | To operate autonomously within the organisation and to integrate in the supply network cross-functional units must have both unique resources and interface capabilities | 0.82 | 3.55 |
| | # 29 | The more mature, attractive and transferable a competence is the more potential value it can create for the supply network | 1.17 | 3.90 |
| | # 30 | Competencies can be developed and deployed through collaboration with other companies in the supply network | 1.06 | 3.73 |
| Relationship Success (Holistic Competitive Advantage) | # 31 | For each new inter-firm project a new appropriate supply base has to be selected and managed | 0.20 | 3.64 |
| | # 32 | There is a positive correlation between the extent of inter-firm collaboration and the sustainable success of the supply network and its individual companies | 0.62 | 3.50 |
| | # 33 | Establishing inter-firm collaboration is an effective way of improving quality and innovation of products as well as reducing development lead-times and cost in a supply network | 1.05 | 4.04 |
| | # 34 | The short term success of inter-firm collaboration in the supply network is related to cost and lead time reduction | 1.09 | 4.01 |
| | # 35 | The long term success of inter-firm collaboration in the supply network is related to quality and innovation improvement | 0.93 | 4.10 |

**Table 5.5: Validated propositions (N=110)**

A more detailed summary of the validation results can be found in Appendix G which entails the report that was sent to the questionnaire respondents.

As can be seen in Table 5.5, the respondents agreed with the majority of the propositions (i.e. a rating above 0 = neutral) and considered them to be important (i.e. a rating above 3 = medium). Two propositions, namely proposition #3 (Agreement = -0.38; Importance = 4.10) and proposition #18 (Agreement = -0.31; Importance = 3.31), were rated negatively (i.e. disagreed on) by the survey respondents. However, because all proposition statements were phrased in a positive manner to provide consistency for the survey respondents their inverse meaning is still useful for theory induction. Moreover, based on the insights gained from the interviews these two proposition were anticipated to be rated negatively on the *Agreement* dimension which is an implicit evidence for the internal consistency, i.e. reliability, of the used measurement scale. Only statements that were rated low on the *Importance* dimension should not be used for the induction of the conceptual framework. However, *none* of the propositions fell into this category. This is shown in a graphical overview of the location of all propositions in a XY scatter diagram in Figure 5.15.

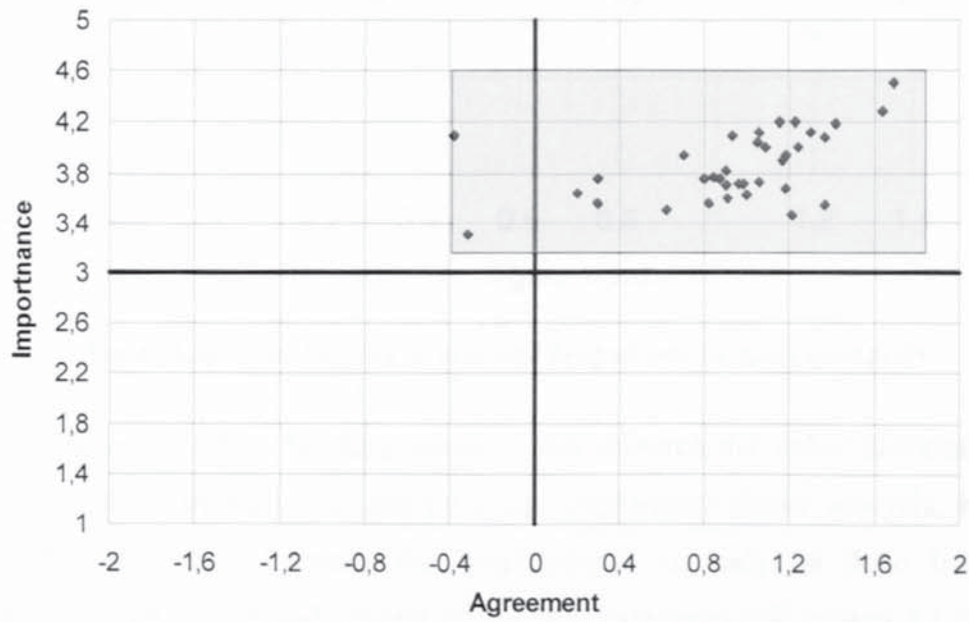


**Figure 5.15: Location of validated propositions in scatter diagram**

As can be seen from Figure 5.15 all propositions are located in the upper quadrants of the diagram characterised by an *Importance* rating above a medium score and hence are subject to the analytical interest of this study. This reflects the accuracy and reliability of the codification and analysis process from which a conceptual framework can be built: if the coding had been biased or unreflective of what the interviewees had said or considered important the percentage of propositions falling into the lower two quadrants (especially the lower left quadrant, i.e. unimportant and disagreed) of the diagram would be high. This also provides supporting evidence that the academic debate framed in this research study has practical implications, and further research would be useful to guide practitioners in the German automotive industry in their inter-firm collaboration activities. A refined illustration of the exact position of each specific proposition within the grey shaded box of Figure 5.15 is given in Figure 5.16.

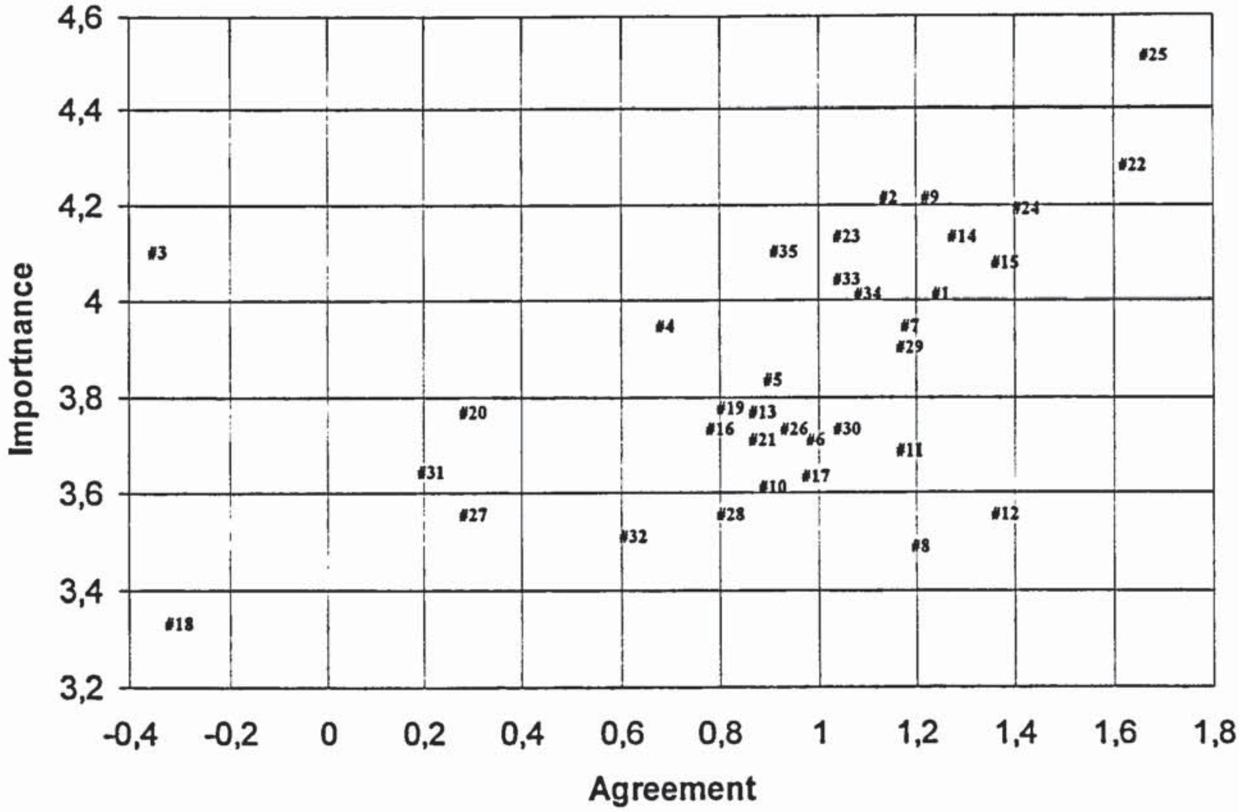


**Figure 5.16: Exact location of validated propositions in upper quadrants**

For the purpose of the theory building nature of this research the author deliberately did not engage in any form of statistical analysis, e.g. exploratory factor analysis, because the induction of relationships between the propositions can only be done based on the understanding of the content and context of the core categories (cf. section 5.1.5). Hence, it was sufficient enough that a proposition had an importance rating above medium (i.e. 3) and thus could be included in the area of analytical interest represented by the upper quadrants in Figure 5.15, particularly the grey shaded box. In other words it is more important that a proposition *appears* in the refined Figure 5.16 rather than *where* it appears.

Therefore, the validation of these propositions must *not* be confused with quantitative hypotheses testing; the purpose of Grounded Theory is only to *code* and *describe* data enough to be able to *generate* and *suggest* theory *not to prove* it statistically (Glaser, 1994). Hence, the author would like to argue that this study has not engaged in the practice of methodological slurring by using Grounded Theory for testing hypotheses but rather makes statements about how actors perceive the social reality of inter-firm relationships (Suddaby, 2006) via a form of validity assessment as suggested by Anderson *et al.* (1994).

## 5.3. Summary

A fundamental tension in analysing qualitative data is the need to be open to the data versus the need to impose some structure on the analytical process (King, 1998). The author tried to address this challenge in the above described coding and analysis procedure by combining various ideas of different qualitative data analysis concepts, such as Grounded Theory (theoretical coding) and template analysis (thematic coding). The result was a coding and analysis process in five stages in order to draw a connection between the specific raw text and the abstract research objectives.

In a *first* step, the author developed four abstract *a priori* themes based on the general research objectives that have been identified in Chapter 4 in order to provide some guidance during the coding but still allow for enough flexibility to produce insightful interpretations of the text (cf. section 5.1.1.). In a *second* step, each interview (intra-case analysis) was coded and analysed using the QSR NVivo 2.0™ software tool. This open coding process subsequently led to a composite list of 237 provisional codes of the entire sample of 28 interviews (cf. section 5.1.2.). In a *third* step, the set of codes was compared across all interviews (cross-case analysis) and the author grouped codes with similar meaning into categories and sub-categories leading to 158 codes, 19 sub-categories and 16 categories (cf. section 5.1.3.). In a *fourth* step, relationships of the developed categories were identified and data explaining their interrelation was extracted (axial coding) (cf. section 5.1.4.). This enabled their refinement and the development of five core categories or abstract themes which explain all other categories and hence the data (selective coding). They were condensed in a detailed Coding Master Table including code title, description / definition, example text passages and referenced interviews in which the code appeared. The *fifth* and final step of the coding and analysis process involved the transformation of the five core categories into theoretical narratives (cf. section 5.1.5.). This was done by breaking them down into their components (categories and codes) and verbalising their relationship using the language of the original relevant text that was given by the interviewees. This led to the generation of a set of 35 tentative propositions that summarise the most important aspects of the theoretical narratives.

The subsequent validation of these propositions (cf. section 5.2.) was based on a self administered questionnaire survey enabling an extensive feedback on the quality and adequacy of the coding and analysis to evaluate whether the derived propositions were 'important' and 'agreed' on. Due to an *Importance* rating above medium all propositions were subject to the analytical interest of this research study which supported the accuracy and reliability of the coding and analysis process and enabled an informed inductive theory building process.

Not only do these two distinct stages serve the purpose of multi-method triangulation by applying a mix of quantitative and qualitative techniques, but also the goal of theoretical sampling to refine the emerging construct by exploring it in different empirical contexts.

The following Chapter 6 adds to this empirical discussion by discussing the empirical findings, i.e. validated propositions, in the context of their theorectical perspectives as identified in Chapter 3 before leading over to the author's interpretation and assembly of the results by inducting a novel conceptual framework in Chapter 7.

# 6. THEORETICAL DISCUSSION OF EMPIRICAL FINDINGS

> *"There is always some relevant literature to refer to. It is very important to address literature that conflicts with the findings. Not to do so reduces confidence in the findings, and doing it my force you into more creative thinking and deeper insights. Literature discussing similar findings will help tie together underlying similarities. Overall effective enfolding of literature increases both the quality and validity of the findings"* (Voss *et al.*, 2002; 216-217).

After having presented the empirical findings of this research in form of a set of validated propositions on inter-firm R&D relationships in the previous Chapter 5, this chapter aims at discussing these findings in the context of specific extant literature. This is an important feature of hypothesis generating research that ultimately leads to theory extension (Eisenhardt, 1989).

The basic inter-firm relationship literature (cf. Appendix A) to be enfolded consists of a broad body of theoretical perspectives in well established academic disciplines (cf. section 3.3. in Chapter 3). Because each of these theoretical perspectives generally refers to more than one individual proposition and vice versa this chapter is structured around the propositions and their related core categories (similar to Chapter 5) in order to avoid redundancies. The following discussion thereby mainly builds on the literature identified in the literature overview in Appendix A supported by general literature on the theoretical perspectives involved.

Similarly to the intertwined codes in Chapter 5, each section in this chapter is mainly based on its related propositions but also indicates spillovers to other propositions that are discussed in the context of their relevant core category in more detail in a different section. Hence, building on the same structure as in Chapter 5, section 6.1. of this chapter confronts the findings regarding the status quo of inter-firm relationships (influenced by various industrial factors) with the relevant literature. Section 6.2. turns to the basic discussion of building inter-firm relationships whereas section 6.3. presents insights on their management. Section 6.4. discusses the aspect of competencies being the main contingency element of inter-firm relationship governance before shedding light on the success of whole relationships in section 6.5. In the final section 6.6. the main aspects of this chapter are summarised before moving on to Chapter 7 and the construction of a novel concept.

### 6.1. Confronting findings on *relationship status quo* with relevant literature

The following discussion in this section 6.1. will mainly draw on the confrontation of the industrial impact on the status quo of inter-firm relationships (reflected by **propositions #1 to #5**) with the relevant perspectives in extant literature.

There are few empirical studies that examine and analyse factors that have caused firms to participate in inter-firm R&D collaboration (Bayona *et al.*, 2001). The question in this context is whether the existing studies can explain why inter-firm collaboration in the automotive industry increasingly occurs on a modular product level and why in this context the governance of these collaborative relationships becomes increasingly contingent upon the focus on the value of competencies in order to address the emerging challenges of increased collaboration.

Hagedoorn (1993) provides an overview of various motives for technology cooperation identified in the literature, including factors such as increased complexity of technology, reduction and sharing of R&D cost, shortening of product life cycle, etc. (**proposition #2**). Similarly, Cousins and Crone (2003) and Karlsson (2003) argue that firms are increasingly entering into long-term, high dependency technology exchanges (in form of complex networks) as a result of: increased demand for quality goods, demand for variability of goods and flexibility in technology, demand for constant innovation and short development lead times, severe price competition and increasing technology costs. And Bayona *et al.* (2001) show in their study of 1652 Spanish manufacturing firms that the main motivation for entering collaborative R&D relationships are the complexity of the technology and the fact that innovation is costly and hence know how of partners is necessary in order to develop innovative products at acceptable cost. Zhao and Calantone (2003) summarise this that in the constant drive for higher quality, lower cost, and faster-to-market products many firms have begun to learn "how not to make things" (p. 51).

Whilst these changes and challenges arise from various sources some key drivers can be identified as expanding product and process complexity and variety, shorter product life cycles and hence shorter product development lead times (i.e. faster industry clockspeed; Fine, 1998), increasing outsourcing tendencies, changing customer expectations, globalisation of production and development activities, and virtualisation of businesses through continuously advancing information technology (Harland *et al.*, 2003; Prahalad and Hamel, 1994; Snow *et al.*, 1992; Von Corswant and Fredriksson, 2002). In addition, Das and Teng (1999) identify environmental factors such as changes in government regulations and market factors such as fierce competition.

This conforms with the observations made during this research **(proposition #1)**. Similarly, Hagedoorn (1993) and Drejer and Gudmundsson (2002) argue that market (external) and technology (internal) related motives and challenges dominate in the context of inter-firm collaboration. More than 20 years ago Boje and Whetten (1981) already demonstrated the value of including both organisational strategies (endogenous factors) and environmental constraints (exogenous factors) in a model of inter-organisational relations. Madhavan *et al.* (1998) add to this discussion by arguing that external industrial events can either have a reinforcing effect on the relationship structure or a structure loosening effect which links to the dynamics of inter-firm relationships discussed in the context of **proposition #11.**

However, only a few studies seem to recognise the importance of modularisation aspects for inter-firm R&D collaboration **(proposition #2)** and the structuring of the resulting relationship **(proposition #7)**. For example, Schilling and Steensma (2001) argue that technological change and competitive intensity within an industry provide additional impetus for firms to use modular (inter-)organisational forms. Wolters and Schuller (1997) and Cigolini *et al.* (2004) are more specific in their discussion by arguing that redesigning products and processes in a modular way is the prominent way for OEMs to reduce complexity and increase competitiveness through the delegation of complete aggregated subsystems to specialised suppliers **(proposition #2)**. Similarly, Dyer (1996a) argues that specialised supplier networks enhance the competitiveness of the OEM through the supply of big sub-system by specialists. Hence, modularity facilitates companies in dealing with product complexity (reduced task complexity) and enables them to increase flexibility, improve quality, and cut costs and development lead time through the delegation of discrete performance packages (decoupled modules) to many different suppliers (parallel work), each of which adds a distinct value **(proposition #32)** (Baldwin and Clark, 1997 and 2001; Henke, 2000; Persson and Ahlström (2006).

The essence of modularisation is the building of a product from smaller subsystems that can be designed independently but function together as an integrated whole (Baldwin and Clark, 1997). Modular R&D can then be seen as "...a special form of design which intentionally creates a high degree of independence or 'loose coupling' between component designs by standardizing component interface specifications" (Sanchez and Mahoney, 1996; p. 65).

Although most benefits can be gained particularly through modular product design, this seems to be a neglected perspective in empirical research. Notable exceptions are Mikkola (2003) who explores the potential of modular outsourcing on inter-firm learning through the interdependencies that emerge between buyer and supplier; Drejer and Gudmundsson (2002) who develop the concept of multiple product development, conceptualising product development as an iterative cross-functional process that is dispersed in a network of organisations rather than within a single organisation; and Persson and Ahlström (2006) who identify the intra-company coordination and integration of modular product development as one of the main managerial challenges of product modularisation (**proposition #27**). This study extends this view onto the inter-company level by combining a modular product architecture with a modular supply base (**proposition #7**).

Nevertheless, other studies call into question the trend toward highly modular designs. Although such designs make product development more predictable (modularity is tolerant of uncertainty; Baldwin and Clark, 2001) many companies appeal to use modularisation techniques to the point where they undermine the innovation process by reducing the opportunities for breakthrough advances (Fleming and Sorenson, 2001). Similarly, Batchelor *et al.* (2001) criticise that outsourcing of modular assemblies carries the risk of a loss of systematic or architectural knowledge, i.e. "the detailed understanding of the linkages between user requirements, system parameters and component specifications" (p. 222), and hence a loss of control over the product which might be triggered through increasing interdependence of the partners in close relationships (**proposition #18**). These authors therefore argue that it is important to consider knowledge assets, such as competencies, in the context of the make-or-by decision (**proposition #5**).

Either way, the change towards more modularisation implies new organisational arrangements between car manufacturers and suppliers to reflect a new relationship between traditionally adversarial firms (Wolters and Schuller, 1997). In the same tenor, many studies and scholarly contributions across industries and business areas claim that more collaboration exists. They argue that American and European (car) manufacturers have begun to move away form arms-length governance mechanisms based on TCE thinking towards the adoption of open and integrated Japanese relationship practices that realise advantages through non-adversarial and collaborative ways of doing business (Baines and Kay, 2002; Cousins and Crone, 2003; Hoyt and Huq, 2000; Liedtka, 1996). This means that OEMs are giving increased responsibility to the suppliers and involving them in product development more deeply at an earlier stage (Dyer, 1996b). This approach to the management of supplier relationships gave the Japanese auto-maker as much as a 22 per cent manufacturing cost advantage in the 1970s (Dyer and Ouchi, 1993). In this context, the most widely cited example of such initiatives in the Western world is Chrysler and its American keiretsu (Dyer, 1996b).

However, these examples fail to account for the fact that reality tells a different story in most cases: it shows a retention (or even enforcement) of adversarial relationship strategies through know how shifts, consolidation and global sourcing tendencies, and decreasing product quality (**proposition #3**). This is supported by Moody (2001) who claims, based on a study of 236 Canadian and U.S. manufacturing companies, that strategic purchasing (as outlined in section 3.3.5. in Chapter 3) remains an oxymoron by showing a big gap between strategic intentions and tactical realities. Similarly, Szwejczewski *et al.* (2005) in their study of the German manufacturing industry (including the automotive sector) conclude that the term 'partnership' is both overused and somewhat equivocal as most respondents believe to be in partnership with their suppliers but still heavily rely on multiple sourcing techniques. And Cousins (2002) is quite specific in stating that "partnership relationships do not exist" (p. 71). He elaborated that rather there are ranges of varying collaborative relationships, all of which are competitive.

A middle ground between these two extreme positions is taken by a few scholars which probably best reflects the premium practice in the German automotive industry (cf. Table 2.1 in Chapter 2). They observe that OEMs tend to manage most of their suppliers in conventional and transaction cost based (i.e. adversarial) ways and target only a few key suppliers (mainly firs-tier suppliers supplying complex and highly innovative modules and systems) for relational partnerships (Ali *et al.*, 1997; McCutcheon and Stuart, 2000; Parker and Hartley, 1997).

Whatever position is taken one aspect is common to all contributions: the recognition that more partnership between manufacturers and their suppliers is necessary to accommodate the various drivers discussed above (cf. proposition #1 and #2).[25] This is in alignment with Takeishi (2001) who states that ideally managers should "ask not what your supplier can do for you; ask what you can do with your suppliers" (p. 419). Similarly, Deming (1986) postulated that purchasers should "end the practice of awarding business on the basis of price tag alone" (p. 33) and include aspects such as quality and building of long-term relationships; but it takes time to overcome this 'show me the money mindset' (Cousins and Spekman, 2003; p. 26). Thereby, 'partnership' has to be differentiated from other formal business relationships as shown in Figure 6.1.

Aston University

Illustration removed for copyright restrictions

**Figure 6.1: Types of business relationships (Source: Lambert *et al.*, 1996; p. 2 quoted in Goffin *et al.*, 2006).**

However, the current literature does not address the main challenge that occurs in the context of more partnership collaboration in that competitiveness for the relationship need to be maintained without applying adversarial forces between the partner companies (**proposition #4**). Hoyt and Huq (2000) as well as Rossetti and Choi (2005) merely argue that competitive advantage derived from trust based and strategically integrated relationships should not be used as justification for mistreating the partners for short-term gains.

According to Zeng and Chen (2003) this inherent tension between cooperation and competition in collaborative relationships is a social dilemma where an individually rational but socially defecting choice may lead to a higher payoff for an individual partner but has a negative impact on the relationship as a whole. This involves balancing the relational risk and performance risk associated with inter-firm collaboration through an appropriate level of intertwining a sense of competition with the spirit of cooperation to mitigate the threat of opportunism (**proposition #8** and **#17**) (Das and Teng, 1999).[26] In the same tenor other

[25] A good overview of advantages of partnership sourcing over competitive supply can be found in Lamming and Cox (1995).

[26] Relational risk is concerned with the probability that partner firms lack commitment to the alliance and that their possible opportunistic behaviour could undermine the prospects of an alliance. Performance risk is the

authors similarly argued for a somewhat optimal combination of competitive and collaborative strategies and approaches to relationship building and supplier sourcing (Cousins, 2002; Parker and Hartley, 1997). Probably the best way to describe the challenge partners in a collaborative relationship are facing in this context is provided by Nalebuff and Brandenburger (1997):

> *"It's about finding ways to make the [value] pie bigger rather than fighting over a fixed pie"* (p. 13).

The genesis of a supply network is generally determined by the deconstruction of a hub firm that focuses on a subset of the value-adding functions and relies on co-ordinated relationships with other firms to provide the remainder of the value chain activities (Nassimbeni, 1998). Nassimbeni (1998) and various other scholars (e.g. Barney, 1999; Madhok and Tallman, 1998; Miotti and Sachwald, 2003; Prahalad and Hamel, 1990; Yasuda, 2005) argue that this disintegration and the related boundary decision on the appropriate governance mode for inter-firm collaboration, in particular in R&D and technology related areas, can be dictated by scope economies, i.e. the value of teaming up with partners that possess complementary resources, capabilities or core competencies (**proposition #5**). Barney (1999) argues that inhouse development and acquisition of competencies is often costly and hence the cooperative form of governance becomes an attractive alternative. Conversely, Baines *et al.* (1999) argue that a firm with a weak supplier base might be forced into the design of a technology not considered to be core. Colombo (2003) supports this general view that bringing the idiosyncrasies of firms' capabilities to the fore is important to extend our understanding of inter-firm relationship governance and boundary decisions.

Das and Teng (2000) suggest a resource based model in which the value creation potential of resources is the rationale for the formation of alliances and the resources' characteristics determine the structural preference of the alliance and thereby influence the overall alliance performance via the resource alignment of the partners. This is outlined in Figure 6.2.

Aston University

Illustration removed for copyright restrictions

**Figure 6.2: Resource based model of alliance governance (Source: Das and Teng, 2000; p. 33)**

probability that an alliance my fail even when partner firms commit themselves fully to the alliance (Das and Teng, 1999).

This study takes a similar approach by identifying the value provided by a competence as main contingency and links it to the design and management of the resulting inter-firm relationships. How this is done and to what extant literature on inter-firm relationship governance is able to explain this is part of the following sections 6.2., 6.3. and 6.4.

## 6.2. Confronting findings on *relationship design* with relevant literature

The following discussion in this section 6.2. will mainly draw on the confrontation of the issues regarding the design of inter-firm relationships (reflected by **propositions #6 to #16)** with the relevant theoretical perspectives in extant literature.

Partnership selection is probably the most important step in creating a successful alliance. Although there has been extensive research into inter-firm relationships over the past years (cf. Appendix A) relatively little empirical evidence was produced that sheds light on the nature of partnership-like relationships (Goffin *et al.*, 2006). This research revealed that the selection of partners and hence the resulting relationship is based on the underlying strategy of the OEM (i.e. the buyer), e.g. does the OEM pursue a innovation leader or follower position on the market, how crucial is the part or system to be outsourced within the overall car, is the car the relevant product is designed and made for a core model or a derivate model with a lower volume, etc. (**proposition #6**). This is partly recognised by scholars such as Kraljic (1983), Olsen and Ellram (1997b), Svensson (2004) and Tang (1999) who identify the importance and the value of the purchased item to the buyer as a main dimension the relationship or sourcing strategy is contingent upon. It conforms with the notion of strategic choice introduced by Child (1972) in the context of organisation design and is in this research work extended to the inter-organisational level of building and managing relationships between buyer (OEM) and supplier.

Major factors that influence or moderate the buyers' decisions on the relationship governance with suppliers were found to be the inherent structural complexity of the product (**proposition #7**), the phase of the product life or development cycle (**proposition #10**), and the value of the suppliers' competencies (**proposition #9**). These factors are accounted for in various scholarly contributions to a greater or lesser degree.

One of the most comprehensive concepts addressing these issues is suggested by Fine (2000) to integrate supply chain design into the concurrent processes of product and process design. He introduced the concept of three dimensional concurrent engineering (3-DCE) that extends the concept of concurrent engineering from product and manufacturing system design to the concurrent design and development of capabilities chains. Thereby, he argues for overlapping responsibilities between product (detailed design choices, e.g. functional specifications), process (systems design and layout, e.g. job shop vs. cellular production) and supply chain (sourcing and contracting decisions) development activities. Similarly, Takeishi and Fujimoto (2002) argue that modularisation links product, process and supplier system architectures and Camuffo (2001) explores the three perspectives of modularity in design, modularity in manufacturing, and modularity in organisation in an inter-firm context in the automotive industry.

*First*, modularity as a contingent factor influences and transforms relations among companies **(proposition #7)** (Baldwin and Clark, 1997). That means any product design process is mirrored by a corresponding inter-organisation design process to engage with the suppliers that have the best technical capabilities to fulfil required specifications (Hoetker, 2006). In this context Lamming *et al.* (2000) observe that the degree of product innovation, the product uniqueness and the product complexity of the supplied product have impacts on the task of managing supply, in particular on the debate concerning the various modes of commercial engagement between OEM and supplier (Doran, 2003). Mikkola and Skjott-Larsen (2003) add to this by illustrating that depending on the technological complexity of the product architecture and how it is decomposed (i.e. the division of labour of functional specification and detail engineering tasks between the firm and its suppliers), the suppliers can be involved during the planning, design, or production stages of new product development process **(proposition #7 and #10)**.

A *second* major, if not the most important, contingent factor of inter-firm R&D relationship governance, i.e. how suitable a particular supplier is for specific value creation projects, that was observed on this research is the level and value of the suppliers' technical and R&D competence profile **(proposition #9)** (Möller and Törrönen, 2003). McCutcheon and Stuart (2000) termed this the 'desirability' of the relationship, i.e. the fit of the technical capabilities of a supplier with the requirements of the OEM. Similar motives were also shown for other areas such as manufacturing technology sourcing (e.g. Baines *et al.*, 1999). Previous research has revealed that buyers actually assign suppliers different roles and varying levels of responsibility in the product development process in correlation to the suppliers' distinctive capabilities (Karlsson, 2003; Maffin and Braiden, 2001; Petroni and Panciroli, 2002).

Thereby, Henderson and Clark (1990) distinguish between component knowledge and architectural knowledge. Component knowledge involves the design and manufacture of a particular component (e.g. gas springs or dampers) for a bigger system (e.g. front module) or the final product (e.g. a car), but not the system or product itself. All the supplier needs is R&D and design knowledge about the component. On the other hand, if a supplier possesses architectural knowledge, it has the ability to integrate and coordinate knowledge, capabilities, activities, or components from other suppliers and the focal firm (**proposition #21**). Similarly, Petroni and Panciroli (2002) find that innovative capabilities are not only associated with traditional competencies in R&D and product/process innovation but also in supportive capabilities in the form of absorptive capacity, technological scanning, innovation-oriented culture, skills and know-how of individuals and managerial practices (**proposition #28**). Therefore, Möller and Törrönen (2003) suggest that a buyer should use a supplier's capability profile (e.g. production capability, relational capability, innovation capability, etc.) as an indicator. However, important aspects that are widely ignored in the current literature in this context are the attributes and features of the competencies and capabilities that determine their value for relationship governance decisions (**proposition #29**).

The *third* contingency factor for inter-firm R&D relationship governance that was identified during this research is the product development process and its stages (**proposition #10**). Previous research showed that there are distinct phases in the life cycle of a product or technology and each has a significant impact on the management of the collaborative relationship with and sourcing of partners in the way that a better collaboration can be achieved through the adaptation of the relationship governance to the innovation stage of a product or technology (Aitken *et al.*, 2003; Baines *et al.*, 1999; Weisenfeld *et al.*, 2001).

It could be argued that the product development or R&D process and its stages can be seen as a specialisation of the concept of product life cycle influence on relationships: product planning can be interpreted as introduction phase, concept design as growth phase, pre-series design as maturity phase, and series design as saturation phase. Thereby, a key factor indicating the depth of the partnering relationship between the buyer and its suppliers is at what stage the supplier selection decision is made (Bonaccorsi and Lipparini, 1994). Similarly, Petersen *et al.* (2005) as well as Petroni and Panciroli (2002) argue that the relationships (in terms of closeness and intensity) are moderated by the stage at which the supplier is brought into the product development process and the level of responsibility assumed by the supplier. Several researchers have investigated the design process, particularly in the automotive industry, and identified various interface points in the product development process at which supplier can be involved (e.g. Bonaccorsi and Lipparini, 1994; Handfield *et al.*, 1999; Karlsson, 2003; Twigg, 1998):

- At the concept stage (product planning and concept design), engineering service providers and systems suppliers contribute design expertise to styling, or suppliers of components may provide manufacturing advice within simultaneous engineering project teams.
- During the detail engineering stage (pre-series design), component and system suppliers may take responsibility for proprietary parts and modules.
- For the process engineering stage (series design), process knowledge is essential. Toolmakers, equipment manufacturers, raw material suppliers, or process specialists all have an important role to play.

Based on the moderating contingencies on the OEM decision making that were discussed above, i.e. product attributes (**proposition #7**), value of suppliers' competencies (**proposition #9**), and stages of the product development process (**proposition #10**), the relationship strategy and collaborative activities between buyer and supplier within inter-firm R&D projects vary (**proposition #8**). This indicates that the conduct and outcome of partnership-like relationships and the related collaboration activities are context dependent and not an absolute concept that will be 'fit for purpose' in all supply circumstances (Cox, 1996; Cox *et al.*, 2003; Goffin *et al.*, 2006; Lambert *et al.*, 1999; Spekman *et al.*, 1999). In this context Cox (1996) states:

> *"The proper role for the academic is not to sell fads, but to first ascertain the full range of hypothetical relationships that are theoretically possible, and then to begin the process of outlining those variables that are potentially the most significant in shaping the relative utility of particular relationships in discrete business contexts. ... It must lead to the development of a coherent body of empirically verified knowledge about which external relationships and contracts are 'fit for purpose' and under which conditions ... The skills that will be required will be those of assessing which*

> *contractual relationships - both internal and external - are most 'fit for purpose' in achieving reductions in costs and improvements in value and quality"* (pp. 65-66).

Typically, a buyer needs a variety of interfaces that affect how he accesses the resources of a supplier (Araujo *et al.*, 1999), i.e. a range of different types of relationships will be appropriate within the supplier base at any one time (Madhavan *et al.*, 1998). Similarly, Parise and Casher (2003) recommend that the supplier base should be managed as a 'portfolio' of relationships because a company will be involved with several alliance partners. Thereby, the optimal type of relationship is matched to various contingencies (**proposition #8**) and an appropriate management approach is adopted for each relationship type (**proposition #17**).

Portfolio approaches to management, such as the BCG Growth-Share Matrix, or the GE matrix, have a long standing tradition despite the critique for their general structure and their limited applicability to specific fields, such as marketing or purchasing (Olsen and Ellram, 1997b). More recently, the underlying contingency idea of portfolio models has also been applied to the field of purchasing and supply management by various scholars (e.g. Bensaou, 1999; Kraljic, 1983; Olsen and Ellram, 1997b). Portfolio approaches can be divided into three general steps to governing inter-firm relationships (Nellore and Söderquist, 2000; Svensson, 2004):

1. Analysis of relationship criteria, i.e. classifying the components into the dimension of the portfolio model (**propositions #7, #9, #10**).
2. Selection of relationship strategy, i.e. classifying suppliers based on their location along the dimensions into the portfolio matrix (**proposition #8**).
3. Managerial decision of relationship strategy, i.e. implementing strategies in order to deliver the desired outcome in optimal conditions (**proposition #17**).

A brief overview of the main portfolio approaches on inter-firm relationship governance in the extant literature is provided in Table 6.1. A similar overview can be found in Dubois and Pedersen (2002).

| Author(s) | Portfolio dimensions | Portfolio strategies | Comments |
|---|---|---|---|
| Bensaou (1999) | Buyer specific investments (high vs. low)<br>Supplier specific investments (high vs. low) | Captive buyer<br>Market exchange<br>Captive supplier<br>Strategic partnership | Builds on asset specificity and TCE thinking |
| Cox *et al*. (2003)<br>Cox (2004) | Way of working (arms-length vs. collaborative)<br>Relative share of value appropriation (equality vs. inequality) | Adversarial arms-length<br>Non-adversarial arms-length<br>Adversarial collaborative<br>Non-adversarial collaborative | Draws on the concept of power |
| Hallikas *et al*. (2002) | Future potential value of partner (high vs. low)<br>Current transactional effectiveness (high vs. low) | Low value partners<br>Potential strategic partners<br>Core partners<br>Operational partners | Partner portfolio matrix based on value and TCE thinking |
| Kaufman *et al*. (2000) | Technology (high vs. low)<br>Collaboration (high vs. low) | Commodity supplier<br>Collaboration specialist<br>Technology specialist<br>Problem-solving supplier | Strategic supplier typology explaining the differences in the composition and performance of various types of suppliers |
| Kraljic (1983) | Importance of purchasing (high vs. low)<br>Complexity of the supply market (high vs. low) | Purchasing Management<br>Materials Management<br>Sourcing Management<br>Supply Management | Framework in context of (physical) materials purchasing |
| Lamming *et al*. (2000) | Product complexity (high vs. low)<br>Product type (functional vs. innovative) | Four competitive priorities:<br>Cost<br>Quality<br>Speed<br>Flexibility | Based on Fisher's (1997) dichotomy of responsive and efficient supply chain |
| Masella and Rangone (2000) | Time horizon of relationship (long-term vs. short-term)<br>Content / strategic nature of the relationship (strategic vs. logistics goals) | Type A to D | Analytic hierarchy process framework |
| Olsen and Ellram (1997b) | Strategic importance of the purchase (high vs. low)<br>Difficulty of managing the purchase situation (high vs. low) | Non-critical<br>Bottleneck<br>Leverage<br>Strategic | Using Kraljic (1983) as point of departure |
| Ring and Van de Ven (1992) | Risk (high vs. low)<br>Reliance on trust (high vs. low) | Market<br>Hierarchy<br>Recurrent contracts<br>Relational contracts | Based on social network theory |
| Spekman *et al*. (1999) | Degree of technical complexity (high vs. low)<br>Degree of commercial complexity (high vs. low) | Purchasing Management<br>Materials Management<br>Sourcing Management<br>Supply Management | Relationship types based on Kraljic (1983) |
| Svensson (2004) | Commodity's importance to manufacturer (high vs. low)<br>Supplier's commitment to manufacturer (high vs. low) | Transactional<br>Friendly<br>Business partner<br>Family | Model for supplier segmentation in the automotive industry |
| Tang (1999) | Strategic importance of part to the buyer (high vs. low)<br>Buyer's bargaining power (high vs. low) | Vendor<br>Preferred supplier<br>Exclusive supplier<br>Partner | Supplier relationship map |
| Wnystra and Pierick (2000) | Development responsibility of supplier (high vs. low)<br>Development risk (high vs. low) | Arms-length development<br>Routine development<br>Critical development<br>Strategic development | Supplier involvement portfolio for product development projects |

**Table 6.1: Overview of portfolio models on inter-firm relationship governance in literature**

Similar to this study these contributions refer to situations in which the general make-or-buy decision has already been made in favour of outsourcing and the question is rather which sourcing or relationship strategy is appropriate to adopt given certain situational contingencies. However, despite this similarity some criticism on these models can be expressed in the context of the empirical findings of this research.

*First*, most outlined portfolio models are based on the purchasing of products whereas this research in the context of R&D collaboration observed the necessity to focus on the sourcing of competencies that create value in inter-firm product development projects (**proposition #5**). Dubois and Pedersen (2002) find that portfolio models focused on products ignore the dyadic aspect of relationships, i.e. the object of exchange might be subject to joint development. A similar point is made by Nellore and Söderquist (2000) who argue that portfolio models based on product types fail to make the link between engineering, purchasing and suppliers within the process of product development. Later in this chapter it will be argued that this link to form cross-functional project teams is crucial for the success of inter-firm R&D collaboration (**proposition #27**). Therefore, Nellore and Söderquist (2000) expanded traditional portfolio models by a (technical) specification aspect of products in the development process. They argued elsewhere (Nellore *et al.*, 1999) that product categories must be matched by suppliers that have the necessary capabilities to satisfy required product specifications which form the language at the engineering interface of the OEM and the supplier. In other words, inter-firm collaboration needs to be formed on the basis of technical competencies and mutual exchange of knowledge (**proposition #13**).

Similarly, other authors (e.g. Dyer and Hatch, 2004; Petersen *et al.*, 2003) argue that the core of successful supplier integration in R&D and product development is the transfer and application of technological knowledge and cost information because this provides the natural source of value creation in inter-firm R&D collaboration. This is identical to Grant's (1996) argument based on the individual firm, i.e. the primary role of the relationship as holistic inter-firm entity (rather than the firm as single entity) can be seen as the integration of the specialist knowledge resident in the individual partner companies. This is because collaboration is a team effort and often a task can only be achieved when the collective resources and expertise are assembled (Lang *et al.*, 2002). Hence, the primary task of relationship governance is to establish the coordination structures through which this dispersed knowledge can be integrated (**propositions #14** and **#16**). However, a communication channel alone only provides the necessary not the sufficient requirement for integrating knowledge (Becker and Zirpoli, 2003). As Cohen and Levinthal (1990) showed the capability to receive, interpret and apply knowledge through 'absorptive capacity' is equally important **(proposition #28)**.

*Second*, all shown models provide typologies based on distinct strategies and roles which, however, offer little guidance for differentiating supplier involvement and management in specific inter-firm R&D projects, especially at the early stages of the development process **(proposition #17 and #22)**. This was already recognised by Wynstra and Pierick (2000) who offer a supplier involvement portfolio that distinguishes specific development situations rather than generalised supplier roles on the basis of two dimensions: (i) the degree of responsibility for product development that is awarded to the supplier (e.g. detailed design, manufacturing, etc.; this is similar to the supplier tasks identified in this research; cf. Figures 5.8 and 5.9 in Chapter 5), and (ii) the development risk (e.g. importance, newness and complexity of the development). They further argue that since the development responsibility is related to the competencies of the supplier it affects the stage of involvement whereas the development risk indicates the stage of involvement through the time and effort required for the development of a product. Hence, a consideration of the stages of the product development or R&D process is necessary when determining the appropriate relationship strategy (**proposition #8** and **#10)**.

*Third*, most traditional portfolio models do not account for the fact that in practice a company with a certain product or competence can be involved in more than one inter-firm project at the same time thereby eventually deploying the same resources and expertise in different types of relationships **(proposition #12)**. This was already claimed by others (e.g. Bititci *et al.*, 2003 and 2004; Karlsson, 2003):

> *"An organisation may be part of more than one value system, that is, as it operates a number of business units, one of its business units may be part of one value system and another business may be part of another value system with each business unit having a different value proposition"* (Bititci *et al.*, 2003; p. 422).

A similar observation was made by Gelderman and Van Weele (2003) and later by Craniels and Gelderman (2005). They found that purchasers make a clear distinction between alternative strategies within each quadrant of the portfolio matrix. This is shown in Figure 6.3.

**Figure 6.3: Strategic directions in each quadrant of the Kraljic portfolio matrix (Source: Gelderman and Van Weele, 2003; p. 212)**

Similarly, empirical findings in this research revealed that OEMs use different relationships strategies with suppliers although all suppliers can be allocated to the same quadrant (e.g. spectrum of critical items such as complex and innovative products in one quadrant) depending on the product type. This is due to the fact that suppliers can have a differing value proposition based on their competencies (although in the same quadrant) which requires a refinement of each portfolio quadrant into a new 'matrix' (e.g. strategies for high vs. low value contribution in context of complex and innovative products).

*Fourth*, most portfolio approaches neglect the dynamic component of inter-firm relationships, i.e. moving between quadrants in adaptation to changes of the situational contingencies the relationship is dependent upon (**proposition #11**). An exception are Lamming *et al.* (2000) who acknowledge that positions in their classification matrix are not static as companies might move between the boxes (e.g. from unique to functional as products mature over time) which, however, need to be linked to the change of relationship strategy. Van de Vrande *et al.* (2006), for example, suggest that in situations with high technological and market uncertainty reversible governance strategies with low commitment should be chosen; when uncertainty has decreased, transaction costs become dominant and companies will shift towards governance modes that are more hierarchical. Gelderman and Van Weele (2003) show how the use of different relationship and sourcing strategies within one portfolio quadrant can lead to transitions across quadrants (cf. Figure 6.3). Other authors also recognise that inter-firm relationships have to adapt and evolve (as the collaborative project moves through its life cycle) whilst maintaining the core ideals on which the relationship is built (e.g. Bruner and Spekman, 1998; Kanter, 1999; Ritter and Gemünden, 2003a; Vonderembse *et al.*, 2006).

Galunic and Eisenhardt (2001) termed this kind of adaptive organisational form 'dynamic community' that "involves diverse and quasi-independent divisions whose capabilities are frequently recombined to create new productive assets within the context of changing markets and coevolving divisions" (p. 1246). Similarly, Kodama (2005) refers to it as 'strategic community', whereby members with different values contribute to a dynamic process of knowledge creation. In this context Fine (2000) suggests a 'Double Helix' that illustrates the oscillation of supply chain structures between vertical/integral and horizontal/modular in an evolutionary cycle of supply chain structures. Clegg (2003) adopts Fine's (1998) concept of industry clockspeed and applies it as a label for changeover rates in inter-firm networks in three dimensions:

- Organisational clockspeed - which is the rate of renewal of the inter-organisational structure and infrastructure.
- Technology clockspeed - which is the regularity with which new products are developed and delivered within the relationship.
- Commercial clockspeed - which is the regularity of new inter-company agreements.

Drawing on complexity theory Surana *et al.* (2005) suggest to treat inter-firm relationships as complex adaptive systems in the sense that they can undergo structural changes when they are stretched from their equilibrium state, e.g. through the adaptation of relationship boundaries when patterns of interaction between the partners change.[27] This involves balancing control (i.e. deterministically reducing dimensionality through negative feedback thereby bringing the system back into equilibrium – 'damping') and emergence (i.e. letting dimensionality increase through positive feedback thereby letting the system move far from equilibrium –

[27] Dussauge and Garrette (1998) identified five major evolutions leading to re-organisation of inter-firm relationships: (i) the alliance comes to a 'natural end' once the objectives for which it was created have been achieved; (ii) the alliance is expanded or extended; (iii) premature termination, i.e. the partner firms break up the alliance before the initial goals have been achieved; (iv) the joint project is continued by one partner alone; and (v) takeover of one partner firm by the other.

'amplifying') in the management of inter-firm supply relationships (Choi *et al.*, 2001). In other words, imposing too much control (e.g. through too a close relationship) might detract from innovation and flexibility (**proposition #18**); conversely, allowing too much emergence can undermine managerial predictability and work routines. Therefore, when managing inter-firm relationships, managers must appropriately balance how much to control and how much to let emerge between the partners in the inter-firm project (**propositions #17, #18 and #19**).

*Fifth*, current research lacks of combining supply and sourcing portfolio models with inter-organisational infrastructures that could underpin the relationship strategies in a 'structural' manner (**proposition #16**). Reviewing the existing literature on inter-firm relationship governance and collaboration these aspects almost seem to account for two parallel and not yet linked research streams. As shown in Table 3.4. in Chapter 3 various terms are used in the literature to describe the inter-organisational structure that can underpin an inter-firm relationship. However, these terms and their underlying structural conceptualisations are not used when determining relationship and sourcing strategies between partners in a portfolio model. Therefore, one of the aims of this research is to contribute to the area of strategic supply management by suggesting a link between strategies and structures that enables an effective and efficient inter-firm relationship governance. Mintzberg *et al.* (1998) identify four general forms and their basic characteristics that can be seen as representative for the terms used throughout the literature:

- *Strategic networks* are characterised by long-term alliances between independent firms with the aim of obtaining competitive advantages over outside competitors. These networks consist of an asymmetrical distribution of power as well as a long-term contractual linkage of the firm involved. Alternative terms can be considered as supply networks, collaborative enterprise or networked enterprise.
- *Compound networks* differ from strategic networks in their poly-centric character. Here, two or more quasi equal firms unite to handle a certain (usually long-term) task. The objective of this co-operation is to use synergies. Alternative terms used are extended enterprise, keiretsu or clan.
- *Operational networks* try to optimise the value creation process. They have the object of enabling the partners involved to use available resources in the network in an easy and efficient way. Lean enterprise or vertically integrated enterprise could be considered an alternative terms applied.

- *Virtual enterprises* are temporary network organisations which consist of independent firms, institutions or individuals. They are formed spontaneously to take advantage of available market opportunities. Hence, the firms involved bring their core competence to the network to obtain mutual benefit from the partnership. Alternative terms used for this structure are virtual corporation or virtual organisation.

Previous research has shown that sharing knowledge in organised innovation networks can be a source of competitive advantage through the creation of innovation and the alignment of complementary resources (Bullinger *et al.*, 2004; Dyer and Hatch, 2004). However, due to the complexity of the knowledge to be conveyed in collaborative R&D efforts these innovation networks and inter-firm relationship structures need infrastructural and organisational tools, such as inter-firm projects, to support cross-company coordination and to regulate the collaborative activities within the relationship **(proposition #16)** (Cigolini *et al.*, 2004). For example, Dyer and Hatch (2004) report on their experience of Toyota that has developed an infrastructure and a variety of interorganisational processes, namely supplier associations, consulting groups and learning teams, that facilitate the transfer of both explicit and tacit knowledge within its supplier network (keiretsu) and ultimately leads to superior competitive advantage. Similarly, Wagner and Hoegl (2006) claim that a focus on the project level is a necessary departure from supplier involvement and inter-firm collaboration on the inter-organisational relationship level stressing the criticality of supplier involvement on the project level, i.e. different inter-organisational relationship strategies need to be differentiated throughout a project and not only from one project to the next (Lakemond *et al.*, 2006). In this context Gerwin and Ferries (2004) offer options for organising product development projects by comparing their costs and benefits, e.g. transaction cost and potential for learning.

However, Liker *et al.* (1996a) in their research on the automotive industry found that often buyers' R&D staff is not competent enough in the technology provided by the suppliers and hence cannot evaluate their value proposition properly which causes problems for supplier involvement and integration in product development and R&D. This is a fact that has also been widely expressed by representatives of suppliers interviewed during this research study. Hence, a car manufacturer as some kind of leader of its supply base needs capabilities and competencies to evaluate and coordinate the interfaces between partners in inter-firm R&D projects **(proposition #14)**. Similarly, Baldwin and Clark (1997) as well as Noori and Lee (2004) claim that increasing modularisation of products requires the establishment of a lead role position that is knowledgeable in the coordination and integration of the inputs of the various partner firms.

In a variety of scholarly contributions this coordination and integration process has been recognised in various ways: Supply network management (Harland and Knight, 2001), enterprise management (Binder and Clegg, 2006a and 2007), networked R&D management (Blomqvist *et al.*, 2004), network management (Ritter and Gemünden, 2003b). Elements that can be considered common to all these management approaches to inter-firm relationships can be identified as supplier evaluation, supplier coordination and supplier development (Hines, 1994; Krause and Ellram, 1997; Mills *et al.*, 2004). Thereby, Johnsen *et al.* (2000) distinguish between the core activities of resource tying, activity linking, and actor bonding. Whereas supplier evaluation involves the grading of the suppliers' competencies for involvement, supplier coordination refers to the activities that mould suppliers into a common way of working in order to meet the buyer's supply needs, which ultimately leads to supplier development that can be defined as efforts of the buyer to improve the performance and / or competencies of the suppliers to increase mutual competitive advantage (Hines, 1994; Krause and Ellram, 1997).

The execution of these activities in inter-firm R&D relationships is a complex process and, as such, requires different skills and capabilities compared to traditional approaches (Cousins and Crone, 2003; Möller and Svahn, 2003). Ritter and Gemünden (2003b) suggest that a distinction can be made between specialist and social qualifications; whereas, specialist qualifications are necessary to handle the technical side of the collaboration, the social qualifications enable the interaction within the relationship (**proposition #28**). This competence that enables an OEM to successfully involve suppliers in its internal R&D and product development process (thereby emphasising internal and external integration; **proposition #27**) is often referred to as: network competence (Ritter, 1999; Ritter and Gemünden, 2003b), meta-core competence (Clegg, 2003), supply chain competence (Spekman *et al.*, 2002), alliance capability (Draulans *et al.*, 2003), or interface competence (General Manager Central Quality Assurance, OEM), all of which can be based on Liedtka's (1999) original idea of 'meta-capabilities': a competence that affects the ability to coordinate. In this context authors (e.g. Dyer *et al.*, 2001; Kale *et al.*, 2002) suggest that the creation of a dedicated alliance function, probably in form of a cross-functional buyer team with the intent to strategically coordinate internal and external integration activities from a multi-disciplinary perspective, might facilitate the building of this inter-firm relationship competence.

However, OEMs must rethink the value of external connections, i.e. they must assess the trade-offs between improving internal skills and accessing superior external capabilities through collaboration with partners that can offer the same competencies to competitors (**proposition #15**). In other words, the challenge (particularly in technical relationships such as R&D) is to maintain open knowledge exchange by securing, preserving and leveraging the unique competencies of the partners but also control a sufficient level of technological knowledge to avoid complete dependency on the partners through know how leakage and to outperform competitors (Noori and Lee, 2004; Oxley and Sampson, 2004; Takeishi, 2001). In this context Takeishi (2001) suggests to keep integrative capabilities, i.e. architectural knowledge as explained above (Henderson and Clark, 1990), inhouse when determining boundary decisions since they are a critical source of competitive advantage through their influence on network positioning (resource dependency theory). This is confirmed by empirical findings form this research:

> *"In order to be able to evaluate and manage the interfaces of car components and modules and their related suppliers properly, you need to do it yourself from time to time. ... It is common for the OEM to develop cars in certain segments itself which then serves as a reference for developing ones own competencies because even if we outsource more responsibilities to the suppliers, we need to make sure to keep the necessary know how for the overall car"* (General Manager Design Doors, OEM).*

Karlsson (2003) refers to this as 'feature engineering' which concerns the development of the total product concept and its functions and characteristics which will typically be sources internally as opposed to 'specialised engineering' of part, components or modules that will typically be outsourced externally. This leads to a further division of labour between the OEM and the suppliers where the suppliers take care of the technical specialisation while development and integration of product functions stays the responsibility of the OEM (Fusco and Spring, 2003; Karlsson, 2003). This relates to the fact of the OEM being the 'architect' of the car (**proposition #6** and **#20**). Thereby, the OEMs do not need to fear a hollowing out (Becker and Zirpoli, 2003) of know how to suppliers if they possess a strong competence as car integrator and apply modern supply chain management (Caputo and Zirpoli, 2002). And Oxley and Sampson (2004) add that this can be facilitated by the choice of an appropriate governance structure and its adequate management (**proposition #8** and **#17**).

## 6.3. Confronting findings on *relationship management* with relevant literature

The aspects discussed in section 6.2. on relationship design have direct implications for the discussion of the related relationship management issues in this section 6.3. which has partly been shown by briefly referring to some issues regarding inter-firm relationship management (reflected by **propositions #17 to #27**) that will be fully discussed in the following section.

Similar to the view of Fusco and Spring (2003) and Karlsson (2003), Baldwin and Clark (1997) consider OEMs to be architects that create design rules for modular products and suppliers to be designer of modules that conform to the architecture. Although this would assume that the OEM has the overall responsibility for the management of the supply base involved in a certain inter-firm R&D project, the results of this research reveal that this is not always the case and the management of sub-suppliers can be delegated to first tier system suppliers or prime contractors (**proposition #20**). This would account for a shift of the OEM from its module 'integrator role' (where the OEM retains module control) to a somewhat 'modulariser role' (where the OEM delegates module responsibility to a first tier supplier that manages the sub-supplier network) (Sako and Murray, 1999 quoted in Doran, 2003). In order to yield desired outcomes in such a situation Johnsen and Ford (2005) call for supply network leadership rather than supply chain control. Or as Lao Tzu put it:

> *"To lead, one must follow"* (quoted in Bruner and Spekman, 1998; p. 147).

A more abstract discussion acknowledges this phenomenon as the shift from a *tertius gaudens* role of the OEM towards a *tertius iungens* (Obstfeld, 2005) or *primus inter pares* (Binder and Clegg, 2005b) orientation. *Tertius gaudens* describes the role of a broker (e.g. OEM) who gains advantage through playing off parties against one another for his own benefits; correspondingly, the *tertius iungens* or *primus inter pares* orientation is a strategic behaviour that aims at introducing disconnected partners in a relationship through bridging structural holes (i.e. missing connections between partners; Burt, 1992) or facilitating new coordination between already connected partners by adopting a lead position but without adversarial tension and competing claims (Obstfeld, 2005). Put simple that mean that OEMs orchestrate relationship activities to ensure the creation and extraction of knowledge without applying hierarchical authority (Dhanaraj and Parkhe, 2006).

However, both Takeishi (2001) and Karlsson (2003) similarly argue that sourcing whole sub-modules and systems (which is related to the delegation of responsibility to the supplier) can also become a risk to the OEM because through this increase in performance responsibility suppliers can develop into so called 'mega-suppliers' that can eventually be bigger and more profitable than the OEMs themselves. This is due to the fact that integrating parts and components of various smaller lower tier suppliers increases the power position of the first tier supplier who becomes a more central and significant member within an automotive network and its inter-firm R&D projects (**proposition #21**). This was already assumed by Boje and Whetten (1981) who suggested that "network centrality is beneficial because it increases an actor's ability to influence resource transactions between network members" (p. 392). This makes the execution of a *tertius gaudens* behaviour more difficult for the OEM and requires a differentiated approach to the management of the supply base, thereby finding the right balance between emergence and control (**proposition #17**). The suppliers, on the other hand, face the strategic dilemma that moving towards the supply of full systems or modules not only enables better access to resources through a superior network position, access to structural holes, and more cognisance of activities across the whole supply base, but also increases the dependency on complementary technologies and competencies of lower tiered part and component suppliers (Choi *et al.*, 2001; Johnsen and Ford, 2005, Zaheer and Bell, 2005).

As mentioned above, managing inter-firm relationships requires to apply the right balance between emergence and control. Therefore, different relationship and sourcing strategies towards inter-firm collaboration between OEM and suppliers require the adoption of different types of management styles (roles) and managerial activities (tasks) (**proposition #17**). This notion is supported by previous research that recognises that inter-firm relationships are organised around structured role systems that vary in their degree of pro-activity appropriate to a given context leading to a balanced approach (e.g. Das *et al.*, 2006; Harland and Knight, 2001; Snow *et al.*, 1992). Snow *et al.* (1992) were amongst the first to sketch broker roles (dependent on the life cycle of the network) that significantly contribute to the success of business networks:

- *Architect:* facilitates the building of specific networks.
- *Lead operator:* formally connects specific firms together into an ongoing network.
- *Caretaker:* focuses on activities that enhance network performance.

Based on these generic roles, Harland and Knight (2001) in their research on the UK health sector developed a set of six 'supply network management roles', thereby rejecting Snow *et al's.* (1992) assertion that network life cycle is the key variable in determining which role should be performed and arguing for a complex set of factors:

- *Network structuring agent*: Monitoring and influencing the competitiveness of supply markets.
- *Co-ordinator*: Acting as co-ordinator for one-off requirements and ongoing requirement.
- *Advisor*: Providing advice on supply policy and strategy matters.
- *Information broker*: Collating, analysing and disseminating information to various parties.
- *Relationship broker*: Facilitate communication between and within groups of network members.
- *Innovation sponsor*: Promoting and facilitating product and process innovation.

The research conducted in this study identified similar roles but focused on the context of relationship management in joint R&D and product development. Depending on the roles different activities within inter-firm R&D projects are executed by the OEM (cf. Figures 5.8 and 5.9 and Appendix J):

- *Incubator*: Scouting for potential partners; initiating collaborative activities and facilitating innovation creation through specification translation and design (similar to *architect, innovation sponsor*).
- *Integrator*: Coordinating collaborative activities and intermediating between partners; facilitating and enabling partners in competence development (similar to *lead operator, co-ordinator, relationship broker*).
- *Incumbent*: Developing of internal proprietary systems for development and manufacturing; relying on power and authority to make decisions (not mentioned by Snow *et al.* (1992) and Harland and Knight (2001); approximates *tertius gaudens* position).

Similarly, Johnsen *et al.* (2000) offer a set of networking activities which relate to the core activities of relationship management identified (i.e. resource tying, activity linking, and actor bonding): partner selection, resource integration, knowledge capture, social co-ordination, risk and benefit sharing, decision making, and conflict resolution.

Research has shown that firms are better able to manage their inter-firm relationship networks effectively when those relationships are stable and close (e.g. Snow *et al.*, 1992). In addition, Lai *et al.* (2005) reveal that a stable relationship is positively linked to the suppliers' commitment and efforts to quality for the buyer firm. This commitment could allow the supplier to simultaneously delay substitution and control the threat of imitation to its proprietary assets (e.g. competencies) through the influence on the buyer and the building of relational capital (Kale *et al.*, 2000; McEvily *et al.*, 2000) because the loss of knowledge is seen as a major risk to any firm in a long-term relationship caused by a more intense sharing of proprietary information between the partners (Parry *et al.*, 2006). Hence, Blankenburg Holm *et al.* (1999) establish a causality between network connection through mutual commitment to value creation. Despite these positive notions, there seems to be an even bigger body of scholarly contributions stressing the conflictive position of the 'dark side' of stable and close relationships. These authors (e.g. Anderson and Jap, 2005; Bruner and Spekman, 1998; Dyer *et al.*, 1998; Handfield *et al.*, 1999; Inkpen and Ross, 2001) argue that close relationships are costly to set up and maintain and therefore may reduce a buyer's ability and willingness to switch away from inefficient and incompetent suppliers through the path dependency they create. This path dependency and overembeddedness (sometimes referred to as organisational inertia; Li and Rowley, 2002) could also inhibit a fresh knowledge flow into the relationship, i.e. intense ties can lead to a lock-in into the partner's technology and hence a reduced flexibility to take advantage of technologies and competencies outside the relationship.

Therefore, it is suggested that breakthrough innovations require new the involvement of new suppliers with new knowledge not available in a firm's existing supply base (Primo and Amundson, 2002). Murmann (2003) draws on the concept of 'creative chaos' in the sense that the chances for the generation of new knowledge are higher the more partners are involved in an open, flexible, loose and unstructured way. This has been shown by Dyer and Nobeoka (2000) in the case of Toyota's knowledge sharing network. This means that in sparse relationship structures rich in structural holes the opportunity and likelihood for generating new ideas increases with the available diversity of competencies (Obstfeld, 2005).

However, the validation exercise in this research clearly showed that respondents in the automotive industry disagree with the fact that stable and closely integrated relationships lead to a loss of creativity and innovativeness (**proposition #18**) but also agree with the suggestion that new relationships produce innovative solutions (**proposition #19**). Although this might look like a contradiction at first glance it is not but rather stresses the necessity for a portfolio of balanced relationship strategies within a network of inter-firm relationships (**propositions #8** and **#17**). This is supported by Beckman *et al.* (2004), based on March (1991), who take the middle ground by reconciling the tension between change (**proposition #19**) and stability (**proposition #18**) in relationships by proposing that firms form new relationships with new partners as a form of exploration (expanding their knowledge), and form additional or intensify existing relationships with current partners as a form of exploitation (utilise existing knowledge more effectively).

Hence, this research (remaining in its collaborative and partnership orientated domain) shows strong support for an intense integration of strategic partners early in the inter-firm R&D and development projects to facilitate the successful delivery of these projects in terms of quality, development time, and cost (**proposition #22** and **#32**). It is similarly acknowledged in extant theory that early supplier involvement in product development projects has become an increasingly popular method for improving project effectiveness and efficiency, i.e. reduced development cost and lead time, improved product quality, easier and earlier access to innovative technologies, and reduced opportunistic behaviour of the suppliers (Fynes *et al.*, 2005; Handfield *et al.*, 1999; Petersen *et al.*, 2005; Primo and Amundson, 2002; Provan, 1993; Wynstra and Pierick, 2000).[28] A study by Johansson *et al.* (2000) even revealed that involving original equipment manufacturer suppliers and tool manufacturers from an early stage of product development can reduce lead times up to 50%. In a similar vein Noori and Lee (2004), for example, suggest to involve suppliers at the ideation and concept stage of product development in order to capture valuable industrialisation input which could reduce quality problems during the manufacturing stage. Mikkola and Skjott-Larsen (2003) summarise these points in a concise table depicting the advantages and disadvantages of early supplier involvement. This is shown in Table 6.2.

[28] Primo and Amundson (2002) provide a good overview of existing research studies on supplier involvement.

**Table 6.2: Advantages and disadvantages of early supplier involvement in product development (Source: Mikkola and Skjott-Larsen, 2003; p. 33)**

Dyer (1996b) subsumes this discussion under the banner of 'presourcing':

> *"Presourcing means choosing suppliers early in the vehicle's concept-development stage and giving them significant, if not total, responsibility for designing a given component or system"* (p. 51).

However, because a coin always has two sides, there are also barriers to 'presourcing'. McIvor and Humphreys (2004) provide an extensive list of aspects that potentially inhibit early supplier involvement which, however, are not discussed here. Nevertheless, one factor mentioned by them is the conflict between members of the integrated product development team (e.g. design attempts to make the supplier selection thereby limiting the influence of the supply management function) leading to their suggestion to establish a culture that breaks down the internal barriers that exist within functional organisations. This was identified in this study as one of the most crucial barriers to inter-firm collaboration in form of functional and short-term thinking within a partner organisation that produces sub-optimisations for the inter-firm project and relationship (**proposition #26**). Other comments made on this issue are that the majority of firms are still functionally organised and people are managed in functional silos (Bititci *et al.*, 2003), that firms should focus on the activities they undertake rather than the department that is responsible leading to a process enterprise (Silvestro and Westley, 2002), or that engineering departments are typically organised by components which is not conducive to the design of systems which requires multiple component groups closely working together (Henke, 2000).

Similarly to McIvor and Humphreys (2004) this led to the proposal that autonomous cross-functional teams within a partner firm can facilitate inter-firm R&D collaboration and contribute to the success of inter-firm projects (**proposition #27**). This establishes a clear link between internal and external cooperation, a relationship that is currently underrepresented in the literature (especially in the context of R&D and product development) despite a large number of publications on both aspects.[29] Notable exceptions to this are Caputo and Zirpoli (2001), Dyer (1996b), Koufteros *et al.* (2005) and Takeishi (2001).

Koufteros *et al.* (2005) argue that the link between internal and external cooperation is relevant as there is a co-existence of internal and external integration in the context of product development in many firms. Takeishi (2001) elaborates that the car manufacturer's integrated problem-solving process with the supplier is related to effective internal coordination, e.g. between engineering and purchasing functions (cf. Wynstra *et al.*, 2001), implying that effective external coordination requires effective internal coordination. In this context, Dyer (1996b) reports on the efforts of Chrysler to re-organise into cross-functional vehicle development teams to present one face to suppliers thereby improving continuity, coordination, and trust within Chrysler but also between Chrysler and its suppliers; whereas Caputo and Zirpoli (2001) give an example of Fiat that adapted its organisational structure for modular product development into divisions for platform development (internal technical and technological divisions), and component development platforms through which the suppliers can be involved in product development at earlier stages in a systematic way. They claim that this enables Fiat to plan, develop and industrialise innovative solutions together with its suppliers more effectively and efficiently.

In a more general view, Miles and Snow (1986) already anticipated that key business units, such as design engineering or prototype production, will be autonomous building blocks to be assembled, reassembled, and redeployed within and across company boundaries. This insight has more recently been extended by modularity research (Baldwin and Clark, 1997) that has pointed out that internal organisation of a firm needs to reflect the modular structure of its products and processes (**proposition #7**) and allow for the creation of separable modules that can improve their own performance independently, without putting excessive strains on the system. Similarly, Martinez and Bititci (2001) identified that value propositions arise at the business unit level as each business unit within an individual company may have a different value proposition. Then:

[29] A good overview of the literature on internal and external integration can for example be found in Hillebrand and Biemans (2003).

> *"Extended/virtual enterprises emerge as a result of collaboration between business units of companies, rather than whole companies"* (Bititci *et al.*, 2004; p. 259).

Similarly, Anderson *et al.* (1994) propose a focal dyadic relationship between supplier business units and customer business units. These autonomous units are sometimes also referred to in the (mainly manufacturing related) literature as competence cells (Neubert *et al.*, 2004), competence units (Berlak and Weber, 2004), or fractals, i.e. multifunctional units that are capable of producing a wide variety of competencies, products or services, (Saad and Lassila, 2004), which implies the composition of a set of relevant skills to participate within an inter-firm relationship (**proposition #28**). However, a study by Booz Allen Hamilton showed that companies in the German automotive industry have to improve their internal organisation to become more 'healthy' and capable for external integration: 57% of companies are considered to be too complex, un-coordinated and passive, 34% are considered to be flexible and lean, and 9% are unclear (Schaudwet, 2004).

Other means to overcome a general prevention to early and intense supplier involvement in inter-firm R&D projects and to facilitate successful collaboration were identified as the essence to focus on technical rather than commercial issues when determining supplier involvement and integration (**proposition #23**), strategic and long-term thinking for the whole inter-firm project and relationship (**proposition #24**), and a clear definition of distinct responsibilities of the involved partners (**proposition #25**).

Particularly the fact that at the early stages of collaboration technical rather than commercial issues need to be at the forefront (**proposition #23**) seems to be a rather ignored aspect in the literature, although it is considered as quite important among practitioners, especially in the context of inter-firm R&D collaboration. Kanter (1994) merely comments that decision makers devote more time to screening business partners in financial terms than to managing the partnership in human terms thereby drawing on the importance of social issues. Similarly, Carter (2005) draws on the concept of 'Purchasing Social Responsibility (PSR)' and shows that it leads to improved supplier performance and ultimately reduced costs. However, he does not explain the exact elements of (PSR) but refers to his earlier work (Carter and Jennings, 2004) that identifies some of the key drivers and facilitators of the concept including a people orientated organisational structure, top management leadership, and employee initiatives. Emden *et al.* (2006) find that technological alignment of the partners triggers the partner evaluation process at the early stages of collaboration, which is then followed by strategic and relational alignment phases. Only Rich and Hines (1997) become a bit more specific by recognising the limitations of a price orientated approach towards collaboration and instead focuses on the quality, total acquisition cost, and delivery of products (which can as far as possible be interpreted as technical competence features; cf. Appendix J) to ensure operational efficiency. Similarly, Chen and Chen (2006) argue that quality is the fundamental factor for supplier evaluation among various criteria because the quality of the parts obtained from the suppliers determines the quality of the end product.

More widely discussed is the aspect of strategic and long-term thinking for the whole inter-firm project that increases the chances of successful collaboration and supplier integration (**proposition #24**). This has been discussed in Chapter 3 (section 3.3.5.) as total system optimisation which relates to the statement of Nalebuff and Brandenburger (1997) above that partnerships only work when both parties try to expand the pie (also see Dyer, 1996b). Similarly, drawing on Fine (1998), Boardman and Clegg (2001) argue that strategy must reach beyond the boundary of a company in that inter-firm relationships as complex systems are the work of various heterogeneous and autonomous elements whose common interest is based on the effective operation of the whole of which these elements are parts. Similarly, Baines *et al.* (2005) state that previous work has mainly focused on individual boundary decisions in the context of strategic positioning. Bititci *et al.* (2004) add more specifically:

> *"An extended enterprise is a chain of enterprises, which essentially behave as a single enterprise trying to maximise the corporate goals of the extended enterprise, thus optimising the performance of each individual enterprise"* (p. 258).

Hence, a formulation of strategic value not only from the myopic point of view of individual resources and capabilities but also taking into account the collective and shared resources and capabilities between the partners does provide support for their inter-firm collaboration (Afuah, 2000; Wong *et al.*, 2005) but also leads to better performance of the individual partners (**proposition #33**). Miles and Snow (1986) already stated that viewing the network as a whole, each firm's distinctive competence will be enhanced (**proposition #30**). However, this can only be the case if a long-term commitment is established that facilitates a greater level of integration and knowledge exchange, and increases the encouragement to invest in dedicated relationship specific assets which ultimately creates relational rents for the partners (Dyer, 1996a and 1996b; Dyer and Singh, 1998; Krause and Ellram, 1997; Szwejczewski *et al.*, 2005; Zeng and Chen, 2003). Various authors argue that an emphasis on strategic purchasing and related supply management practices of the buyer firm is crucial which will lead to higher supplier responsiveness and thereby facilitate closer working relationships (e.g. Carr and Smeltzer, 1999; Chen *et al.*, 2004; Li *et al.*, 2006).

An even more important aspect for successful inter-firm projects (as rated by the questionnaire respondents) is the clear definition of distinct responsibilities of the involved partners (**proposition #25**). Similarly, Wu and Sun (2002) state that for inter-firm collaboration to be successful, the role and the activities of each potential partner needs to be appropriately determined in advance. Garel and Midler (2001) add that in order to realise frontloading problem solving in product development, a strategy to reduce development cost and lead time, the responsibilities between the car manufacturer and the supplier need to be defined based on their specific expertise. They are, however, aware of the fact that a clear division of responsibilities and skills is difficult to achieve which often leads to confusion and conflicts about who is responsible for what activities in the R&D process. Hence, Kelly *et al.* (2002) are very clear that:

> *"An understanding of partner roles and a definition of responsibilities is the foundation of manageable alliances. Typically partners will have some initial ideas about these assignments prior to launching the operation"* (p. 17).

## 6.4. Confronting findings on *relationship contingency* with relevant literature

In the above discussion on industrial impact (section 6.1.), relationship design (section 6.2.), and relationship management (section 6.3.), the aspect of competence recurred as underlying feature of inter-firm relationship governance. Hence, competencies and the focus on these were recognised during this empirical research to be the most crucial contingency aspect that facilitates inter-firm collaboration through internal and external integration (**proposition #28**), that determines the relationship strategy and structure between the partners and their related roles and activities through a distinct value proposition (**proposition #29**), and that contributes to the success of the inter-firm project and the individual partners through its development and deployment (**proposition #30**).

This research revealed that the efficacy of internal and external integration in inter-firm relationships depends on the autonomous and cross-functional unit's value proposition to potential inter-firm R&D project which is determined by the unit's unique competencies (i.e. task relevant capabilities and skills in R&D and product development) and interface capabilities (i.e. capabilities that help to deploy the unique competencies in the project) **(proposition #28)**. Overall, this is not a new insight but confirms current wisdom in the specific case of inter-firm R&D collaboration in the automotive industry. For example, Araujo *et al.* (2003) have already developed the argument that the boundaries of the firm are determined by the capabilities necessary to undertake productive activities (direct or core capabilities) as well as by the capabilities the firm requires to interact with its customers, suppliers and other external actors (indirect or ancillary capabilities). Similarly, Croom (2001) in a study of collaboration in the UK automotive industry found that operational and relational competencies are critical factors in the performance of inter-firm product development. He refers to operational competencies as capabilities obtaining to design, manufacture and delivery, whereas relational competencies are those obtaining to communication, interaction, problem solving, and relationship development.

This stream of argumentation can probably be traced back to the contention of Teece (1987) that competitive advantage is gained through the development of distinctive capabilities supported by complementary assets which, then again, might find its foundation in Selznick's (1957) 'distinctive competencies' on the business unit level. Based on this Mills *et al.* (2003) develop a competence architecture that distinguished between high-level competencies that customers/buyers recognise, e.g. fast product delivery, and competencies that support high-level competencies but are less visible to customers/buyers, e.g. rapid knowledge acquisition and deployment. This concurs with an earlier interpretation of Cox (1996) that the more a competence contributes to the maintenance or creation of distinct value, the more it should be regarded as of high asset specificity; on the other hand, medium or lower asset specificity refers to complementary competencies that are significant to sustainability of a firm's activities within inter-firm relationships.

However, an important discussion in the context of inter-firm relationships and their related projects is the recognition and demonstration by various authors (e.g. Chang, 2003; Croom, 2001; Gulati, 1999; Lorenzoni and Lipparini, 1999) that an increased emphasis on relational competencies/capabilities is a significant catalyst for improving collaborative product development performance through more effective knowledge access and transfer between the partner. Over time, the development of relational capabilities will enable to lower the cost of know how exchange, to optimise the choice of governance structures and strategies, and to internalise specialised knowledge across the inter-firm network (Lorenzoni and Lipparini, 1999). In the author's view this is due to the fact that the relational capabilities/competencies determine the degree of 'absorptive capacity' of the partner within a relationship. As mentioned above, absorptive capacity refers to the ability to recognise, incorporate, and apply knowledge (Cohen and Levinthal, 1990). However, in the context of inter-firm relationships Lane and Lubatkin (1998) reconceptualised the firm-level construct as a dyad-level construct 'relative absorptive capacity' and argued that a firm's ability to learn from another firm in a relationship depends on the similarity of the partners' knowledge base and organisational structure (also see Mowery *et al.*, 1996). Similar insights were gained during this research as such that elements of interface capability include technical and organisational interfaces (cf. Appendix J on the category *Relationship Interfaces*).

As mentioned above, value propositions for inter-firm projects are created at the business unit level of the relationship partners (Martinez and Bititci, 2001). In this context, Baldwin and Clark (2006a) use the notion of 'encapsulation' to show that all activities associated with specific aspects of an inter-firm project the company is involved in are conducted within one organisational unit that possesses all relevant skills to ensure its autonomy, even if it needs to embody multiple skill sets, disciplines or activities. In the following a comparison between the relevant skill set for inter-firm (R&D) collaboration that exists in the extant literature (e.g. Caputo and Zirpoli, 2002; Goffin *et al.*, 2006) and the skill set identified in this research is provided including elements of highly asset specific unique competencies (task relevant capabilities) and lower asset specific complementary capabilities (relational interface capabilities). Without assertion to completeness this comparison (using the terminology of this research; cf. Appendix J) is shown in Figure 6.4.

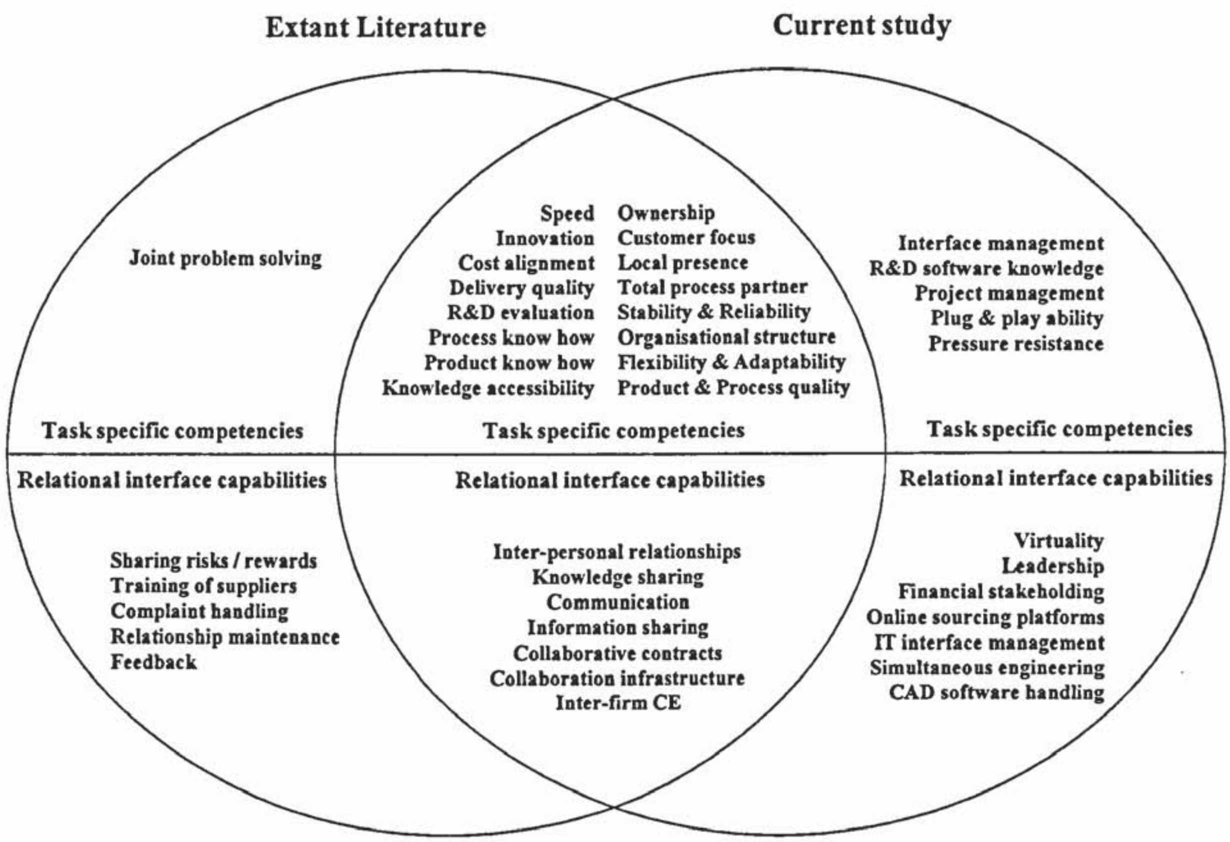


**Figure 6.4: Venn diagram of capabilities necessary for inter-firm (R&D) collaboration**

The task specific competencies identified in this study were grouped into three superior categories during the coding: technical competence features, efficiency competence features, and social competence features (cf. Appendix J). Similarly, Ahuja (2000) identified three forms of accumulated resource capital (technical, commercial, and social) that can affect a firm's inducements and opportunities to engage in collaboration.

In this context, it is proposed by the author that the more mature, attractive and transferable these unique task specific competencies are, the higher the value proposition they create for an inter-firm project in a buyer-supplier relationship (**proposition #29**). A value proposition can be referred to as the offer of a supplier to provide a certain value to the buyer which is a function of carefully shaped competencies (Bititci *et al.*, 2004). Thereby, value can be defined as the "net rent earning capacity of an asset or resource, tangible or intangible" (Madhok and Tallman, 1998; p. 328) that is (based on empirical observations in this research) determined by its maturity, attractiveness, and transferability. Drawing on Madhok and Tallman (1998) this can be seen as a more inclusive and integrative perspective that provides more robust insights into the value creation in inter-firm relationships based on a combination of elements from TCE and RBV. Whereas, for example, RBV recognises transferability (imperfect mobility) of a resource or competence as a critical determinant of its capacity to confer value, TCE draws on the risk and suitability of competence deployment (asset specificity and frequency) and the uncertainty of the competence value to determine its attractiveness. Similarly, Cox (1996) suggests to redefine the concept of asset specificity in terms of 'fitness for purpose' of competencies and transactions in achieving a sustainable position within inter-firm relationships. Madhok and Tallman (1998) extend this to the notion of 'relational specificity' by acknowledging that inter-firm relationships are not only a governance structure but, more importantly, a productive resource for value creation and realisation.

This conforms with findings from this research that inter-firm relationships are a vehicle for developing new and deploying existing competencies through collaboration in inter-firm projects (**proposition #30**). This is rooted in the knowledge based literature that proposes two distinct dimensions of knowledge management: *first*, activities that increase and further develop a firm's knowledge – what March (1991) refers to as 'exploration' of new possibilities and Hamel (1991) terms 'value creation'; *second*, activities that deploy and apply a firm's knowledge – what March (1991) refers to as 'exploitation' of existing certainties and Hamel (1991) terms 'value appropriation'. A firm's activities related to exploration include such aspects as search, risk taking, experimentation, discovery, radical change, creativity, and innovation; those related to exploitation include such aspects as refinement, standardization, rigidity, selection, choice, efficiency, incremental change, implementation, execution, and improvement (March, 1991). In relation to inter-firm relationships Podolny and Page (1998) and later Grant and Baden-Fuller (2004) distinguish between the ways in which knowledge is shared: *first*, the relationship acts as a conduit for accessing partner's knowledge to exploit complementarities but with the intention of maintaining its distinctive base of unique knowledge (**proposition #15**); *second*, the relationship acts as a vehicle of learning and becomes the locus of novel knowledge creation through transferring and absorbing the partner's knowledge.[30] As Kodama (2005) put it:

> *"The act of transcending boundaries stimulates deep, meaningful learning, which in turn opens possibilities for the generation of new knowledge and creativity"* (p. 39).

Thereby, new knowledge can be generated within both capability dimensions of an autonomous cross-functional unit, i.e. task specific unique capabilities and relationship

[30] In this context Inkpen and Tsang (2005) outline conditions facilitating knowledge transfer in network type structures (p. 155).

specific interface capabilities, that collaborates with other units in an inter-firm R&D project. For example, inter-firm relationships play a significant role in the development of new products and in the fine-tuning and improvement of the related core or distinctive competencies (task specific capabilities) of the partnered organisations through their interactions (Croom, 2001; Lorenzoni and Lipparini, 1999). Anderson *et al.* (1994) even go as far as making a critical claim for the development of a dyadic capabilities view in that resources possessed by a firm could be considered to be inert and valueless until activated by interaction with partners in a relationship. And Kogut (2000) adds in the same vein that networks as outcome of generative rules of coordination constitute capabilities that generate rents which are subject to private appropriation (value for the individual firm).

On the other hand, an outcome for firms resulting from their membership in relationships is that they can develop managerial capabilities associated with forming new relationships (interface capabilities), thereby improving their absorptive capacity (Gulati, 1999). A problem related to this is the situation that one partner could accumulate knowledge from the relationship to a lesser degree than another one due to a lower absorptive capacity (Quintara-Garcia and Benavides-Velasco, 2004). Hence, Hamel (1991) conceives a relationship as a 'collaborative membrane' where the extent and direction of its permeability determines the relative learning in a relationship, whereby Khanna (1998) distinguishes between 'private benefits' that only accrue to a subset of partners and 'common benefits' that accrue collectively to all partners. In this context Møller *et al.* (2003) identify four types of inter-organisational competence development:

- *Purchased competence* refers to the situation in which both the supplier's and the buyer's knowledge contribution to the relationship is minimal.
- *Transferred competence* refers to situations in which the buyer transfers expertise to complement the supplier's knowledge.
- *Supplied competence* refers to situations in which the supplier transfers expertise to the buyer to provide insight into a particular technology.
- *Cross competence* refers to situations in which both buyer and supplier equally contribute complementary knowledge to the relationship to realise synergy effects.

## 6.5. Confronting findings on *relationship success* with relevant literature

The following discussion in this section 6.5. will mainly draw on the confrontation of the issues regarding the success of inter-firm relationships (reflected by **propositions #31 to #35**) with the relevant theoretical perspectives in extant literature.

One of the main aims of this research was to achieve and / or maintain sustainable success for the whole relationship and its individual partners through an appropriate governance, i.e. design and management, of these relationships and the various inter-firm projects within them. Empirical results of this study show that the selection and management of an appropriate supply base for inter-firm projects (**proposition #31**) based on collaborative practices and partnership can lead to sustainable competitive success for the partnership and its members (**propositions #32 and #33**) which in the short-term is related to reductions in cost and development time (**proposition #34**) and in the long-term to improvements in quality and innovation (**proposition #35**).

Similarly, Masella and Rangone (2000) argue that supplier selection and management is one of the most crucial tasks of the purchasing manager in inter-firm collaboration (**proposition #31**). Then, the integration of the individual partners' complementary value propositions (based on their competencies) creates a unique competency and value proposition for the whole partnership entity (Bititci *et al.*, 2004). Ritter and Gemünden (2003a) argue that this value creation is determined by how well the very different competencies of the partners are merged together. Christopher (1992) proposes in this context that "the greater the collaboration, at all levels, between supplier and customer, the greater the likelihood that an advantage can be gained" (quoted in Rich and Hines, 1997; p. 214). Other authors (e.g. Cousins and Spekman, 2003; Dyer and Singh, 1998; Geffen and Rothenberg, 2000; Kalwani and Narayandas, 1995; Lorenzoni and Lipparini, 1999; Monczka *et al.*, 1998; Walter *et al.*, 2001) specify this point in that long-term relationships based on trust, commitment, and cooperation deliver sustainable competitive benefits for both the buyer and the supplier (relational rents) because the relational safeguards are resistant to easy imitation by competition based on the socially complex and idiosyncratic nature of the relationship (**proposition #32**). Kanter (1994 and 1999) uses the term 'collaborative advantage' to describe this phenomenon and Dyer and Singh (1998) as well as Liker and Choi (2004) use Toyota and its keiretsu as an example in which buyer and suppliers prosper together. Another example is given by Romano and Vinelli (2001) who report on the Italian textile and apparel company Marzotto showing that the whole supply network could improve its quality through the joint definition and co-management of quality practices.

This, however, involves the clarification of two important questions: (i) what is a sustainable competitive success and (ii) how do you know that you realised it? Whereas the first issue refers to the definition of the concept of sustainable competitive success, the second aspect relates to its measurement.

Coyne (1986) argues that a competitive advantage is a function of the positive difference in important product/service attributes (as perceived by the customer) based on an underlying capability gap between a firm (or holistic inter-firm partnership) and its competitors. The advantage is sustainable if existing and potential competitors cannot imitate the firm's (or relationship's) superior product/service attributes, i.e. cannot close the capability gap, in the foreseeable future. However, since time eventually renders nearly all advantage obsolete, the firm (or inter-firm relationship) need to link its unique resources to different strategies over time (**proposition #11**) (Williams, 1992). In the context of (inter-firm) R&D and product development it can be argued that the product attributes (e.g. quality or price of a car) are determined by the R&D and product development process. Hence, the measurement of this process is gaining increased importance because its performance and quality determines the competitive success of the inter-firm relationship and its partners (also cf. Chapters 1 and 2).

This is supported by the empirical evidence obtained in this research which shows that inter-firm R&D collaboration is an effective means to improve product quality and innovation and reduce development time and cost, ultimately providing competitive advantage (**proposition #33**).[31] This is widely accepted in the literature and has been proven in many studies and contributions across various industries (e.g. Caputo and Zirpoli, 2001; Cusumano and Takeishi, 1991; Dyer, 1996a and 1996b; Fynes *et al.*, 2005; Martinez Sanchez and Perez Perez, 2003; Primo and Amundson, 2002; Ragatz *et al.*, 2002; Yasuda, 2005). However, this research also revealed that in the context of these benefits two success dimensions have to be distinguished, namely aspects related to short-term success versus aspects related to long-term success (**propositions #34 and #35**). This distinction was considered to be an important

[31] Other benefits were also identified during this research (cf. coded category *Collaboration Outcomes* in Appendix J) but were not considered as crucial (partly determined by the frequency count of the related codes). Also see Table 6.3.

determinant of the quality of the relationship (e.g. long-term success factors were assumed to reveal more likely within 'real' partnerships) but seems not to be widely expressed in extant literature. Two exceptions that were found are Goffin *et al.* (2006) and Van der Valk and Wynstra (2005). A short comparison is provided in Table 6.3.

| Success dimension | Goffin *et al.* (2006) | Van der Valk and Wynstra (2005) | This research |
|---|---|---|---|
| Short-term | •Quality improvement<br>•Delivery performance<br>•Cost reduction | •Product quality<br>•Product cost<br>•Product development cost<br>•Product time-to-market | **•Speed improvement**<br>**•Cost reduction**<br>•Risk reduction<br>•Interface improvement<br>•Less SC disruptions |
| Long-term | •Competitive advantage<br>•Innovation | •Efficient / effective future collaboration<br>•Access to suppliers<br>•Technology roadmap alignment | **•Quality improvement**<br>**•Innovation improvement**<br>•Stability & Continuity<br>•Competence development<br>•Ownership improvement<br>•Exclusivity<br>•Product portfolio coverage |

**Table 6.3: Comparison of relationship success dimensions in literature and this research**

In the same way that early supplier involvement and integration in product development revealed not only advantages but also disadvantages (cf. Table 6.2), research on relationship success also shows negative effects of inter-firm collaboration on competitiveness, i.e. negative correlations with the success variables mentioned above. Eisenhardt and Tabrizi (1995), for example, show in their study on the global PC industry that supplier integration may have a negative impact on product development time. Littler *et al.* (1995) state that over 40% of their respondents (UK manufacturers of information and communications technology) expressed the view that inter-firm collaboration makes product development more costly and more time consuming. And Kessler *et al's*. (2000) results of 75 new product development projects from ten large U.S. based companies in various industries (excluding automotive) indicate that: (1) more external sourcing during the early stage (idea generation) was related with lower competitive success; (2) more external sourcing during later stage (technology development) was related with slower innovation speed; (3) development cost tended to rise with greater reliance on external sources. Only Koufteros *et al.* (2005), in their study on manufacturing firms across various industries (as well excluding automotive), show somewhat mixed results in that an allocation of product development tasks to suppliers negatively affects product innovation but therefore leads to higher product quality. However, citing the work of Liker *et al.* (1996b), they also admit that many of the U.S. supplier integration practices that were adopted from Japan may still be in their relative infancy and hence their contribution insignificant or even counterproductive. This criticism also reflects the main position of the author of this study together with the facts that (i) money one of the four cited studies directly includes the automotive industry in their sample and (ii) two of the studies are more than ten years old and might not be representative of current industry practice regarding inter-firm collaboration anymore.

A final but very valuable point to mention in the context of the above discussion on relationship success is made by Cox (2004) in his work on mutuality in business relationships. Therein he argues for a relaxation of the assumption that mutuality can only occur with an 'ideal' outcome for both parties by identifying a total of nine transactional outcomes that can occur in buyer-supplier exchange. This is summarised in Figure 6.5.



**Figure 6.5: Transactional outcomes for buyers and suppliers in business relationships (Source: Cox, 2004; p. 415)**

He shows that only one of these outcomes (Cell C) fully equates with the 'ideal' concept of equal win-win that is traditionally assumed when considering mutually beneficial business relationships. In his opinion, however, this is an impossible situation. Nevertheless, it needs to be recognised that there will be many situations in which both parties realise some of their goals, even though one partner wins more than the other (Cells B, E, and F); but still both partners win more than without the relationship at all (note of the author).

## 6.6. Summary

This chapter has engaged in the discussion of the empirical findings in the context of conflicting and supportive literature (cf. Appendix A) thereby drawing on a broad body of theoretical perspectives (cf. section 3.3. in Chapter 3) until the point where a further discussion of extant literature does not add to the explanation of the empirical observations on inter-firm relationship governance. The discussion was structured around the five core categories and their related validated propositions from Chapter 5 to avoid major redundancies. It has been shown that existing theories, models, concepts and frameworks lack of comprehensiveness in the context of inter-firm relationship governance and empirical observations could only be explained on their individual level by drawing on a large and fragmented body of knowledge. In alignment with the literature gaps identified in Chapter 3 (cf. sections 3.2. and 3.4.) the discussion in this chapter revealed that:

- No portfolio model in supply management is based on the value proposition of the potential partners (determined by the distinct features and attributes of their competencies) which was found to be a – if not the most - critical contingency aspect for the selection of an appropriate relationship governance strategy and structure between buyer and supplier in inter-firm R&D collaboration (cf. propositions #5, #6, #8, #13, #28, #29).
- No approach accounts for the fact that an infrastructural link between product, process and supply structure needs to be established (cf. propositions #7 and #10) that enables the integration of the partners' competencies (cf. proposition #16).
- No portfolio model includes an adjusted relationship management approach (cf. proposition #17) in terms of roles (cf. propositions #10 and #14) and activities (cf. propositions #20 and #21) for its dynamic execution.

Hence, **a concept or framework that links the main elements of inter-firm relationship governance, i.e. building relationships, managing relationships and the sustainable success of these relationships, in a comprehensive but simple manner is necessary to provide tools and concise guidelines to practitioners involved in inter-firm collaboration.** This will be discussed in the subsequent Chapter 7.

# 7. DEVELOPMENT OF THE NOVEL COLLABORATIVE ENTERPRISE GOVERNANCE CONCEPT

> *"When the researcher is convinced that his analytic framework forms a systematic substantive theory, that is a reasonably accurate statement of the matters studied, and that it is couched in a form that others are going into the same field could use – then he can publish his results with confidence"* (Glaser, 1994; p. 192).

Having seen that the extant inter-firm relationship theory cannot explain all empirical observations on the sustainable governance of inter-firm relationships in a comprehensive manner, this chapter is devoted to the development of a novel and comprehensive conceptual framework for the sustainable governance of inter-firm relationships using empirical evidence from R&D collaboration in the German automotive industry. This presents the ultimate goal of this study and can be considered as the core of this thesis by providing a novel contribution via the extension of the existing inter-firm relationship theories and literature. This is based on the new concept of *Collaborative Enterprise Governance*.

However, because no model, framework, concept or theory was identified during the discussion in Chapter 6 that could be used as a foundation for the novel concept of *Collaborative Enterprise Governance*, the development of the concept and its conceptual elements was mainly based on the validated propositions (cf. Chapter 5) and the theoretical perspectives that were identified to have merit in the context of inter-firm relationship governance (cf. Chapter 3).

Therefore, the subsequent section 7.1. of this chapter serves as a reminder to the validated propositions and puts the quantitative ratings in context. Based on this section 7.2. engages in the construction of a competence based contingency framework in the context of the new concept of *Collaborative Enterprise Governance* to address the shortcomings of the literature (cf. Chapter 6) and to provide guidance to practitioners dealing with inter-firm relationship governance. Section 7.3. takes the conceptual arguments back to the level of the empirical findings, i.e. to the validated propositions, in an iterative loop in order to facilitate the internal validity of the framework. The final section 7.4. summarises the main aspects of this chapter.

### 7.1. A reminder of the empirical findings

The validation exercise from Chapter 5 showed that inter-organisational collaboration is generally regarded as an effective means to maintain and achieve competitiveness for the whole supply network and its individual member companies with short-term and long-term effects (cf. propositions #32, #33, #34 and #35). Each member of the supply network and the supply network as a whole is thereby challenged by a variety of exogenous and endogenous forces leading to increased collaboration activities that are increasingly carried out on a module basis rather than a parts or component basis (cf. propositions #1, #2, and #7).

In this context, strategic sourcing based on proactive supply management and a focus on competencies and collaborative partnerships is considered a principle factor for the development and management of successful supply networks and relationships therein (cf. proposition #5). This is because competencies together with the stages of the product development process are the main determinant of the role of the individual partners in the collaborative venture (cf. propositions #9 and #10) via the value they are creating for the supply network (cf. proposition #29). Therefore, companies should possess 'unique sales points' (e.g. innovativeness, R&D knowledge, etc.) which enables the differentiation from competitors; but they should also have interface capabilities that enable the linking with partners (e.g. project management, organisational structure, etc.) (cf. proposition #28). This is necessary because individual companies collaborating within a supply network have to be linked via cross-company projects for the effective and efficient development and deployment of their competencies (cf. propositions #16 and #30).

Specific ratings for the related proposition #23 showed that at the early stages of R&D collaboration within a supply network, competence development and transfer (technical and knowledge based exchanges) rather than transactional cost optimisation should be the primary focus for sourcing and collaboration activities. This may be because competence development and the exchange of related knowledge is seen as an important precursor to establishing effective operational R&D transactions (cf. proposition #13). In the opinion of the industrial experts, this is best achieved by taking a long term strategic view (cf. proposition #24), an intense integration of partners at early stages of a project (cf. proposition #22) and the creation of autonomous cross-functional units within the collaborating partner companies (cf. proposition #27). This is preferable to taking a sub-optimal view based upon organisational functions, departments or business units that is focused on the individual partner company rather than the whole supply network (cf. proposition #26).

Furthermore, the existence of a multiplicity of dynamic relationships and projects within a supply network (cf. propositions #8, #11 and #12) require a differentiated management based on the respective project and relationship characteristics (cf. proposition #17). It also requires a leader or coordinator who has enough competencies to clearly define boundaries of responsibility within an inter-firm project and manage the resulting interfaces between the partners (cf. propositions #14 and #25). In order to pursue this coordination and interface management successfully, the coordinator needs to have sufficient own competencies but also encourage the participating partners to contribute with their own know how allowing for a certain degree of autonomy within the collaborative venture (cf. proposition #15). This is true for both the whole car as well as the individual sub-system, module or part which implies that becoming more influential within the supply network also requires managing competencies and products belonging to other collaborating companies (cf. proposition #21).

In this context the validation showed that the strategic design of the supply network via the selection and sourcing of appropriate partners remains the responsibility of the car manufacturer (cf. proposition #6). This is supported by the fact that the structure of the supply network is influenced by product modularisation and proliferation which is mainly driven by the car manufacturer (cf. proposition #7). However, the operational management may be executed by other significant partners within the network such as the prime contractors or the first tier system suppliers (cf. proposition #20). Either way, although new inter-firm constellations can be a stimulus for innovation (cf. proposition #19) overly stable relationships between collaborating companies in the network do not automatically lead to a loss of innovativeness (cf. proposition #18) which can make the selection of a new supply base for each new project obsolete (cf. proposition #31).

It was observed that despite all agreement on the facilitators for effective inter-organisational R&D collaboration (cf. propositions #22, #23, #24, #25 and #27), the validation also showed that current practice in the German automotive industry *does not* apply the necessary mechanisms for good practice collaboration to become a reality in the near future. This is probably due to adversarial sourcing strategies and competitive relationships that still dominate over long-term orientated collaborative partnerships (cf. proposition #3). However, because such a strategic and partnership orientated approach towards sourcing and inter-firm collaboration abandons price competition, a major challenge for a collaborative supply network is to maintain competitiveness without actually applying adversarial forces (proposition #4).

### 7.2. Constructing a competence based contingency framework

Decision makers who face the challenges in governing inter-firm relationships need to be provided with practical guidance in form of strategies and operational mechanisms on how to build effective and sustainable inter-firm relationships that contain the most suitable partners. However, as argued in Chapters 3 and 6, a simple and comprehensive conceptual framework that integrates and balances exogenous and endogenous theoretical perspectives in the context of inter-firm relationship governance (relationship design, management, and success) is, to the best knowledge of the author, currently absent from the literature.

In this research collaborative inter-firm relationships are referred to as *collaborative enterprises* and the design (*enterprise design*) and management (*enterprise management*) of them as the concept of *Collaborative Enterprise Governance*.[32] The European Commission (2003) defines a (*collaborative*) *enterprise*[33] as "... an entity, regardless of its legal form ... including partnerships or associations regularly engaged in economic activities". Therefore, in its most simple form an *enterprise* could be a single integrated company. However, this concept builds on the distinctive assumption that *enterprises* can also be made up of autonomous parts of different individual companies (*enterprise modules*) because existing observations fail to emphasise that the examples they cite are drawn from only *one part* of a large company, whilst other parts of the same company are operating on a completely different *modus operandi* with their partners and suppliers.

To explain this behaviour this concept uses the *collaborative enterprise* (to emphasise joint collaboration) and its sub-units known as *enterprise modules* (to allow part-to-part company relationships to be explored) as unit of analyses thereby embedding single dyadic

[32] The specific terminology that is used in the context of the novel *Collaborative Enterprise Governance* concept (indicated in *italics*) is explained in the Glossary at the beginning of this thesis.

[33] In the following the terms *collaborative enterprise* and *enterprise* are used interchangeably throughout this thesis.

relationships between collaborating partners (e.g. OEM and supplier) in their overall network context reflected by collaborative inter-firm R&D projects (cf. Chapter 3).

### 7.2.1. The Enterprise Module

Similar to the assumption of Competence Theory that a firm should be considered as portfolio of competencies, the conceptual framework proposed here conceptualises an individual company as a set of autonomous cross-functional units, termed *enterprise modules*, that deliver specific competencies (e.g. special design and engineering know how) to *collaborative activities* (e.g. R&D projects) within the *enterprise* (cf. proposition #27). Thereby, the *enterprise modules* possess all relevant competencies to perform a certain task in the project (encapsulation; Baldwin and Clark, 2006a). This forms a unique and valued proposition for the company via its *enterprise modules* (cf. proposition #29) drawing on aspects of competence and Resource Dependency Theory. However, these highly task specific assets need to be supported by relationship specific resources (e.g. communication technology, co-operative contracts, and shared processes) that help to intermediate the specific competencies into a viable *value stream* within the *enterprise* (cf. proposition #28). This not only facilitates the design of inter-firm governance structures, i.e. *enterprise structures*, with economically acceptable transaction costs (cf. proposition #5) but also the development (exploration) and deployment (exploitation) of competencies through the 'absorptive capacity' (Cohen and Levinthal, 1990; March, 1991) that is linked to the relationship specific assets (cf. propositions #28 and #30). This draws on ideas of TCE and Relational View as such that investment in relationship specific assets can generate economic rents beneficial to all parties (Dyer and Singh, 1998). In alignment with Industrial Organisation Theory and Competence Theory these competencies are then the basis for the sustainable competitive advantage of the individual partner and the holistic *enterprise* alike (cf. propositions #32, #33, #34 and #35).

The following Table 7.1 provides an overview of the elements of an *enterprise module* derived from this empirical research that are partly confirmed by extant literature (cf. Figure 6.3. in Chapter 6). Task specific assets are based on the category *Competence Features* whereas relationship specific assets result from a combination of the categories *Relationship Interfaces* and *Collaboration Facilitators* (cf. Coding Master Table in Appendix J).

| | | |
|---|---|---|
| Task specific assets (unique competencies) | Technical | Innovativeness<br>Product know how<br>Product and process quality<br>R&D evaluation<br>Interface management<br>Delivery quality<br>Total process partner<br>R&D software knowledge |
| | Efficiency | Speed<br>Cost alignment<br>Project management<br>Flexibility and adaptability<br>Knowledge accessibility |
| | Social | Structure and culture<br>Customer focus<br>Ownership<br>Local presence<br>Plug & play ability<br>Stability and reliability<br>Pressure resistance |
| Relationship specific assets (interface capabilities) | Commercial | Negotiation based on trust and fairness (collaborative contracts)<br>Information sharing (cost)<br>Financial stakeholding |
| | IT | Online sourcing platforms<br>IT interface management |
| | Project | Simultaneous engineering (intra-organisational)<br>Inter-firm concurrent engineering<br>Leadership (management support)<br>Communication<br>Inter-personal relationships |
| | Organisational | Collaboration infrastructure (e.g. Key account management)<br>Cluster creation<br>Holistic and strategic thinking |
| | Technical | CAD software handling<br>Virtuality<br>Knowledge sharing (knowledge base) |

**Table 7.1: Elements of an enterprise module**

This requires industrialists to overcome traditional thinking about internal sub-units being functions and departments (cf. proposition #26) and think differently in a modular fashion in terms of *enterprise modules*. This means connecting *enterprise modules* (parts of a company) with *enterprise modules* owned by other companies (parts of other companies) in cross-company projects within the *enterprise* (cf. propositions #16). Thereby, *enterprise modules* can be extended across company boundaries e.g. in form of inter-firm concurrent engineering teams which supports the idea of a boundary-less organisation of the Relational View. This is in order to create an (inter-)organisational structure that can meet the demands of a rapidly changing industrial environment (cf. proposition #1) whilst still operating within acceptable cost limits (Binder and Clegg, 2006a). Similarly, Anderson *et al.* (1994) and Bititci *et al.*

(2004) propose a focal dyadic relationship between supplier business units and customer business units.

### 7.2.2. The Enterprise Matrix

This, however, requires tools to regulate *collaborative activities*, i.e. connecting *enterprise modules*, within the *enterprise* (cf. proposition #16). Fine *et al.* (2002) already acknowledged that:

> *"Understanding and redesigning a company's value chain begins with a map, one that identifies the organizations involved, the capabilities they bring to the value proposition, and the technological contribution each makes to the company's products and services"* (p. 70).

Hence, drawing on the basics of the *value stream* concept (cf. Chapter 3) the *Enterprise Matrix* tool was developed based on previous work (e.g. Clegg, 2003; Clegg and Binder, 2004) to accommodate cross-company coordination in *collaborative enterprises*. This is shown in Figure 7.1. Alternative tools and frameworks that similarly aim to integrate key strands of relationship decision making, such as value chain, competence and supply base aspects, can be found in the literature (e.g. Fine *et al.*, 2002; McIvor, 2000).[34]

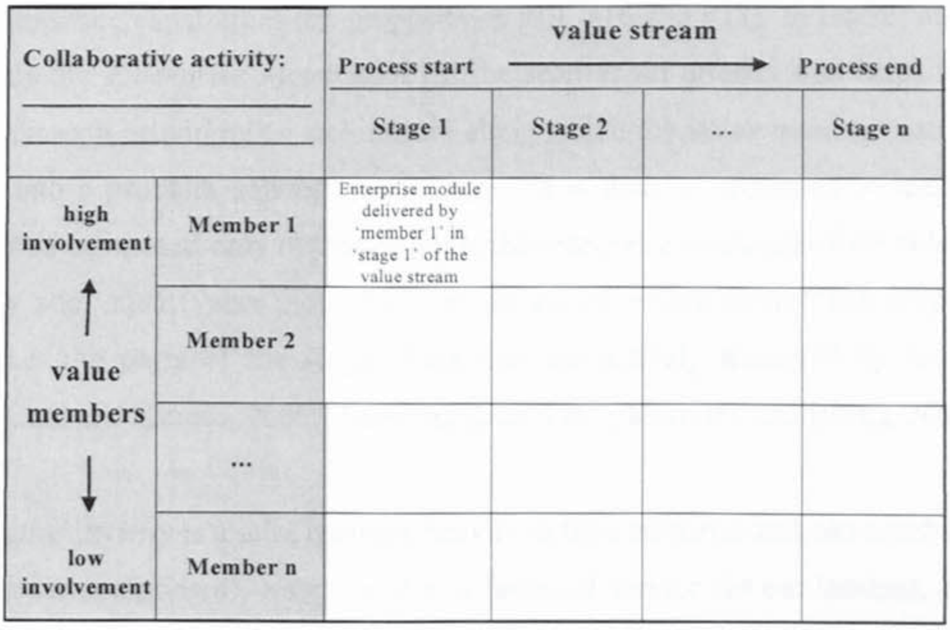


**Figure 7.1: The Enterprise Matrix - A tool for coordinating collaborative activities in enterprises by linking product, process and structure**

[34] Hines and Rich (1997) provide and overview of seven basic value stream mapping tools.

Collaboration within inter-firm relationships is based on transactions between heterogeneous *value members* (e.g. OEM and suppliers) that traditionally pursue diverse strategies but try to fulfil a common task (e.g. joint product development) by establishing a mutual *modus operandi* through sharing knowledge and information (cf. proposition #13). However, due to the specialisation and differences in knowledge (e.g. in the context of R&D and product development) difficulties occur when sharing their know how and competencies across occupational boundaries within *collaborative activities*.

In this sense, the *Enterprise Matrix* tool helps to optimise the whole *enterprise* operation (represented by the respective *collaborative activity*) through the allocation of the most suitable *value members* to process stages of the *value stream* based on their value proposition to the *enterprise* (as determined by their specific competencies) (cf. propositions #9, #10, #16). Baldwin and Clark (2006b) use the notion of a 'task and transfer network' that "defines and performs tasks, transfer tasks, and matches agents to tasks in such a way that the desired goods are obtained, and no agent has to carry out tasks that are beyond its ability" (p. 5).

Thereby, this kind of allocation bridges 'structural holes' (Obstfeld, 2005) between the *value members* in the *enterprise* through the establishment of common ground based on the *enterprise modules* that consist of task relevant unique competencies and relationship facilitating interface capabilities (cf. propositions #13, #16 and #28). In Becker and Zirpoli's (2003) words the *Enterprise Matrix* tool can be seen as an artefact that helps to integrate knowledge through providing an architecture along which the v*alue members* can place their knowledge into a problem solving *value stream*. It is thereby important to realise that the *value stream* is composed only of the parts (i.e. the *enterprise modules*) of the *value members* that actually add value (value proposition) to the *collaborative activity* (cf. propositions #9 and #29), i.e. the parts of the supply base that are actively managed by the *enterprise governor*, (Choi and Krause, 2006; Hines and Rich, 1997; Martinez and Bititci, 2001).

A *collaborative activity* is a joint business activity in the *enterprise* and can involve a product (e.g. car, or car component), a service (e.g. a financial service for car leasing), or a project (e.g. a construction project) that should be reasonably defined and circumscribed. This task should be conducted by a distinct leader, i.e. the project owner, who should have the competence to evaluate the *enterprise modules* of the *value members*, allocate suitable modules and their competencies to respective stages and tasks of the *value stream*, and define the responsibilities of and boundaries between the *value members* (cf. propositions #14, #15, #25). This is especially crucial at the early stages of the *value stream* in order to deliver successful *collaborative activities* (cf. proposition #22) and needs to be applied for each new *collaborative activity* (e.g. R&D project) within the *enterprise* (cf. proposition #31).

As already argued elsewhere (Binder and Clegg, 2005a) this competence of governing, i.e. designing and managing, *collaborative enterprises* can be considered as meta-competence or interface competence, i.e. a competence that affects the capability to coordinate (Liedtka, 1999), which requires an overall strategic orientation towards the whole *enterprise* (cf. proposition #24). In alignment with elements of *enterprise modules* (cf. Table 7.1 above) it involves aspects of relationship management, technology management and knowledge management, such as coordinating & intermediating, translating & designing, decision making & allocating, scouting & integrating, leading & initiating, facilitating & enabling, developing & manufacturing, and marketing & selling (cf. Figures 5.8 and 5.9 in Chapter 5 and Coding Master Table in Appendix J).

However, the responsibilities of designing and managing *enterprises* do not necessarily need to be occupied by a single *value member* but can involve various partners. In the German automotive industry it is, for example, often the case that the OEM defines the overall product specifications and selects the suitable partners for an R&D project, i.e. acting as *enterprise governor*, depending on his strategic choice (cf. proposition #6) moderated by product attributes (cf. proposition #7), supplier competencies (cf. proposition #9), and stage of development process (cf. proposition #10) but delegates the actual management of the supply base, i.e. the coordination of the *collaborative activity*, to a first tier prime contractor or system supplier, i.e. a significant *value member*, (cf. proposition #20). Karlsson (2003) describes this as the distinction between 'feature engineering' and 'specialised engineering'. This, however, requires the OEM to move away from his traditional role as *tertius gaudens* and move towards *tertius iungens* (Obstfeld, 2005) or *primus inter pares* (Binder and Clegg, 2005b) whereas the first tiers need to take more responsibility for integrating and coordinating products and competencies of other *value members* in the *enterprise* (cf. propositions #17, #20 and #21). This is very much in line with the interaction model of the IMP Group and aspects of Resource Dependency Theory in such that the possession of critical resources (e.g.

meta-competence) determines the power position and the interaction options of a *value member* in the *enterprise*.

Hence, the proximity of inter-firm relationships in an *enterprise*, described by the involvement of the *value members* in the *collaborative activity* (cf. *Enterprise Matrix* above), can range from a high involvement relationship with influence in negotiating ones own situation through the integration of complex systems and modules as a Tier 1 systems supplier or prime contractor to some sort of 'design & make suppliers', which will typically have less influence and become a hired competence (e.g. concept design or product realization), such as Tier 2 and 3 suppliers for specific parts and components. Thereby, the degree of involvement is not only dependent upon the value proposition of the competencies (cf. proposition #9) but also the stages of the *value stream* of the *collaborative activity* the *enterprise module* and its competencies are delivered to (cf. proposition #10). For instance, during the concept phase of product development *value members* that possess innovative capabilities and technological product know how can gain more influence within the *collaborative activity* by contributing highly to the competitive advantage of the *enterprise* than *value members* that only deliver competencies to the later stages of series development or production. Thereby, the *Enterprise Matrix* is a vehicle for linking the architecture of modular products with the *value stream* of the *collaborative activity* and the structure of the *enterprise* (i.e. supply base) in the sense of Fine's (1998) 3-DCE concept (cf. propositions #7 and #10) by effectively combining the most suitable competencies of individual *value members* along the *value stream* to deliver superior products to the marketplace (cf. propositions #16 and #33).

### 7.2.3. The Enterprise Reference Grid

The crucial part of the concept is to determine the appropriate relationship or governance strategy, i.e. *enterprise structure*, between the *enterprise governor* as project owner (normally the OEM) and the participating *value members* (normally suppliers) in the *collaborative activity* based on the various situational contingencies discussed above. Or as Baines and Kay (2002) phrased it: "Many sourcing practices exist and the challenge is to find the right practice, for the right product, at the right time" (p. 101). Thereby, the unit of analysis is the dyadic relationship between *enterprise governor* and *value member* that is, however, embedded in the overall *enterprise* (captured by a particular *collaborative activity*; cf. proposition #16).

The empirical evidence of this research suggests that a balance of different collaborative types of inter-firm relationship strategies and structures, i.e. *enterprise structures*, and their related relationship roles and activities is necessary (cf. propositions #8 and #17) in order to minimise commercial risk for short-term success whilst simultaneously encouraging innovation and quality improvements for long-term success of the *enterprise* (cf. propositions #33, #34 and #35). In turn this facilitates the success of each individual *value member* participating within the *collaborative enterprise* (cf. proposition #32).

Based on the observations made during the study, three distinct *enterprise structures* for the governance of *collaborative enterprises* could be identified that partly equal inter-firm relationship structures identified in Table 3.4 in Chapter 3 that have been discussed in Chapter 6 on a general level. However, in order to avoid specific assumptions associated with existing terms (especially with ICT linked confusion) the author decided to remain loyal to the terminological recommendations of the European Commission (2003) and hence applies the terms *autonomous enterprise*, *partner enterprise* and *linked enterprise* for the three identified governance structures. This is mainly due to the fact that current terminology for inter-firm structures in the literature mainly takes whole individual firms as elements of inter-firm relationships whereas the concept introduced in this research perceives inter-firm relationships, i.e. *enterprises*, as consisting of a collection of semi-autonomous *enterprise modules* that are conceptualised as autonomous parts of individual companies containing specific competencies relevant to tasks in a *collaborative activity* as well as interface capabilities that are relevant to deploy these competencies within the *enterprise* (cf. proposition #27). The main characteristics of the three structures are described in Table 7.2 which is mainly based on empirical insights (cf. coded categories *Relationship Criteria*, *Strategic Collaborator Roles*, and *Operative Collaborator Activities* in Coding Master Table in Appendix J) but was also informed by the discussion of the literature in Chapters 3 (cf. Table 3.4) and 6.

| Characteristics | Autonomous Enterprise | Partner Enterprise | Linked Enterprise |
|---|---|---|---|
| **Similar terms and supply chain philosophies** | Virtual enterprise, virtual corporation / organisation; agile philosophy | Extended enterprise, keiretsu, clan; hybrid philosophy | Vertically integrated enterprise; Lean enterprise; lean philosophy |
| **Foundation of relationship** | Mainly based on technical competence features; Emphasis on high innovation context; Decision of allocating resources depends on competitive and comparative advantage | Mainly based on social competence features; Past relationship experience important; Emphasis on strategic sourcing of critical products based on synergy for the whole enterprise | Mainly based on efficiency competence features; Emphasis on transaction costs (prices) |
| **Evolution of relationship based on competencies** | Newly emerging, speculative, untested, high risk, require many members to spread risk; high asset specific investments; high transaction costs | Tested to some extent, medium risk, has had some testing, understood by innovators; medium asset specific investments; medium transaction costs | Mature, well accepted, tested and widely usable; low asset specific investments; low transaction costs |
| **Scope of relationship** | Project based to quickly exploit specific opportunities across company boundaries; Present a unified face to externals; Partners involved in other collaborative activities simultaneously for more power and maturity | Long-term and holistic thinking in collaborative dimensions; Often spans whole product life cycle across company boundaries | Standardisation of high product volumes and corporatisation of structures; Focus on scales of economies rather than on extension and virtualisation |
| **Longevity of relationship** | Short-term temporary alignment of operations | Medium - long-term | Foreseeable as permanent (as long as competitive) |
| **Proximity and depth of relationship** | No stability as well as dynamic and unpredictable environment; Collaboration impacts operations directly and immediately (agility, flexibility and leanness); low degree of interdependence and integration | Strategic dimensions of collaboration; Relationship, technology and knowledge management become critical; medium degree of interdependence and integration | Tend toward industrial dominance; Emphasis on removal of legacy systems; high degree of interdependence and integration |
| **Governance of relationship** | Loose and flexible environment based on innovator scouting; Temporary, re-active and loose governance; Right balance of control and emergence (i.e. co-opetition) | Stable and strategic environment based on integration through appropriate strategic sourcing and partner development; Design and implementation of business mutual processes; Strategic and pro-active governance | Unity of command and control; Focused on monitoring and control through standardisation and corporatisation |
| **Strategic role and main tasks of enterprise governor** | Incubator; Scouting for potential value members; Initiate collaborative activities | Integrator; Coordination of collaborative activities; Support value members in competence development | Incumbent; In-house development of proprietary systems; Relying on power and authority |
| **Strategic role and main tasks of value members** | Innovation supplier; Deploying specific competencies for innovating new technologies and solving complex R&D problems | Integrator; Integrating parts to more complex systems and managing and coordinating sub-supply base based on meta-competence | Volume player; Value creation through cost efficient making and delivery of parts in high quality |
| **Collaboration points in PDP** | Mainly product planning and concept design | Mainly concept design / pre-series design | Mainly series design |

**Table 7.2: Enterprise structures fundamental to Collaborative Enterprise Governance**

It has been observed in this research that *autonomous enterprises, partner enterprises* and *linked enterprises* are not, as some would believe, governance structures resulting from completely different strategies but that they are better thought of as a continuous spectrum of the same strategy focused on inter-firm collaboration. Thereby the *linked enterprise* is the inter-firm governance form that most closely approximates the traditional vertically integrated company (a single legal entity) and could be seen as a kind of proto-institution that emerges from a high level of embeddedness and integration of the partners (cf. Lawrence *et al.*, 2002). Similarly, Lambert *et al.* (1996) proposed three kinds of partnership structures depending on their short-term (Type 1), long-term (Type 2), and long-term with no end (Type 3) character as shown in Chapter 6 (cf. Figure 6.1).

This research suggests that an individual part of a single company (i.e. an *enterprise module*) may be part of numerous different *enterprises* that operate quite independently (cf. proposition #12). For instance, an *enterprise module* of a company, i.e. *value member*, can be engaged within more than one *collaborative activity* within the *collaborative enterprise* whilst drawing upon the same specific competence. It is therefore useful to perceive *enterprises* as consisting of a collection of semi-autonomous *modules* (i.e. autonomous parts of individual companies; cf. proposition #27), where each *module* is able to contribute value to a number of co-existing *enterprises structures* simultaneously by deploying its competencies in *collaborative activities* of the *enterprise* (cf. proposition #12). This is similar to the 'meta-system' perspective suggested by Boardman and Clegg (2001) that considers a supply chain as an organisation in its own right where each specific configuration of it forms a separate virtual organisation.

It is already recognised that competencies need to be regarded as a strategic resource which should be managed and developed in a balanced approach so that companies are prepared for changing industrial requirements. For instance, Prahalad and Hamel (1990) proposed the idea to use a portfolio of *competencies* rather than a portfolio of *businesses*. This conceptual framework uses competencies similarly, but differs from the traditional viewpoint by considering them to be an *enterprise-wide* resource rather than just an individual company's resource (cf. propositions #16, #29 and #30). Thereby, the *enterprise governance* perspective (similar to Fine's (1998) notion of capabilities chains) discusses how *competencies* are designed and delivered to a *collaborative enterprise* in order to optimise the competitiveness of the whole system through linking product, process and structure and hence differs from a traditional *supply chain* and *operations management perspective* that primarily concentrates on the flow of products and services *per se* (Binder and Clegg, 2007).

Thereby, the number and type of *enterprise engagements* for any one company is closely aligned with the value proposition of its competencies and the capability of deploying them within *collaborative activities* of the *enterprise* (cf. propositions #9, #29 and #30). This is referred to as *engage-ability* of the competence in the *enterprise* with regard to the respective *collaborative activity*, i.e. the ability of a value member to be involved in the *collaborative activity* due to its value proposition. In alignment with aspects of Contingency Theory, Competence Theory and TCE, this determination of an appropriate *enterprise structure* for the resulting governance of the inter-firm relationship between *enterprise governor* and *value member* was identified to be dependent upon three main competence attributes (cf. Coding Master Table in Appendix J) that are influenced by various exogenous (external to relationship) and endogenous (internal to relationship) factors.

In other words, the selection of an appropriate governance mode for a specific dyadic relationship within a *collaborative enterprise* is dependent upon various exogenous and endogenous factors that influence the value proposition of the competence (embedded in the *enterprise module*) to the *collaborative activity* and ultimately to the *enterprise*. The three identified competence attributes (cf. coded category *Competence Attributes* in Appendix J), their related exogenous and endogenous factors (derived from RBV and TCE to provide an integrative perspective; Madhok and Tallman, 1998) and their impact on the *engage-ability* of the competence (and the *enterprise module*) are outlined in Table 7.3.

| Competence attribute | Exogenous and endogenous factors | Impact on engage-ability (correlation) |
|---|---|---|
| Transferability | Competence specificity (endo)<br>Transaction frequency (endo) | Negative<br>Positive |
| Attractiveness | Marketability (market value) of competence (exo)<br>Uncertainty of competence value (exo)<br>Suitability of competence deployment (exo)<br>Risk of competence deployment (exo) | Positive<br>Negative<br>Positive<br>Negative |
| Maturity | Advancement and sophistication of competence (endo)<br>Sustainability of competence (exo) | Positive<br>Positive |

**Table 7.3: Attributes influencing the engage-ability of competencies in the enterprise**

For instance, if the specificity of a competence (an endogenous factor) is **high** due to specific knowledge of one particular *value member* the transferability of this know how within the *collaborative activity* is **low** (negative impact) resulting in a **low** *engage-ability* of the competence in the *collaborative activity* and hence the *enterprise*. However, the transferability and hence *engage-ability* of the competence can be increased as *value members* get more integrated over time and transaction frequency (endogenous factor) between them increases (positive impact). Similarly, a **low** marketability of a new competence (exogenous factor) due to its untested market value will result in a **low** attractiveness and hence a **low** engage-ability (positive impact). However, this market value can for example be increased through further advancement and sophistication of the competence (or related technology) (endogenous factor) leading to a **higher** maturity (positive impact), **less** risk of deployment (negative impact) and therefore **higher** market value and engage-ability of the competence.

However, these examples show that the determination of an appropriate *enterprise structure* for the governance of dyadic relationships in *collaborative enterprises* should not only be based on the current value and *engage-ability* of a competence (which only contributes to the current competitiveness of the *enterprise* and its *value members*) but also on its future value and *engage-ability* (which contributes to the future competitiveness of the *enterprise* and the *value members*).

Figure 7.2 summarises the findings in a concise reference grid which shows four prevailing current and future types of competencies and their *engage-ability* (ranked simply as 'high' or 'low'). In each of the quadrants the best suited *enterprise structure* (*autonomous*, *partner* or *linked*) depending on the current and future *engage-ability* of the prevailing competencies is given with some of its key characteristics. Similar overviews (using other dimensions) can be found in the literature (e.g. Bensaou, 1999; Hallikas *et al.*, 2002).

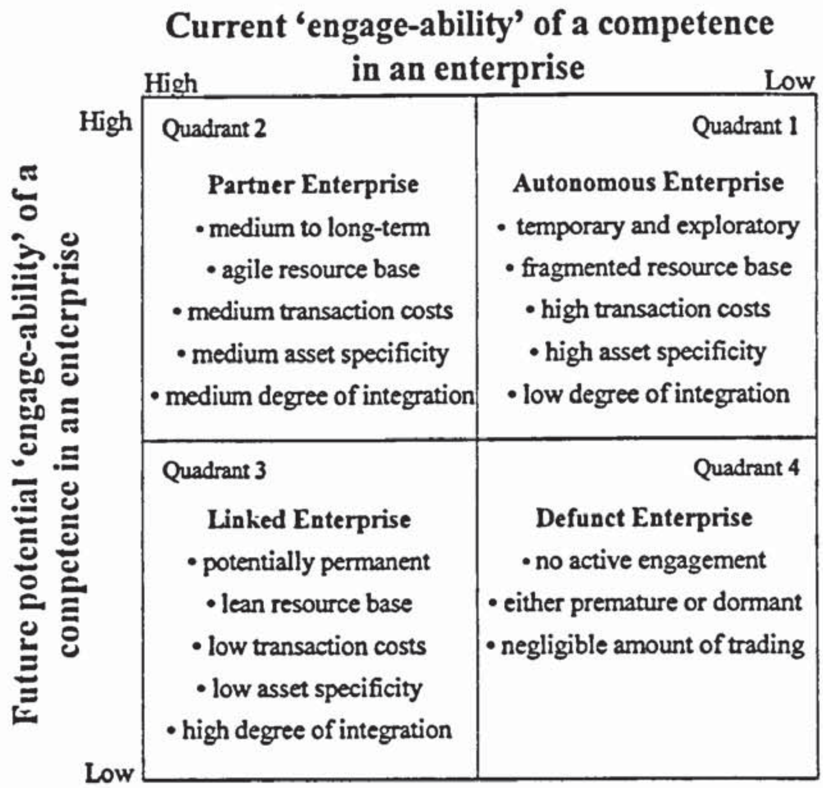


**Figure 7.2: The Enterprise Reference Grid - determining appropriate enterprise structures**

Each quadrant of the *Enterprise Reference Grid* is now taken in turn to be characterised in more detail (also cf. Table 7.2 above).

*Quadrant 1: low current engage-ability but high future potential engage-ability*

*Value members* governed in this quadrant show a prevalence of competencies with low current but high future *engage-ability*. This is due to the possession of newly emerging competencies, that are untested on the market and often are very specific to the *value members*. This impacts negatively on the transferability, attractiveness and maturity of these competencies and hence *enterprise governor* and other collaborating *value members* will be very reluctant to make long term plans and investments, and so arrangements will be temporary to exploit market opportunities quickly. Thereby, risks spread over many different *value members* to increase the chances for the generation of new knowledge ('creative chaos; Murmann, 2003). In addition, the cost of collaborating will be very high due to the fragmented resource base, high specificity of the competencies and their low ability to be integrated in the wider system of the *enterprise* which favours a short-term collaboration – these are characteristics of an *autonomous enterprise*. In an *autonomous enterprise* every *value member* delivers a very specific and limited value to the overall *collaborative activity* tailored to its very specific competence features leading to a low involvement along the *value* *stream* of a *collaborative activity* (cf. *Enterprise Matrix* above). Thereby, the selection of theses *value members* is mainly based on their innovative capabilities and their competence to solve complex technological problems.

***Quadrant 2: high current engage-ability and high future potential engage-ability***

*Value members* governed in this quadrant possess competencies that are currently highly engaged due to matured, partly tested and market proven competencies that are also highly attractive involving low degrees of uncertainty and risk for their deployment. They are also perceived to have high potential *engage-ability* in the future based on high sophistication and sustainability of the competencies' value proposition. Therefore, the *enterprise governor* seeks more stable, strategic and medium to longer term co-developmental supply strategies with these *value members* to minimise commercial risks leading to more frequent transactions and competence deployments. This decreases the cost of collaboration and increases the ability to integrate these competencies closer into the *enterprise* – these are characteristics of a *partner enterprise*. In a *partner enterprise* the *value members* are more involved in the *collaborative activity* both in terms of proximity and longevity of the relationships often spanning the whole product life cycle. Their selection is mainly based on their interface capabilities and meta-competence that are valuable to the synergy of the *enterprise* often leading to the responsibility for managing other *value members*, i.e. integrating their competencies, on behalf of the *enterprise governor*.

***Quadrant 3: high current engage-ability but low future potential engage-ability***

*Value members* governed in this quadrant occupy competencies that are currently highly engaged due to their mature, well established and widely usable character. But they also have the perception of becoming less attractive in the future, e.g. due to high profits becoming eroded or technologies becoming obsolete and substituted. Therefore, the *enterprise governor* seeks whole ownership of the assets and capabilities that he may have become highly interdependent on, which often leads to a consolidation between *enterprise modules* within the *enterprise* moving to a control-based governance structure (corporatisation) – these are characteristics of a *linked enterprise*. In that way, this *collaborative enterprise* structure most closely approximates the traditional vertically integrated company which, however, is a single legal entity. In a *linked enterprise* a single or very few significant members with a distinct value contribution cover most of the *value stream* in order to utilise economies of scale and potential for standardisation. The selection of *value members* is hence based on their capability to be highly efficient in their operations to compensate for decreasing value propositions of the competencies through the minimisation of their deployment (transaction) costs.

*Quadrant 4: low current engage-ability and low future potential engage-ability*
*Value members* found in this quadrant have a prevalence of *enterprise modules* and competencies that are perceived as undesirable for current and future engagement and are confronted with the strategic decision to either disengage from the current structure and search for other new *autonomous* or *partner engagements* or merge completely into single legal entities – these are characteristics of a *defunct enterprise.*

However, a single legal entity cannot be considered as collaborative inter-firm venture anymore which is the *conditio sine qua non* for the concept of *Collaborative Enterprise Governance.*

### 7.2.4. The Evolutionary Enterprise Configuration

Findings show that, once established, inter-firm relationships and their related governance structures, i.e. *enterprise structures,* will and have to change over time (cf. proposition #11) depending on the varying significance of endogenous and exogenous contingency factors acting upon it (cf. proposition #1 and #2). This is in order to stay adaptive to constantly and rapidly changing industrial as well as inter-firm relationship requirements which reflects basic ideas of Contingency and Complexity Theory in the sense that dyadic inter-firm relationships, i.e. *enterprise structures,* are complex adaptive systems that evolve within the 'ecosystem' (Kauffman, 1993) *collaborative enterprise* thereby requiring a twofold fit between industrial (exogenous) and relationship (endogenous) contingencies. For instance, stable and more path dependent relationships between *value members* could be used to utilise the existing knowledge base more effectively – what March (1991) calls exploitation, e.g. for producing moderate innovation - without necessary limiting their adaptability or creating a lock-in situation (cf. proposition #18) whereas links with new *value members* could be used to expand the existing knowledge base – what March (1991) calls exploration - to facilitate thinking outside the box and produce radical innovation (cf. proposition #19).

These changes of *enterprise structures* seem to be constantly reiterating and evolving, and occur partially (i.e. based on the reconfiguration of autonomous *enterprise modules* rather whole companies) leading to a closed loop continuum of *collaborative enterprise structures.* This is similar to Miller and Friesen's (1980) assumption that the complexity of adaptation is a structured phenomenon in that the same adaptive scenarios keep recurring over time. An illustration of this is Fine's (2000) 'Double Helix' that illustrates the evolutionary oscillation of supply chain structures. This was previously referred to by the author as 'Partial Evolutionary Multiplicity' of *enterprise structures* (e.g. Binder and Clegg, 2005a and 2005b). Figure 7.3 suggests the evolutionary configuration that *enterprise structures* may go through.

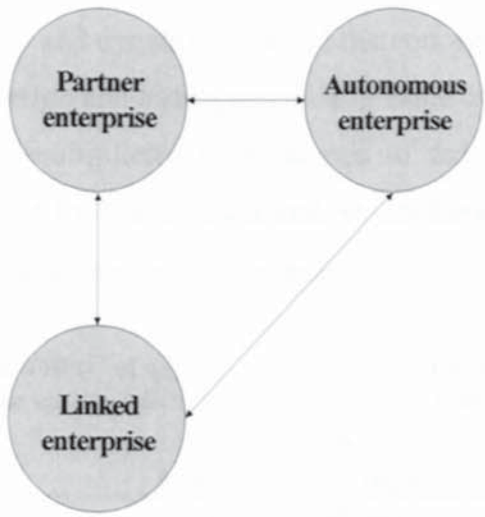


**Figure 7.3: Evolutionary configuration of enterprise structures**

Galunic and Eisenhardt (2001) termed this kind of adaptive organisational form for a *collaborative enterprise* 'dynamic community'. Based on MacBeth (2002), each of these *enterprise structures* (*autonomous*, *partner* and *linked*) is considered to be a 'dynamic equilibrium' within the ecosystem '*collaborative enterprise*' around which the *collaborative activities* cluster for a certain period until flipping over to another structure (bifurcation). However, as opposed to the assumptions of mere quantum change of the structures applied in complexity theory this research also reveals evidence for step-by-step adaptation and reconfiguration of *enterprise structures* to balance emergence and control between the *value members* more in line with the argumentation of contingency theory (see examples for both in Table 7.4 below). Moreover, these examples show that the bifurcation from one structure to another can follow a two-way pattern (hence the double sided arrows in Figure 7.3) although the anti-clockwise cyclical pattern from *autonomous enterprise* through *partner enterprise* to *linked enterprise* is the most common and likely evolution to be observed in practice.

### 7.2.5. The Dynamic Enterprise Reference Grid

The *Enterprise Reference Grid* (cf. Figure 7.2) is intended to show a picture of how one *enterprise structure* may change into another as a result of a changed predominance in the attributes of competence (and its *engage-ability*) that the relationship is built upon. This is a two-way dependency as the *enterprise structure* will affect the development of future potential competencies just as the development and deployment of competencies will influence the emergence of *enterprise structures* (cf. proposition #30). Figure 7.4 puts the evolutionary change in *enterprise structures* (from Figure 7.3) and their dependence on the prevailing type of competencies (from Figure 7.2) together. It aims to give a simple consolidated overview of static and dynamic views of the concept of *Collaborative Enterprise Governance*, i.e. *enterprise design* and *management*. The basic idea of combining competence theory with an evolutionary multiplicity of structures in the context of contingency and complexity theory is supported by Halldórsson and Skjøtt-Larsen (2004) who argue that it helps to achieve competitive advantage in the context of changing environments.

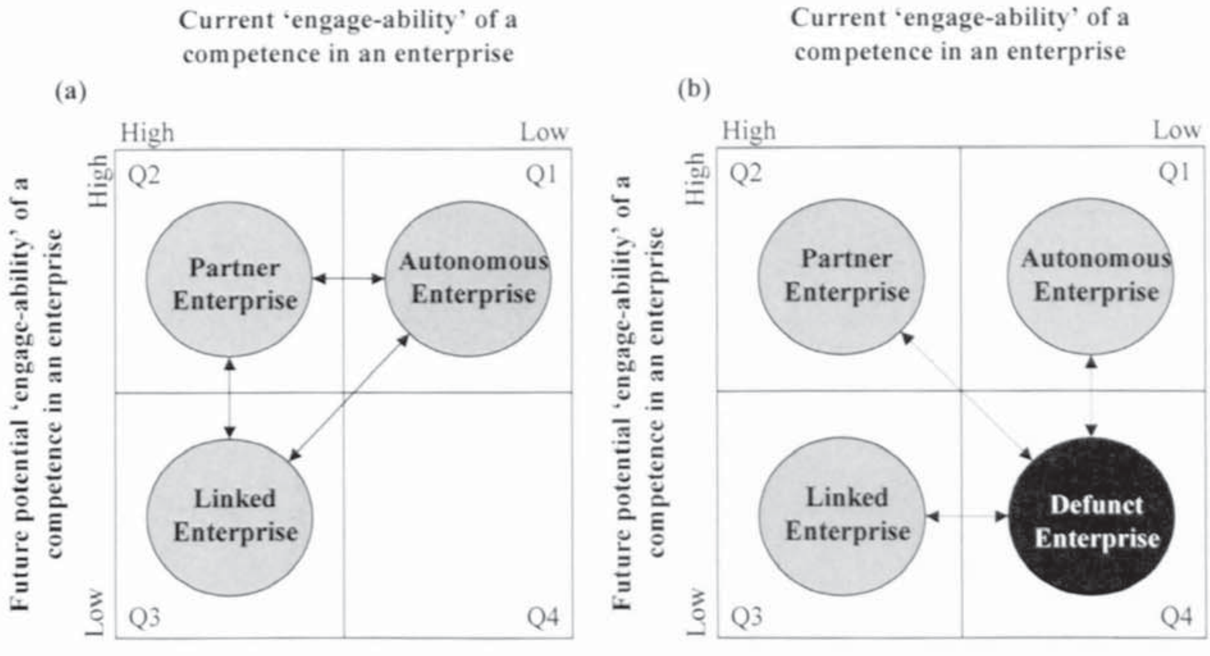


**Figure 7.4: The Dynamic Enterprise Reference Grid – planned (a) and unplanned (b) reconfiguration of enterprise structures**

It is argued that such reconfiguration actions (as shown in Figure 7.4a) are largely planned on controllable endogenous contingency aspects that influence the *engage-ability* of competencies (e.g. transaction frequency, sophistication of competence, etc.; cf. Table 7.3 above). Unplanned and reactive actions are represented by arrows from and to Quadrant 4 (shown in Figure 7.4b). These are predominantly caused by adverse and uncontrollable exogenous contingency aspects influencing the *engage-ability* of the competencies (e.g. marketability and competition; cf. Table 7.3) and have not been covered in this research.

To illustrate the implications of the developed concept of *Collaborative Enterprise Governance* and its competence based contingency framework (as summarised in Figure 7.4a) qualitative empirical examples derived from this research are given in Table 7.4 to explain how and why *enterprise structures* change. This explanation is based on: (i) a combination of conceptual interpretation of the empirical data (column 1 in Table 7.4) based on the characteristics of *enterprise structures* given in Table 7.2 combined with Figures 7.1, 7.2. 7.3 and 7.4; and (ii) empirical examples derived from the interviews (column 2 in Table 7.4).

Thereby, different examples are used to explain the static and dynamic components of the concept because this has been a cross-sectional study and not a longitudinal one. However, at an aggregated level Table 7.4 demonstrates the connection between the concept of *Collaborative Enterprise Governance* and the empirical examples which is representative of inductive grounded reasoning.

| (1) Conceptualisation of Collaborative Enterprise Governance | | | (2) Empirical examples from research |
|---|---|---|---|
| **Static** | **Dynamic** | **Characteristics** | |
| **Q 1**<br>Autonomous Enterprise (AE) | | • Flexible, loose, temporary and project based collaborative venture (low degree of integration)<br>• Spread risk over many partners (fragmented resource base)<br>• Using highly specific but untested competencies (high transaction cost due to high asset specificity) | BMW uses this structure for highly innovative projects and technologies in the early stages of a joint product development process to increase collaboration with small and medium sized companies perceived as being innovative. This happened in the case of BMW's i-drive navigation system, where one small company identified the technology, another company developed the initial concept and another partner conducted the industrialisation of the production-ready product. All the partners were co-ordinated within an *autonomous enterprise* that was co-ordinated by BMW. |
| **Q 2**<br>Partner Enterprise (PE) | | • More stable, strategic, close and permanent collaborative venture focused on mutual relationships (medium degree of integration)<br>• Risk spread over critical and successful partners (agile resource base)<br>• Using matured and tested competencies that are synergistic to collaborative venture (medium transaction cost due to lower asset specificity and less involved partners) | BMW used this structure by engaging more closely with a sole prime contractor (Magna Steyr) for the development and manufacturing of the X3 sport utility vehicle. BMW designed and developed the basic product concept in its mainstream research and development function but then for the medium to long term partnered with Magna Steyr to help orchestrate the large number of sub-suppliers (*enterprise management of value members*). BMW remained an overall *orchestrator* or *enterprise governor* via their purchasing authority. |
| **Q 3**<br>Linked Enterprise (LE) | | • Potentially permanent collaborative venture focused on control and command (high degree of integration)<br>• Corporisation of risk through re-intermediation and ownership of assets (lean resource base)<br>• Using fully matured, tested and widely accepted competencies (low transaction cost due to low asset specificity) | VW re-designed the structure of its product development process using so called 'Project Houses' (an *enterprise module*); these are totally autonomous but wholly owned R&D subsidiaries of the main VW organisation. The core organisation covers the design and development of the generic models (e.g. Golf or Passat) and the remaining engineers were re-located to Project Houses competing directly with external suppliers for future development projects of derivate models. This gives VW the option on a fair and planned basis to re-intermediate their position in the *enterprise* leading to collaboration between the 'basic' organisation and the 'Project Houses' in a *linked enterprise*. |
| **Q 4**<br>Defunct Enterprise | | • No active engagement in a current *collaborative activity* (no degree of integration)<br>• Dormant relationship with negligible amount of trading (no transaction cost only data maintenance) | VW kept a supplier for locks in its supply base (stand-by mode) although the company was not competitive anymore due to severe structural and strategic problems. This would contribute towards a *defunct enterprise*. However, after re-structuring efforts the company's competitiveness and value was re-evaluated and it was re-integrated into the 'active' supply base (i.e. *collaborative enterprise*) and its *collaborative activities*. |
| | **Q1 to Q2**<br>From AE to PE | • Strategic move for successful ventures depending on existing mutual experiences<br>• Effective relationship, technology and knowledge management is critical to establishing common strategies (culture, trust, advanced IT systems, etc.) | The production of the Smart Car, was initially a temporary collaboration with weak ties between parts (*enterprise modules*) of DaimlerChrysler (DC) and Swatch to exploit temporary market opportunities for very small cars. As the relationship strengthened it became longer term and more permanent. This shift in structure was also accompanied by a change in the role of DC, whose role grew from coordinator of manufacturing and logistics operations (relationship and technology management) to include the co-ordination of strategic information (knowledge |

| | | | |
|---|---|---|---|
| | | | management). DC acts as an *enterprise orchestrator* or *broker*. |
| | **Q2 to Q1**<br><br>From PE to AE | • Successful stable ventures trigger the creation of new temporary ventures<br>• Open minded management with pro-active strategies and capabilities in outsourcing is necessary<br>• Fulfil a niche or temporary market opportunity requiring a new structure | VW have established *partner* (and *linked*) *enterprises* for conventional product development with partner companies. However, major innovations often require temporary new engagements with companies outside of existing *partner enterprises* that possess the competencies for newly required technologies. This occurred in the case of the Bugatti Veyron where VW engaged with *value members* outside its traditional *enterprise*. This was an example of an new *autonomous structure*. |
| | **Q2 to Q3**<br><br>From PE to LE | • Often known as the 'shake-out' stage<br>• The owners of *enterprise modules* with predominantly medium asset specific content move to adopt 'lock-in' tactics to gain industrial dominance<br>• Involves large financial resources<br>• Objective to achieve economies of scale | Due to problems of achieving further market penetration for the Smart Car, tension between DC and Swatch grew and led to the buyout of the two-seated Smart Car from Swatch by DC. This means a transition from a *partner enterprise structure* towards a *linked enterprise structure* as major parts of the know-how and competencies of the venture became re-intermediated (or re-insourced) into units of DC. DC became an overwhelmingly dominant force controlling the collaborative relationship that once has been a *partner enterprise*. |
| | **Q3 to Q2**<br><br>From LE to PE | • Moving from quadrant 3 to 2 would mean that a new partnership has revived an existing and proven module by deploying it in a new *partner enterprise* | For the Smart Car, DC deployed its core competencies in other new directions, for example the production of the new Smart Forfour car jointly designed by Mitsubishi in another separate inter-company activity where 50% of the parts are supplied by Mitsubishi and the engines are supplied by another German-Japanese venture involving Mercedes-Benz forming a *partner enterprise* that spans the whole product life cycle across company boundaries. |
| | **Q3 to Q1**<br><br>From LE to AE | • Owners of *linked enterprise modules* that are based on proven competencies should not become complacent but seek new innovative ventures to remain competitive; this could take place in form of a new spin-off *enterprise*<br>• Increasing profitability and competitiveness as main goals for new links (shareholder value maximisation) | Ford span off its wholly owned internal component suppliers (an *enterprise module* of the Ford organisation) into a new organisation called Visteon that depends less on being a sole supplier to Ford. Ford's new relationship to Visteon is on the basis of an *autonomous enterprise*. As a result Visteon has grown in volume and competence by also supplying other OEMs, becoming more focussed and specialised. Ford's return on capital employed in the relationship grew as Visteon assets disappeared from its accounts and lower prices arose from increased innovation throughout the *enterprise*. |
| | **Q1 to Q3**<br><br>From AE to LE | • In case of attractive, highly asset specific and complementary competencies, a former partner can strive to control those assets internally<br>• Aiming at in-house development of proprietary systems, e.g. through acquisition of external competencies, to lower transaction cost<br>• Objective of extending business portfolio to cover whole product life cycle | In 2002, the engineering service provider IVM was acquired by the Edscha Group (a large systems supplier who specialises in convertible roofs) and integrated as an *autonomous* business unit, i.e. *enterprise module*, (keeping its own company name) so that IVM's research and development competencies could be deployed internally with lower transaction costs. It also enables Edscha to offer a comprehensive service package (e.g. design, development, manufacturing, delivery and assembly) not only for convertible roofs but gradually for whole cars drawing on IVM's design and development expertise. This could increase the Edscha Group's future potential to rise towards the role of an *orchestrator* itself by becoming more influential. |

**Table 7.4: Provenance of the conceptual framework based on findings and examples**

Governing *collaborative activities* in *collaborative enterprises* is like putting together a jigsaw where each bit of the jigsaw (i.e. *enterprise modules*) is owned by a different company. A potted account of how to apply the conceptual elements of the framework is given in Figure 7.5 followed by a step-by-step approach. This is similar to the main four steps of managing supplier relationships in commonly used portfolio models (e.g. Bensaou, 1999; Kraljic, 1983; Olsen and Ellram, 1997b; Svensson, 2004): (i) classify components or activities / analyse business environment, (ii) classify supply base / analyse of relationship criteria, (iii) determine appropriate relationship strategy, and (iv) develop action plans / managerial decision of relationship strategy. Special attention is thereby paid to the issues of building and managing inter-firm R&D relationships in alignment to the structure-conduct-performance paradigm (Bain, 1956) in the sense that performance of the R&D project and the related inter-firm relationship depends on the adoption of appropriate sourcing and relationship strategies and structures according to the R&D project requirements.

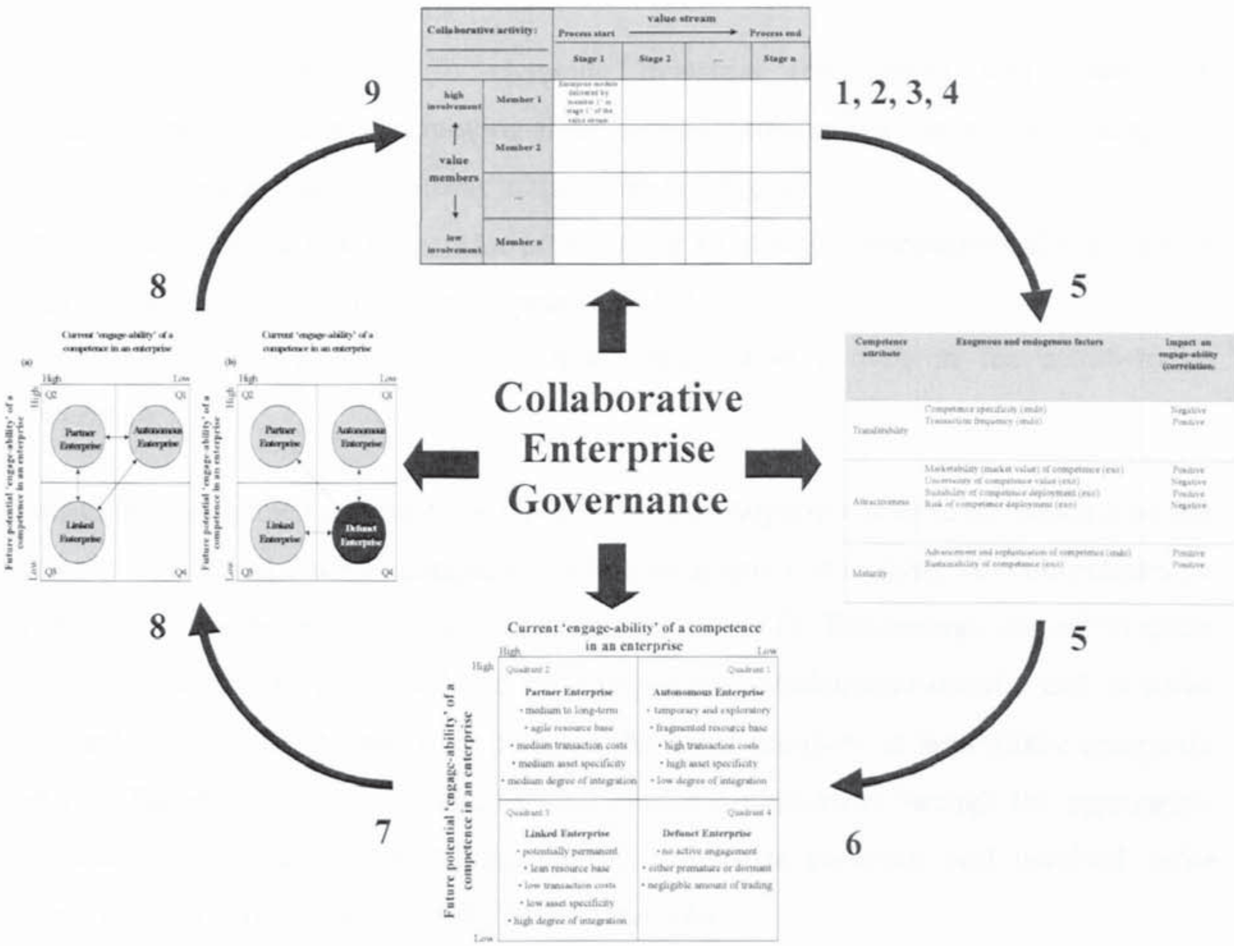


Figure 7.5: A step-by-step approach of applying the concept of Collaborative Enterprise Governance

1. Identification of a *collaborative activity* to be performed within the *collaborative enterprise*.
2. Mapping out the *value members* of the *enterprise* (in terms of their roles) that make an engaging value proposition to the *collaborative activity*.
3. Mapping out the *value stream* – the sequence of events from beginning to end that add value to products and services that the *enterprise* delivers.
4. Population of the cells in the *Enterprise Matrix* (cf. Figure 7.1) that deliver information about who (a *value member*) does what (stage of the *value stream*) based on their value proposition to the *collaborative activity*.
5. Determine *engage-ability* of *value members* based on transferability, attractiveness and maturity of their competencies (cf. Table 7.3).
6. Select appropriate *enterprise structure* (i.e. governance strategy) for the *engagement* with the *value members* (cf. Figure 7.2).
7. Manage the inter-firm relationship according to the selected governance mode (cf. Table 7.2).
8. Adapt *enterprise structure* to changing industrial (exogenous) and relationship requirements (endogenous) as moving along the *value stream* based on active contingency planning to sustain competitiveness in the future (cf. Figure 7.4).
9. Re-populate cells in *Enterprise Matrix* according to changed environmental (exogenous and endogenous) requirements and repeat steps 5-9.
10. Repeating the above steps for each new *collaborative activity* in the *collaborative enterprise*.

The result is a disciplined approach for *Collaborative Enterprise Governance* which does not necessarily seek to make whole-company to whole-company connectivity but concentrates on the criticality of the *enterprise modules* (autonomous parts of collaborating companies) to the whole *collaborative enterprise* captured by a respective *collaborative activity* and its *value stream* and the resulting connectivity between the *value members* in appropriate *enterprise structures*. Thereby, the concept ensures total system optimisation through the appropriate governance of all dyadic relationships between *enterprise governor* and involved *value members* within a *collaborative activity* of the *enterprise*.

## 7.3. Revisiting the propositions

As argued above, the discussion in Chapter 6 revealed shortcomings of the existing literature on inter-firm relationship governance because often only small parts of existing concepts and their theoretical perspectives could be used to explain the empirical observations made. Hence, the validated propositions from Chapter 5 shown in section 7.1. together with general theoretical perspectives identified in Chapter 3 mainly guided the development process for the new concept as shown in the section 7.2. above. Although the validated propositions have thereby been incorporated in the developed concept they need to be revisited in order to establish internal validity through a conceptual iteration before in a further step the concept is evaluated empirically by industrial experts (cf. Chapter 8). This is done by iteratively confronting the study's analytical generalisations with the observed phenomena in form of the validated propositions to determine what the concept does explain and where it does not hold the explanatory power. The results are shown in Table 7.5.

| Proposition | Theoretical perspective | Conceptual framework |
|---|---|---|
| #16, #26, #27, #28, #30 | Competence theory<br>Relational view | A company is conceptualised as nexus of *autonomous enterprise modules* that consist of task specific competences and relationship specific interface capabilities that help to deploy the competencies within *collaborative activities* of the *enterprise* and eventually develop new competencies via their absorptive capacity **(cf. section 7.1.1.).** |
| #32, #33, #34, #35 | Industrial organisation theory<br>Competence theory | Competence deployment in *collaborative activities* leads to competitive advantage of the whole *enterprise* and the individual *value members* alike **(cf. section 7.1.1.).** |
| #7, #13, #16, #23 | Total system optimisation<br>Value stream concept | Enterprise matrix conceptualises a *collaborative activity* as value stream of tasks and activities that is covered by *value members*. Thereby it serves as tool for regulating deployment of competencies (via enterprise modules) in *collaborative activities*, i.e. linking competencies of value members, by focusing on the effective combination of most suitable competencies and the exchange of related technical knowledge to optimise the competitiveness of *collaborative activity* and hence the whole *collaborative enterprise* **(cf. section 7.1.2.).** |
| #5, #9, #10, #12, #29 | Resource dependency theory<br>Competence theory | The value proposition of an *enterprise module* via its competence attributes determines the number and degrees of involvement of a value member in *collaborative activities* via the *engage-ability* of its competencies. This is also dependent on the respective stage of the value stream within the *collaborative activity* the competence is delivered to **(cf. sections 7.1.2. and 7.1.3.).** |
| #1, #2, #5, #6 | Competence theory<br>Contingency theory<br>TCE | The selection of an appropriate governance mode for a specific dyadic relationship within a *collaborative activity* is contingent upon the *engage-ability* of the competence that is influenced by exogenous (external to relationship) and endogenous (internal to relationship) factors but is also dependent on the strategic choice of the decision maker, i.e. *enterprise governor* **(cf. section 7.1.3.).** |
| #6, #14, #15, #20, #21, #25 | Resource dependency theory<br>Interaction model of IMP Group | The *enterprise* requires a distinct leader, i.e. *enterprise governor*, that possess the *meta-competence* of evaluating the *enterprise modules* of the *value members*, allocating suitable modules and their competencies to respective stages and tasks of the value stream, and defining the responsibilities of and boundaries between the *value members* (*enterprise design*). The actual *enterprise management*, however, can be delegated to a *value member* that possesses the necessary competencies **(cf. section 7.1.2.).** |
| (#3), (#4), #22, #23, #24 | Strategic sourcing<br>Relational view | *Collaborative Enterprise Governance* suggests to adopt strategic sourcing practices based on strategic and long-term thinking for the whole *enterprise* especially at early stages of the development process which is crucial to the success of the whole *collaborative activity*. This generates relational rents in form of competitive advantage without adversarial pressure through effective collaboration **(cf. section 7.1.2.).** |
| #8, #11, #17, #18, #19, #31 | Contingency theory<br>Complexity theory<br>TCE | A portfolio of constantly re-configuring relationships (evolutionary enterprise life cycle) is suggested in order to be adaptive to changing industrial and relationship requirements and at the same time minimise commercial risk, i.e. simultaneously exploit advantages of stable and flexible relationships **(cf. section 7.1.4.).** |

**Table 7.5: Revisiting the validated propositions**

The comparison of the propositions and the conceptual framework in Table 7.5 suggests that the derived and validated propositions on the subject of sustainable governance of inter-firm R&D relationships in the German automotive industry can be thoroughly explained by the developed concept of *Collaborative Enterprise Governance*. However, for the purpose of methodological rigor it needs to be mentioned that the support for internal validity is somewhat limited because the concept has been developed in the specific context of inter-firm R&D collaboration in the German automotive industry and hence the development of the concept was influenced by the specific empirical constellations that existed in the empirical sample.

On a more abstract level the concept of *Collaborative Enterprise Governance* can fulfil two purposes. *Firstly*, it can be used for *ex post* analytical reasons in order to analyse the relationship and sourcing strategy in inter-firm relationships. Thereby, it helps to evaluate the success of different sourcing approaches. *Secondly*, it can serve as *ex ante* model to determine the appropriate relationship strategy for decision making in inter-firm (R&D) collaboration. A structured model of *Collaborative Enterprise Governance* for potential future testing is suggested in Figure 7.6.

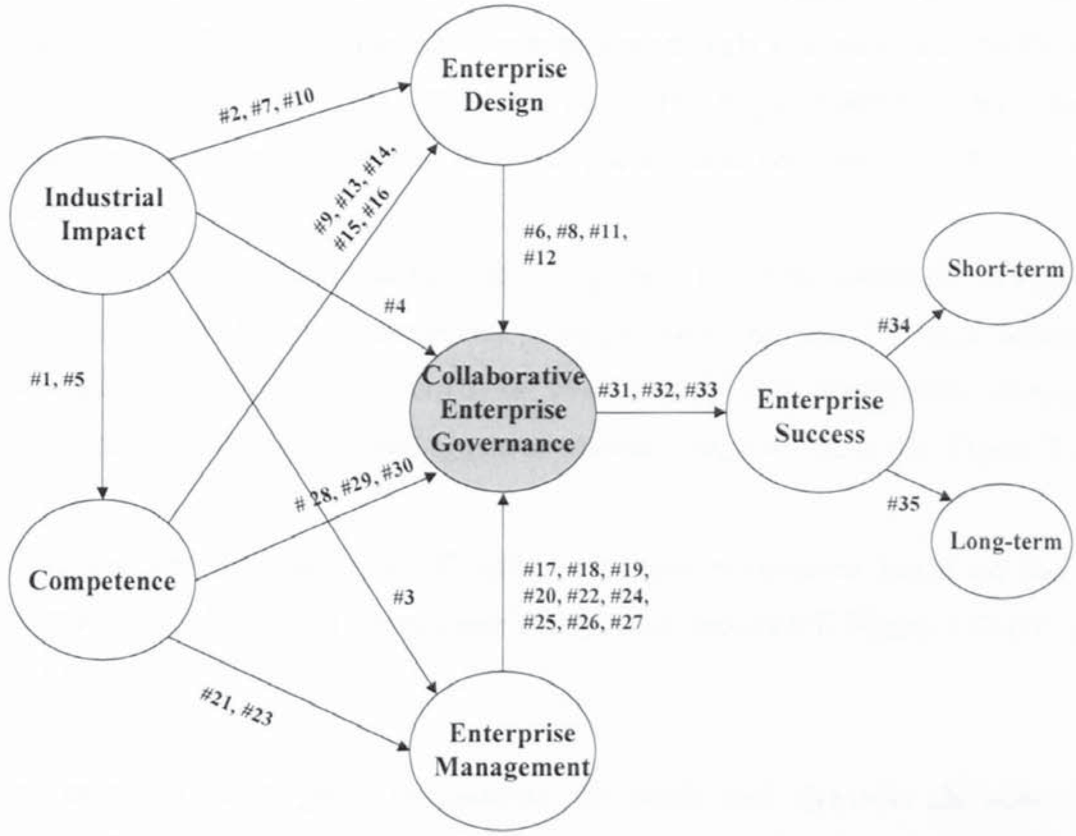


**Figure 7.6: A structured model of Collaborative Enterprise Governance**

### 7.4. Summary

This chapter is the logical consequence of the discussion in Chapter 6 and forms the ultimate goal of this research to present a comprehensive concept that can address the empirical observations and challenges in inter-firm relationship governance. This was accomplished by the development of the concept of *Collaborative Enterprise Governance* with the following key characteristics:

- Individual companies are conceptualised as a nexus of autonomous *enterprise modules* that deliver competencies to *collaborative activities* in *collaborative enterprises* thereby combining issues of internal and external coordination (cf. section 7.2.1.).
- The coordination of *collaborative activities* is facilitated by the *Enterprise Matrix* tool (cf. Figure 7.1) that helps to combine the most suitable *value members* along the *value stream* of the *collaborative activity* (cf. section 7.2.2.).
- The decision of involvement in a *collaborative activity* of an *enterprise* depends on the *engage-ability* of the respective competencies of the *value members*. Thereby, the selection of an appropriate inter-firm governance structure, i.e. *enterprise structure*, is contingent upon three main competence attributes (transferability, attractiveness and maturity) (cf. Table 7.3). These has been parsimoniously summarised in the *Enterprise Reference Grid* (cf. Figure 7.2) identifying three major *enterprise structures*, i.e. *autonomous enterprise*, *partner enterprise*, and *linked enterprise* (cf. Table 7.2) (cf. section 7.2.3.).
- The structures and their related relationships are, however, constantly changing and reiterating (*Evolutionary Enterprise Configuration*) in order to stay adaptive to changes of exogenous (external to relationship) and endogenous (internal to relationship) requirements and hence to sustain competitiveness (cf. Figure 7.3) (cf. section 7.2.4.).
- This requires a dynamic and flexible *enterprise governance* based on the active contingency planning of controllable endogenous factors (cf. Figure 7.4) (cf. section 7.2.5.).

Empirical examples were given to illustrate the static and dynamic elements of the *Collaborative Enterprise Governance* concept explaining how and why *enterprise structures* change (cf. Table 7.4). This was finally merged into a potted account of how the elements of the concept should be applied in a step-by-step approach (cf. Figure 7.5) before the propositions were revisited by iteratively confronting them with the developed framework to establish internal validity through adhering to methodological rigor (cf. Table 7.5). This facilitated the next step of empirically evaluating the concept with industrial experts in the following Chapter 8.

# 8. PRACTICAL IMPLICATIONS

> *"It's not a panacea, but collaboration can be the differentiator that gives one supply chain the edge over another"* (Forger, 2000; p. 97)

In the previous Chapter 7 a novel conceptual contingency framework was presented in the context of the *Collaborative Enterprise Governance* concept. It is embedded in the empirical context of R&D collaboration in the German automotive industry (cf. Chapter 2) and tries to close the identified gap between theory and practice in this area (cf. Chapters 3 and 6) through theory extension based on insights gained from extensive empirical field work (cf. Chapter 5).

However, one aspect of inter-firm relationship governance remains uncovered: its impact on sustainable competitive success. This involves the identification of the usability and practicality of the developed concept and its impact on the success of the whole partnership, i.e. *enterprise*, and its *value members*. This was pursued by conducting a focus group in form of an industrial workshop with experts from the German automotive industry.

Therefore, this chapter is structured as follows: the following section 8.1. briefly outlines the background and context of the conducted focus group. Section 8.2. describes the identified and suggested implications of applying *Collaborative Enterprise Governance* to R&D projects and inter-firm relationships on their competitiveness and success. This is followed by an exploration of the emerging challenges for OEMs and suppliers that arise in the context of *Collaborative Enterprise Governance* (section 8.3.) before the main aspects of this chapter are summarised in the final section 8.4.

## 8.1. Focus group with industrial experts

During the focus group session the basics of the developed conceptual framework (cf. Chapter 7) were presented to the five participating experts (cf. Chapter 4) in a pragmatic and practical way avoiding academic parlance as far as possible. In particular, the main elements of *Collaborative Enterprise Governance*, such as *Enterprise Module* (cf. section 7.2.1.), *Enterprise Matrix* (cf. section 7.2.2.), and *Enterprise Reference Grid* (cf. section 7.2.3.) and their step-by-step application (cf. Figure 7.5 in Chapter 7), were explained in the context of

R&D collaboration in the automotive industry and its applicability and usefulness in terms of creating competitive advantage was discussed.[35]

The discussion lasted for about three hours and was tape recorded resulting in 20 pages of transcript that were validated and approved by all participants (see Appendix H for consent form of focus group). Similar to the interviews the analysis of the transcript was done using the QSR NVivo 2.0™ software tool (cf. Chapters 4 and 5). However, no strict coding procedure was applied and no comprehensive Coding Diagram and Coding Master Table were created. For the purpose of a validation of the conceptual framework and its practical implications a rather pragmatic and less structured analysis of the focus group was considered sufficient. Nevertheless, reference to the focus group will be made during this chapter whenever appropriate.

## 8.2. Implications for sustainable competitive success

Based on the empirical findings and their validation (cf. Chapter 5), the author of this study argues that applying *Collaborative Enterprise Governance* to the management of inter-firm R&D projects and their relationships leads to a sustainable competitive success not only for the project, i.e. *collaborative activity*, and the relationship, i.e. *enterprise*, but also for its individual partners, i.e. *value members*, (cf. propositions #32 and #33). However, one of the biggest problems in this context is the actual measurement of the performance of R&D projects, because it is difficult to allocate all costs and benefits to the inter-firm R&D project and its partners properly. Therefore, Otto and Kotzab (2003) suggest to base the performance measurement on reaching goals rather than on making profit, i.e. on effectiveness rather than efficiency of R&D projects.

The literature on 'competitive priorities' (e.g. Corbett and Van Wassenhove, 1993; Hult *et al.*, 2006; Mohr and Spekman, 1994) suggests that three performance measures can be directly linked to the success of inter-firm R&D relationships on the project level: *time*, *quality* and

[35] In this context the conventional automotive term 'frontloading' was sometimes used interchangeably with *Collaborative Enterprise Governance*. It describes "a strategy that seeks to improve development performance by shifting the identification and solving of (design) problems to earlier phases of a product development process" (Thomke and Fujimoto, 2000; p. 132). However, in contrary to these authors who focused on the early and quick solution of problems during the product development of a *single* company, the approach used in this study extends the idea to the *inter-firm* level of problem solving in co-development within inter-firm R&D relationships.

*cost* which was empirically and scholarly supported (cf. discussion on relationship success in section 6.5. in Chapter 6).

Hence, sustainable competitive success through the application of *Collaborative Enterprise Governance* can be defined as a function of time, quality and cost, i.e. the overall effectiveness goals are to reduce development time, minimise errors, and realise target costs through the application of *Collaborative Enterprise Governance* and its conceptual tools in managing *collaborative activities* in an *enterprise*.

This was extensively discussed during the focus group. The expressed opinions and suggestions of the industrial experts that are involved in inter-firm R&D collaboration between OEMs and suppliers on a day-to-day basis led to a comparison between the still prevailing adversarial practice towards R&D collaboration and the proposed *Collaborative Enterprise Governance* approach and their impact on the three competitive priorities (time, cost, quality) along the product development process. This resulted in a trend figure shown in Figure 8.1 that is based on qualitative and anticipative assumptions of the focus group participants (based on their individual experience) and hence does not reflect an exact and verified shape of the related time, cost and quality curves.

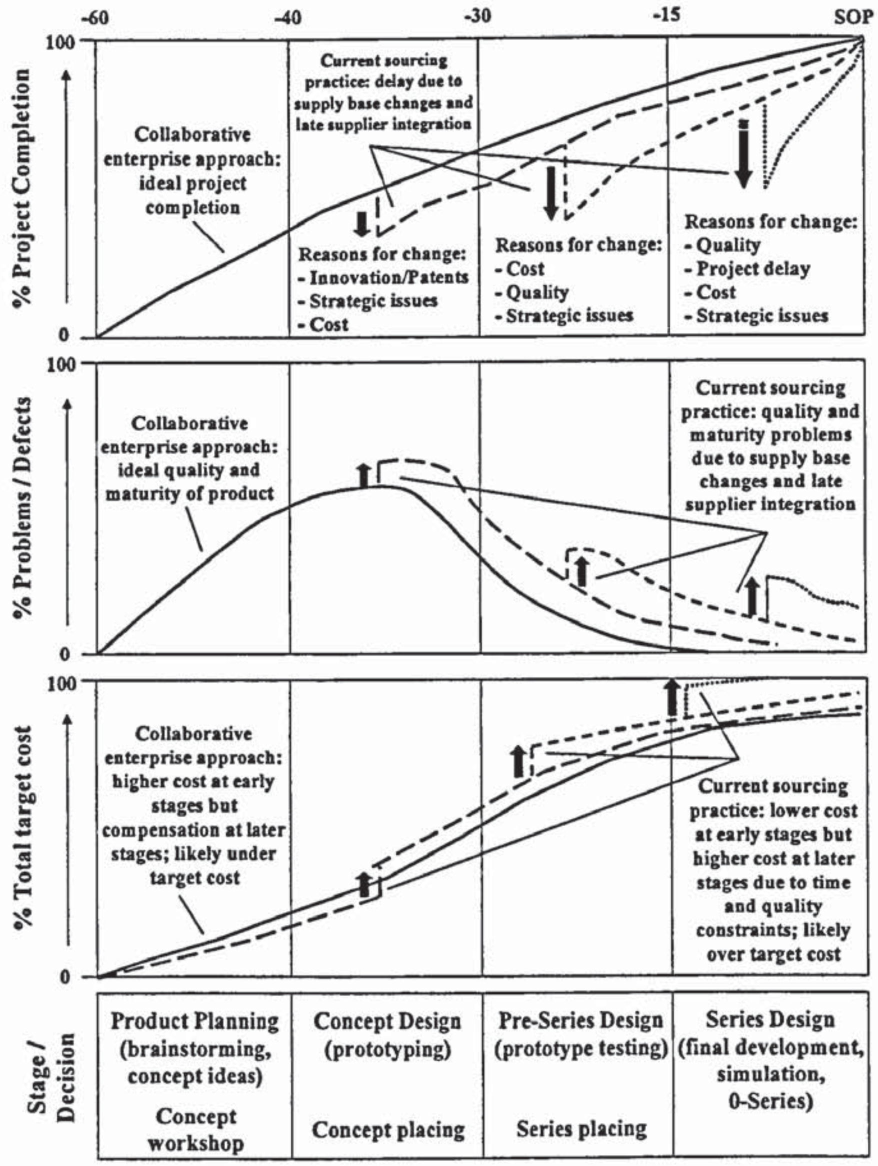


**Figure 8.1: Impact of *Collaborative Enterprise Governance* on time, quality and cost of R&D projects**

*Time* is described in % project completion, *quality* is described in % problems / defects, and *cost* is described in % total target cost. Figure 8.1 depicts that often necessary changes in the supply base, i.e. switching suppliers, due to a supplier selection based on short-term orientated cost criteria rather than long-term orientated total value creation, a late and insufficient involvement of suppliers in the development process, and a lack of open communication and information sharing (characteristics of the still prevailing sourcing practice) have a negative impact on the competitiveness of the R&D project and its relationship. This is due to emerging time delays, quality and maturity problems and higher cost to compensate for these problems and unplanned changes in order to still meet the start of production (SOP) deadline. Thereby, the later the changes take place the more severe the impact will be (symbolised by the length of the arrows in Figure 8.1). Furthermore, it became evident during the focus group session that the reasons for supplier switches change as the project moves along the development stages: "whereas during the early concept stages technology and innovation issues are drivers for supplier switches, in the later stages quality and time issues are more important" (Specialist Engineer Design Car Body, OEM)*. Paradoxically, this increases the dilemma of time delays, quality problems and cost increase leading to a vicious circle of supplier switches and R&D effectiveness.

This supports the empirically grounded argument of this research that establishing and institutionalising inter-firm collaboration, e.g. through *Collaborative Enterprise Governance*, is an effective means to reduce costs and development time of R&D projects in the short-term as well as to improve quality and innovation output in the long-term, not only for the individual *value member* but also for the whole *enterprise* (cf. propositions #32, #33, #34 and #35). Major aspects that facilitate this causality, thereby confirming and building on key features of *Collaborative Enterprise Governance*, were identified by the industrial experts in the focus group as:

- Quick and early problem solving through early collaboration (cf. proposition #22)

  *"We agree that errors occur early during the development stages and that if you work well at these stages you will get the benefit at the end. However, this is hard to measure and hence difficult to argue"* (R&D Director, Module supplier).*

- Less opportunistic behaviour off all partners through mutual safeguards and strategic thinking (cf. proposition #24)

  *"The supplier accepts the target price which the OEM has calculated in his cost estimation. Therefore, the supplier is involved from the beginning and has a certain planning stability"* (R&D Director, Module Supplier).*

- Risk and reward sharing (cf. proposition #32)

  *"You will be more likely to invest into a new product line if you have an OEM in the background that wants to this together with you"* (Group Leader Design, Systems Supplier).*

  *"Often you have a competent partner that is not necessarily lean, i.e. there is a potential for mutually optimising processes and structures. The savings should then be equally shared"* (Specialist Engineer Design Car Body, OEM).*

- Increased communication and information sharing (cf. proposition #13)

  *"In product development it is the question how to get the knowledge to the supplier. Thereby, trust as well as open and constant communication are the key factors to achieve this. Only then both parties will benefit"* (Specialist Engineer Design Car Body, OEM).*

- No switching cost through competent leadership (cf. proposition #14)

  *"Experience shows that our current approach is normally very expensive, because you have to re-negotiate for unplanned changes, eventually switch suppliers shortly before SOP, develop new tooling, change concepts, etc. This could be avoided with such a collaborative approach. But therefore we need to move away from being multi-project managers and become engineers again"* (Manager Project Integration, OEM).*

- Joint definition of product and process specifications with clearly defined responsibilities (cf. proposition #25)

  *"For a long-term partnership it is important that you clearly define the component and its functionality. Then, you need to transfer this information to the supplier and integrate the supplier in the development of the detailed specification and task catalogue for this part"* (Manager Design Car Body, OEM).*

- Convergent expectations and goals through holistic thinking (cf. proposition #24)

  *"Of course we transfer the quality requirements of the OEMs onto our sub-suppliers because only then the quality of the final product can be assured"* (Group Leader Design, Systems Supplier).*

- Higher responsiveness through strong integration (cf. proposition #22)

  *"When we worked on the Z8 with BMW we had to change the position of the lock in the very last minute. This did only work out in the end because we had a good and close working relationship with BMW"* (Group Leader Design, Systems Supplier).*

Similar aspects in the context of general benefits of good collaboration practice in inter-firm relationships and co-development projects can be found in the existing literature (e.g. Dyer and Singh, 1998; Maloni and Benton, 2000; Mohr and Spekman, 1994; Primo and Amundson, 2002).

## 8.3. On the road to Collaborative Enterprise Governance

However, this focus group exercise confirmed results from the previous empirical steps, i.e. interviews and questionnaire survey, that the majority of companies in the German automotive industry are not thinking in dimensions reflecting a *Collaborative Enterprise Governance* (cf. proposition #3). Hence, a main issue of this round with experts was to identify ways to break out of this current vicious circle and travel along the road to a more partnership-focused collaborative approach as suggested in *Collaborative Enterprise Governance*. Based on the insights gained a list of commandments for OEMs and suppliers to consider in the future was put together. It was argued by the participants that addressing these points is crucial in order to be prepared for adopting and applying collaborative approaches like *Collaborative Enterprise Governance*. Many of these aspects were identified in this research as positive facilitators for collaboration (cf. Appendix J; coded category: *Positive Collaboration Facilitators*) conceptualised in the context of relational interface capabilities of an *enterprise module* (cf. Table 7.1). Similar, although more general, suggestions can be found in the inter-firm relationship literature (e.g. Ballou *et al.*, 2000; Handfield and Bechtel, 2002; Swink and Mabert, 2000).

***For OEMs***

- Commitment to suppliers

  An early and long-term commitment (ideally with guaranteed return business for suppliers over vehicle life time) will allow for long term planning of suppliers and in return will lead to higher ownership commitment towards cost, quality and innovation.

- Open book accounting

  The target price of each product should include a mutually agreed profit margin for the suppliers that is assured and that is not affected by any re-negotiations for unplanned changes.

- Life cycle costing

  OEMs need to start thinking strategically in terms of the whole life cycle costs of a product rather than just the short-term R&D costs upfront.

- Open communication and information sharing

  Not only design data in form of drawings and CAD data should be shared with the suppliers but also time schedules for development and production processes, production volume data, etc. in order to allow the supplier to get a bigger picture of all the aspects involved.

- Leadership

  OEMs need to pursue the role of the leader and coordinator within inter-firm R&D projects with the clear authority of final decision making. Therefore, they need to increase the speed and quality of their decision making to ensure a more effective and efficient project and interface management.

- Balancing internal and external know how

  As collaboration (especially within the R&D process) is based on the exchange of technical know how, it is inevitable that the OEMs build up a sufficient level of product specific technical competencies (not only relationship specific social competencies) in order to manage the interfaces between the partners and their know how effectively.

- Balanced supply base

  For their sourcing strategies OEMs need to take into consideration product attributes (e.g. complex system, standard commodity, innovative and differentiating product, etc.) as well as supplier attributes (e.g. R&D competence, high quality, low cost, etc.) when selecting an appropriate supplier for collaboration leading to a balanced supply base for different types of constellations and requirements.

- Customer focus

  OEMs need to be aware of customer needs and requirements and have to translate these into technical functionalities and specifications for the suppliers in order to develop innovative products that also fulfil generic category benefits at important customer interfaces, i.e. areas that matter to the customer.

- Boundary spanning

  It can be argued that transforming the traditional role of purchasing into a more strategic sourcing function might not be sufficient to achieve real cross-boundary collaboration but that a dedicated alliance function acting as a 'Ombudsman' (Handfield and Bechtel, 2002) between OEM and suppliers is necessary. This does not necessarily need to be a single person but could involve an independent cross-functional and inter-firm R&D committee of OEM and suppliers.

***For Suppliers***

- Ownership

  Suppliers are required to take more ownership in the product development and play a more active role during in inter-firm R&D projects, e.g. through investments in testing and tooling (customer-specific assets), active commitment towards quality goals, meeting negotiated requirements such as target price, etc.

- Offer exclusivity
  In return for early and long-term commitment with potential return business of the OEM (see above) the supplier should offer the OEM exclusive rights to the innovation and not aim at standardising this part among as many OEMs as possible.

- Organisational adaptation
  Suppliers need to adjust their organisational structure and processes to be adaptive to the increased requirements of inter-firm R&D relationships, particularly on the systems and module level (e.g. creation of customer specific key account management).

- Sub-supplier management
  Because inter-firm R&D collaboration is increasingly carried out on the more complex systems and module level and these suppliers (especially 1$^{st}$ tiers) do not possess the competence for all sub-parts in-house they need to develop skills (relationship-specific assets) for effectively and efficiently managing their sub-suppliers in accordance to the overall project requirements.

- Information sharing
  Same as for the OEMs above suppliers also need to be willing to share their information (especially cost information) with the OEMs in a transparent manner.

- Total process partner
  Suppliers should increase their efforts to identify future technological trends and developments (independent from the OEMs) based on end consumer desires and requirements.

- Physical proximity
  Local or regional presence and proximity to the OEM can facilitate face-to-face contact in critical phases of R&D projects.

The fundamental root of all this is the development of trust in each other to safeguard the transactions from opportunistic behaviour of the individual partners (e.g. Dyer, 1996c; Johnston *et al.*, 2004; Monczka *et al.*, 1998). Both sides need to overcome bad experiences from the past and move on in an unbiased and unprejudiced way (*tabula rasa*). Furthermore, the German automotive industry on the macro level needs to focus on high technology and innovation rather than price dumping which should be reflected in the business behaviour within and between firms, e.g. through the adoption of *Collaborative Enterprise Governance* which was suggested to be most effective for complex and innovative products rather than standard commodity parts by the industrial experts. However, it has been argued elsewhere (Binder and Gust, 2006) that although the terminology reflecting *Collaborative Enterprise Governance*, e.g. frontloading, is commonly used in the German automotive industry, the underlying philosophy is not widely recognised. Hence, it is inevitable that aspects of partnerships and collaborative inter-firm relationships are considered more thoroughly in the future in order to remain and become competitive.

## 8.4. Summary

This chapter reported on the validation of the implications of *Collaborative Enterprise Governance* on the sustainable competitive success of *enterprises* and their *value members* through a focus group exercise with industrial experts from the German automotive industry. The background of this exercise was described (section 8.1.) and its impact on sustainable competitiveness indicated (section 8.2.). It revealed that the use of *Collaborative Enterprise Governance* to design *enterprises* and manage their *collaborative activities* between the *value members* can lead to the realisation of sustainable competitive success in terms of faster development time, higher quality, and lower development cost in R&D projects. Nevertheless, current practice in the German automotive industry is still not reflecting the idea of *Collaborative Enterprise Governance* and is hence facing major challenges on its way to a distinct European governance model based on partnership-focused collaborative relationships (cf. Table 2.1. in Chapter 2). Various commandments have been suggested to help *enterprise governor*s and *value members* (i.e. OEMs and suppliers) on their way to a *Collaborative Enterprise Governance* philosophy (section 8.3.).

# 9. CONCLUSIONS

*"If a qualitative study is rigorously done, I suspect that it is more likely to yield important discoveries than a quantitative study, if for no other reason than this: qualitative researchers often discover something because they usually approach topics with little clue as to what they'll find"* (Barley, 2006; p. 19).

The aim of this final chapter is to provide the big picture of this research study. Therefore, in section 9.1. the logical stream of argumentation and the resulting findings of this research will be summarised. In the subsequent section 9.2. the novel contribution of this research in terms of three generic dimensions (theoretical, methodological, empirical) is discussed before the limitations of this study and the resulting future research issues are outlined in sections 9.3. and 9.4.

## 9.1. Thesis summary

This study focuses on the fundamental choice of how to create sustainable competitive success. The required competencies, however, are usually not existent under one single roof and hence need to be developed either internally or externally via M&A or collaboration. It is this latter form of governance, a rather intermediate or hybrid form between pure market mechanisms and vertical hierarchies, that gains increasing attention within the business world for various reasons (cf. Chapter 1). This implies that companies must adopt a new way of looking at integration and coordination of inter-firm relationships with suitable collaboration partners.

This was embedded in the empirical context of inter-firm R&D collaboration in the German automotive industry for two main reasons (cf. Chapter 1 and 2): *first*, the German automotive industry occupies an exemplary role within the global car industry because its cars can be seen as a main potential driver for technological and managerial innovation which, however, involve complex design and engineering skills that only can be produced through a network of specialists with complementary competencies; *second*, within the overall product life cycle (of a car) the special focus on R&D and product development is crucial due to its key role for the competitive advantage of the products in the marketplace (cf. Chapters 1, 2 and 8).

A review of the relevant inter-firm relationship literature (cf. Table 3.2 and Appendix A) revealed various gaps in the existing literature regarding a sustainable inter-firm relationship governance in terms of general issues such as unit of analysis, theoretical perspectives, methodology, and specific issues such as building and managing relationships and their outcomes and benefits (cf. section 3.2. in Chapter 3). Consequently, this led to the research aim of **developing a framework and practical guidelines on how to govern, i.e. design and manage, inter-firm relationships in a sustainable way to create a competitive advantage for the whole relationship and its individual members.** Thereby, the study focused on the dyadic buyer-supplier relationships in the context of the upstream supply network as unit of analysis of this study in order to provide a technological and innovative competitive advantage by leveraging the inter-firm relationship in R&D and product development with supplier firms; leading to the notion of strategic supply management. The study thereby took a dynamic network perspective concerned with the mechanisms through which inter-firm relationships are created and managed over time. This was embedded in an interdisciplinary body of knowledge involving disciplines such as Organisation Economics, Strategic Management, Organisation Science, Industrial Marketing Management and Purchasing & Supply Chain Management leading to the integration of their complementary theoretical perspectives in form of a grounding of the research in extant literature (cf. section 3.3 in Chapter 3).

Because of an identified lack of explicit and testable hypotheses the study adopted an exploratory nature by engaging in qualitative theory-building research using inductive Grounded Theory as advanced research method (cf. Chapter 4). In this context, several specific research objectives were identified to address the general purpose of sustainable inter-firm relationship governance in the German automotive industry:

- Explore the current practice of R&D collaboration within inter-firm relationships in German automotive industry
- Determine strategic factors and contingencies that influence the creation and management of inter-firm R&D relationships and the development and management of the related inter-organisational governance structure
- Determine operative practices and tools that influence R&D transactions and collaborative activities within inter-firm relationships

- Develop guidelines for achieving sustainable competitive success of inter-firm R&D relationships

The subsequent research process was designed to be consistent with the two key operations of Grounded Theory, constant comparison and theoretical sampling. It led to an empirical research process with four main phases (design, collection, coding and analysis, validation) and a triangulated design involving semi-structured interviews (N=28) for data collection and a self-administered questionnaire survey (N=110) and focus groups (N=2) for data validation purposes (cf. section 4.3.1. to 4.3.4 in Chapter 4) ensuring the quality of this research and its data (cf. section 4.4. in Chapter 4).

The coding and analysis of the interview data (45 hours and 300 pages transcript) was done by applying theoretical coding as structured and hierarchical coding paradigm involving open, axial and selective coding (cf. section 4.3.3. in Chapter 4 and Chapter 5). Subsequently, this led to the identification of five core categories related to inter-firm relationship governance (relationship status quo, relationship design, relationship management, relationship contingency, relationship success) that were summarised in a set of 35 tentative propositions to be validated in a second empirical phase using the questionnaire survey technique (cf. Chapter 5). Thereby, each proposition was assessed on two dimensions (agreement and importance) involving a five point Likert scale. This exercise proved the accuracy and reliability of the codification and analysis (all propositions were agreed on) and revealed the importance of the academic debate framed in this research study (all propositions were considered highly important) (cf. section 5.2. in Chapter 5). From an empirical point of view it also showed that inter-firm collaboration is generally regarded as an effective means to maintain and gain sustainable competitive success for the whole partnership and its members but that despite all agreement and importance current practice in the German automotive industry does not apply the necessary mechanisms for good practice collaboration.

This provided the ground for the confrontation of these emerging empirical findings with specific extant literature which is an important feature of hypothesis generating research that ultimately leads to theory extension (cf. Chapter 6). The basic inter-firm relationship literature to be enfolded by confrontation with the specific propositions on inter-firm R&D relationships in the German automotive industry (organised into the five core categories) consisted of a broad body of theoretical perspectives as identified in Chapter 3 and Appendix

A. The detailed discussion revealed that existing theories, models, concepts and frameworks lack of comprehensiveness in the context of inter-firm relationship governance and empirical observations could only be explained by drawing on a large and fragmented body of knowledge. In particular, current portfolio models do not consider value proposition (based on competence attributes and features) to be a contingency on which the dimensions of the portfolio matrix should be based, they do not establish the important link between product, process and supply structures, and also do not embed relationship management roles and activities for the dynamic execution of the relationship strategies of the portfolio. This created the necessity for developing a novel conceptual framework that merges these main elements of inter-firm relationship governance (i.e. design, management, and sustainable success) and their various theoretical perspectives into a compact and comprehensive model that is consistent with the empirical findings.

This led to the development of the novel concept of *Collaborative Enterprise Governance* based on a competence-based contingency framework (cf. Chapter 7). The main argument inherent in the concept is that within a *collaborative enterprise* (i.e. dynamic network of dyadic inter-firm relationships) different kinds of collaborative (buyer-supplier) relationships underpinned by appropriate inter-firm governance structures need to be established depending on the value proposition the individual partners make to the *collaborative enterprise*. This is contingent upon the fit between their prevailing competencies and the industrial (exogenous) as well as relationship (endogenous) environment which has been conceptualised as *engage-ability* of competencies based on their transferability, attractiveness and maturity (cf. Table 7.3 in Chapter 7).

Thereby, the conceptual contingency framework characterises different types of *enterprise structures* that are assumed to be built from *enterprise modules*, i.e. autonomous cross-functional units originating from the different collaborating partners (cf. Table 7.2 in Chapter 7). At the heart of each of these *enterprise modules* is a highly specific competence asset (a combination of technical, efficiency and social features) that is complemented by other less specific relationship assets (i.e. interface capabilities) that enable the competence to be used (i.e. engaged) effectively within the *collaborative enterprise* and its inter-firm projects (cf. Table 7.1 in Chapter 7). Four different types of *enterprise structures* and four different types of competencies have been parsimoniously characterised and a two-way dependency based on the *engage-ability* of the competence proposed between each respective pairing (cf. Figure 7.2 in Chapter 7). Competencies with:

- low current but high future *engage-ability* should be governed within *autonomous enterprise* structures
- high current and high future *engage-ability* should be governed within *partner enterprise* structures
- high current but low future *engage-ability* should be governed within *linked enterprise* structures
- low current and low future *engage-ability* should be governed within *defunct enterprise* structures.

This has been consolidated in a step-by-step approach of how to use the various elements of the concept to govern *collaborative activities* in *enterprises* (cf. Figure 7.5 in Chapter 7). This provided the basis for validating the applicability of the concept in practice (cf. Chapter 8). The key features and tools of the concept of *Collaborative Enterprise Governance* were presented to industrial experts of the German automotive industry in a focus group exercise in a more practical and pragmatic manner avoiding academic parlance as far as possible. The emerging discussion (three hours and 20 pages of transcript) resulted in the identification of the concept's impact on sustainable competitive success of inter-firm relationships, i.e. *enterprises*, and the individual partners, i.e. *value members*, showing that its application to the management of inter-firm R&D projects can lead to faster development time, higher quality, and lower development cost. However, since current practice in the German automotive industry does not apply *Collaborative Enterprise Governance* on a broad basis yet, various commandments have been suggested to help automotive *enterprise governors* and *value members* (i.e. OEMs and suppliers) on their way to a *Collaborative Enterprise Governance* philosophy.

Summarising, the conceptual foundations of *Collaborative Enterprise Governance* applied in this research are illustrated in Figure 9.1.

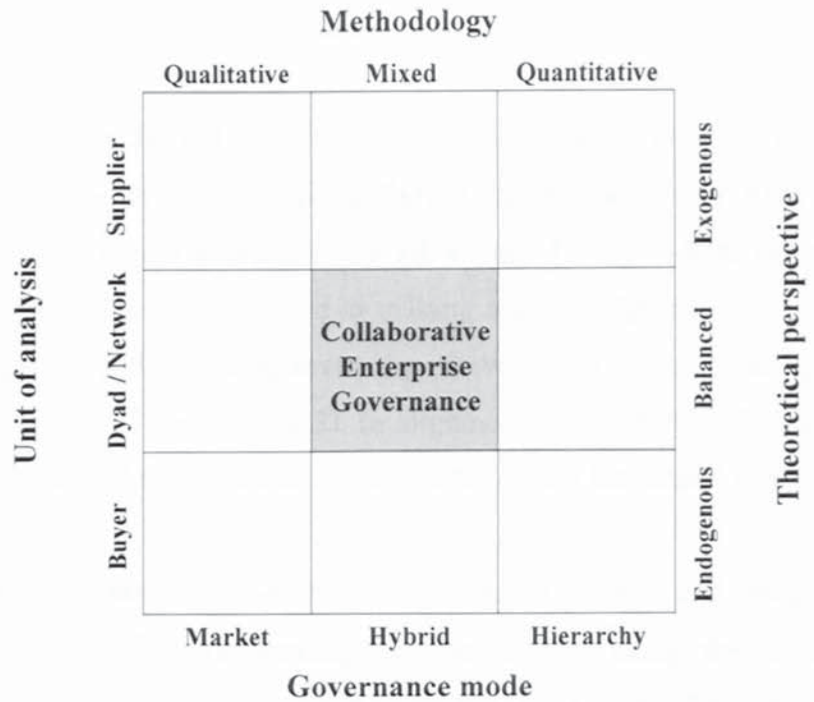


**Figure 9.1: Conceptual foundation of this research study**

Unit of analysis and governance mode issues were discussed formally in Chapters 1 and 3 of this thesis. The methodological concept was described in detail in Chapter 4 (with resulting empirical findings in Chapter 5). The theoretical perspectives were addressed in Chapter 3 and more specifically in Chapter 6 of this thesis. The concept itself and its practical implications have been described in Chapters 7 and 8.

## 9.2. Contribution to knowledge

This research study makes a contribution to three general knowledge areas. *Firstly*, due to its qualitative and inductive hypotheses generating nature it was able to extend existing theory on inter-firm relationship governance in a theoretical sense thereby supporting the establishment of strategic supply management as a normative academic domain. *Secondly*, through the sound use of Grounded Theory as research method this study makes a methodological contribution by establishing qualitative theory building research in the general field of Logistics and Operations Management. *Thirdly*, this research study makes an empirical contribution by offering guidelines to practitioners and decision makers in the automotive industry involved in inter-firm R&D collaboration on how to gain sustainable competitive success through the effective use of *Collaborative Enterprise Governance*.

### 9.2.1. Theoretical contribution

The main aim that was set out in this research study was to **develop a framework and practical guidelines on how to govern, i.e. design and manage, inter-firm relationships in a sustainable way to create a competitive advantage for the whole relationship and its individual members.** Thereby, it aimed at making a knowledge contribution in the specific area of **Strategic Supply Management** by drawing on a multi-disciplinary body of knowledge (cf. section 3.3. in Chapter 3). In alignment with the identified gaps in the extant literature (cf. section 3.4.) this research makes the following theoretical contributions:

- *Collaborative Enterprise Governance* presents a holistic and integrated concept of sustainable inter-firm relationship governance by using the dyadic relationship (embedded in its network context reflected by a joint R&D project) as unit of competitive analysis (total system optimisation) (cf. section 7.2.).
- *Collaborative Enterprise Governance* establishes the important link between product, process and supply structures by combining issues of SCM and Product Development Management based on the establishment of the *Enterprise Matrix* as tool to coordinate joint R&D projects (cf. section 7.2.2.).
- At the core of *Collaborative Enterprise Governance* lies a portfolio model for strategic sourcing at the early stages of R&D collaboration that builds on value based thinking by drawing on competencies as main contingency. Thereby, the contingent fit (i.e. *engage-ability*) between different types of governance modes for a relationship (i.e. *enterprise structures*) and different types of competencies of the partners in a relationship has been parsimoniously characterised and a two-way dependency (cf. section 7.2.3.).
- *Collaborative Enterprise Governance* introduces modular thinking by conceptualising an individual partner company as a set of autonomous cross-functional units (*enterprise modules*) that contain all necessary competencies to fulfill a certain task within a joint R&D project. It thereby combines issues of internal and external collaboration based on part-to-part rather than company-to-company connectivity (cf. section 7.2.1.).
- *Collaborative Enterprise Governance* considers dynamic aspects of adapting and reconfiguring relationship strategies and governance structures based on active execution of management roles and activities (cf. section 7.2.4. and 7.2.5.).

### 9.2.2. Methodological contribution

Although the use of qualitative theory building or hypothesis-generating approaches, such as Grounded Theory, get more accepted and acknowledged in the general Logistics and Operations Management discipline (examples can be found in: Ellram, 1996; McCutcheon and Meredith, 1993; Meredith, 1998), they are still not very widespread and rigorously applied which makes the sound use of Grounded Theory in this study a contribution in itself. Thereby, it helps to establish qualitative theory building research in the field. In this context Suddaby (2006) provides six common misconceptions of Grounded Theory against which this study and the use of the Grounded Theory method can be evaluated:

1. This study did not ignore the existing literature but rather used the identified themes and gaps (cf. sections 3.1. and 3.2 in Chapter 3) as guiding principles for the data collection and analysis procedure.
2. This study did not just present raw data but used a triangulated research design (cf. section 4.3.1. in Chapter 4) to ensure theoretical saturation. It engaged in a rigorous coding procedure (cf. Chapter 5) to ultimately bridge the abstract gap between the subjective experience of the actors and the generation of theoretical statements that lift the data onto a conceptual level (cf. section 5.1.5. in Chapter 5).
3. Despite the adherence to the theoretical coding paradigm the study also demonstrates theoretical sensitivity by abstracting from too a formulaic approach to data by including creative components more adaptable to the tacit elements of the data by producing a Coding Master Table (cf. section 5.1.4. in Chapter 5 and Appendix J).
4. Thereby this study claims to use Grounded Theory more in a pragmatic and adaptive sense (rather than in its purist form) as a practical approach to understanding complex social phenomena such as inter-firm relationships.
5. Although positivistic techniques such as word count or questionnaire survey were used in a complementary manner this study does not engage in methodological slurring using Grounded Theory for theory testing. It was rather appropriately embedded in the ontological paradigm of constructive realism (cf. section 4.1. in Chapter 4) drawing on a balanced epistemological approach (cf. section 4.2.3. in Chapter 4) using a triangulated research design (cf. section 4.3.1. in Chapter 4).
6. Finally, this study offers a very detailed and clear description of its research concept (cf. Chapters 4 and 5). Using Suddaby's (2006) words on what constitutes a good example of Grounded Theory:

*"The methods section states a research strategy in which the epistemological link between research question and methodology is clear. The process by which interview subjects were identified and selected is made transparent, as is the mode by which raw data were converted to conceptual categories. It offers sufficient detail in the data presented to create a sense of verisimilitude for the reader but also lifts the data by weaving ongoing interpretations, experience, and prior literature into a model. The study incorporates all of the key analytic tenets and procedures of grounded theory and, at the same time, demonstrates a high degree of theoretical sensitivity in the researcher."* (Suddaby, 2006; p. 641).

### 9.2.3. Empirical contribution

The empirical contribution of this research could be seen in the verification of the usability of the concept in industrial practice. It not only determined its positive effect on the competitiveness of partnerships and their individual members through the realisation of faster development lead time, higher quality and innovation, and lower overall development cost (cf. Figure 8.1) but also led to the development of specific guidelines for practitioners (OEMs and suppliers) on changes that need to be made in order to implement and apply the concept of *Collaborative Enterprise Governance* effectively (cf. section 8.3.).

## 9.3. Research limitations

The main limitation to this research is its cross-sectional character. The inter-firm R&D relationship aspects in the German automotive industry have been studied at certain discrete points of time which can only provide static snapshots rather than dynamic longitudinal insights. This particularly limits the causal predictions of the concept in the sense that no deterministic causality can be derived on how governance structures re-configure over time but only a probabilistic dependency can be proposed.

A second limitation can be seen in the focus on competence as single contingency factor for the governance of inter-firm relationships despite its virtue of parsimony. One implication of this is that there will be cases and instances in inter-firm relationship governance in which other factors, such as historically grown situations, capacity utilisation, political factors, etc., play a major role that cannot be explained by the contingency upon competencies. A second implication involves that the concept of *Collaborative Enterprise Governance* might only be applicable to cases where an increase in competitive advantage over-compensates the resulting increase in coordination efforts, such as complex and innovative products in technology and R&D driven industries.

A third limitation to this study can be seen in the nature of its empirical context and research sample. Because this research focused on the German automotive industry the data had to be collected in German language whereas the coding and analysis was done in English which can affect the validity and reliability of the research results. However, the author tried to diminish this limitation by adhering to a rigorous methodological approach in data collection and analysis, e.g. through the application of forward and back-translations of code examples and questionnaire by a bilingual peer.

A fourth and final limitation to this study involves the use of only a few key informants (mainly one or two) as representatives of the participating companies in the semi-structured interviews. This can pose a potential limitation in terms of the validity of the obtained data because potentially extreme subjective positions of individual interviewees are less likely to be balanced. However, this was partly neutralised by the validation of the propositions in a larger scale questionnaire survey (cf. Chapter 4 and 5).

## 9.4. Further research

One issue for future research resulting from the limitation discussed above is the generalisability of the developed concept. Further research is necessary to identify the transferability of the concept to other industries than automotive, to other organisational areas than R&D as well as to product and service settings that are less complex and innovative. In this context the structured model of *Collaborative Enterprise Governance* suggested in Chapter 7 (cf. Figure 7.6) could be used for further quantitative testing in other empirical contexts than automotive.

Another major issue is the resulting necessity for a longitudinal in-depth case study in the context of inter-firm R&D collaboration in the automotive industry for various good reasons. *Firstly*, through a comparative in-depth case study of two similar projects over the whole product life cycle it would be possible to identify and measure the performance benefits of a collaborative approach as opposed to the existing adversarial strategies (similarly to the study of Romano and Vinelli, 2001). In this context it is also necessary to develop a comprehensive measurement system, for example in form of a *collaborative governance indicator* to determine the efficiency of the inter-firm R&D relationship that is not only based on time, cost and quality issues. Existing frameworks for measuring supply chain performance lack of comprehensiveness and attention to R&D aspects. *Secondly*, an in-depth study of a particular dyadic relationship would allow for a richer and more detailed investigation of inter-firm relationships, e.g. identify characteristics of the bifurcation point for the re-configuration from one governance mode to the other or explore inter-operability issues of collaboration on a day-to-day basis that are facilitated by appropriate infrastructure elements (e.g. commercial, technological, etc.). *Thirdly*, the longitudinal aspect would enable the exploration and investigation of the human aspect of increased and more complex inter-firm relationship constellations, e.g. the change of OEM personnel from designer and developers to multi-project managers.

There is a necessity for more research on the dark side of relationships through the study of unsuccessful inter-firm relationships and related projects (similar to Anderson and Jap (2005) and Bruner and Spekman (1998)). Because people actually learn better through mistakes it might be sensible to draw on unsuccessful cases and show reasons for their failure in addition to guidelines on how to improve the situation in order to create awareness for the necessary ingredients of good and sustainable inter-firm relationships.

A final suggestion for further research is not just to focus on inter-firm relationships and *collaborative enterprises* with the OEM as focal firm, but also on those with big first tier suppliers as most strategically important member, i.e. leader of the *enterprise* (similar to Doran (2003) and Johnsen and Ford (2005)). As these suppliers are required to take on much more responsibility for managing supply logistics, design, and sub-assembly integration, they become extremely powerful actors in the automotive industry.

# REFERENCES


A.T. Kearney (2003), "Annual Automotive Study 2003", *Study*, Düsseldorf.

A.T. Kearney (2004), "Produktentwicklungsprozess als Schlüssel zur Kostenführerschaft" [Product development process as key to cost leadership], *Study*, Düsseldorf.

Afuah, A. (2000), "How much do your co-opetitors' capabilities matter in the face of technological change?", *Strategic Management Journal*, Vol. 21, No. 3, pp. 387-404.

Ahmadjian, C.L. and Lincoln, J.R. (2001), "*Keiretsu*, governance, and learning: case studies in change from the Japanese automotive industry", *Organization Science*, Vol. 12, No. 6, pp. 683-701.

Ahuja, G. (2000), "The duality of collaboration: inducements and opportunities in the formation of interfirm linkages", *Strategic Management Journal*, Vol. 21, No. 3, pp. 317-343.

Aitken, J., Childerhouse, P. and Towill, D. (2003), "The impact of product life cycle on supply chain strategy", *International Journal of Production Economics*, Vol. 85, No. 2, pp. 127-140.

Aldrich, H.E. (1979), *Organizations and Environments*, Prentice-Hall, Englewood Cliffs.

Ali, F., Smith, G. and Saker, J. (1997), "Developing buyer-supplier relationships in the automobile industry", *European Journal of Purchasing & Supply Management*, Vol. 3, No. 1, pp. 33-42.

Al-Mudimigh, A., Zairi, M., Ahmed, A.M.M. (2004), "Extending the concept of supply chain: the effective management of value chains", *International Journal of Production Economics*, Vol. 87, No. 3, pp. 309-320.

Amit, R. and Schoemaker, P.J.H. (1993), "Strategic assets and organizational rent", *Strategic Management Journal*, Vol. 14, No. 2, pp. 33-46.

Anderson, D.L. and Delattre, A.J. (2002), "5 predictions that will make you rethink your supply chain", *Supply Chain Management Review*, September-October, pp. 24-30.

Anderson, E. and Jap, S.D. (2005), "The dark side of close relationships", *MIT Sloan Management Review*, Spring, pp. 75-82.

Anderson, J.C., Hakansson, H. and Johanson, J. (1994), "Dyadic business relationships within a business network context", *Journal of Marketing*, Vol. 58, October, pp. 1-15.

Araujo, L., Dubois, A. and Gadde, L.-E. (1999), "Managing interfaces with suppliers", *Industrial Marketing Management*, Vol. 28, No. 5, pp. 497-506.

Argyris, C. (1979), "Using qualitative data to test theories", *Administrative Science Quarterly*, Vol. 24, No. 4, pp. 672-679.

Arthur D. Little (2005), "Wachstumsfinanzierung in der Automobilzulieferindustrie" [Growth investment in the automotive supplier industry], *Study*, Wiesbaden.

Ashby, W.R. (1958), "Requisite variety and its implications for the control of complex systems", *Cybernetica*, Vol. 1, No. 2, pp. 83-99.

Auerbach, C.F. and Silverstein, L.B. (2003), *Qualitative Data: An Introduction to Coding and Analysis*, New York University Press, New York.

Babbage, C. (1835), *On the Economy of Machinery and Manufacturing*, 4th ed., London, Reprint: 1971 New York.

Bain, J.S. (1956), *Barriers to New Competition*, Harvard University Press, Cambridge.

Baines, T.S. and Kay, G. (2002), "Manufacturing sourcing practices and relationships", *The International Journal of Logistics Management*, Vol. 13, No. 2, pp. 101-113.

Baines, T.S., Kay, G., Adesola, S. and Higson, M. (2005), "Strategic positioning: an integrated decision process for manufacturers", *International Journal of Operations & Production Management*, Vol. 25, No. 2, pp. 180-201.

Baines, T.S., Whitney, D.E. and Fines, C. (1999), "Manufacturing technology sourcing practices in the USA", *International Journal of Production Research*, Vol. 37, No. 4, pp. 939-956.

Baldwin, C.Y. and Clark, K.B. (1997), "Managing in an age of modularity", *Harvard Business Review*, September-October, pp. 84-93.

Baldwin, C.Y. and Clark, K.B. (2001), "Modularity after the crash", *Harvard Business School Working Paper*, No. 01-075, pp. 1-18.

Baldwin, C.Y. and Clark, K.B. (2006a), "Modularity in the design of complex engineering systems", in: Minai, A., Braha, D. and Bar Yam, Y. (Eds.), *Complex Engineered Systems: Science Meets Technology*, New England Complex Systems Institute Series on Complexity, Springer-Verlag, New York.

Baldwin, C.Y. and Clark, K.B. (2006b), "Where do transactions come from? A network design perspective on the theory of the firm", *Harvard Business School Working Paper*, No. 06-051, pp. 1-45.

Ballou, R.H., Gilbert, S.M. and Mukherjee, A. (2000), "New managerial challenges form supply chain opportunities", *Industrial Marketing Management*, Vol. 29, No. 1, pp. 7-18.

Barley, S.R. (2006), "When I write my masterpiece: thoughts on what makes a paper interesting", *Academy of Management Journal*, Vol. 49, No. 1, pp. 16-20.

Barney, J.B. (1991), "Firm resources and sustained competitive advantage", *Journal of Management*, Vol. 17, No. 1, pp. 99-120.

Barney, J.B. (1999), "How firm's capabilities affect boundary decisions", *Sloan Management Review*, Spring, pp. 137-145.

Barney, J.B., Wright, M. and Ketchen Jr., D.J. (2001), "The resource-based view of the firm: ten years after 1991", *Journal of Management*, Vol. 27, No. 6, pp. 625-641.

Barwise, P. and Meehan, S. (2004), "Don't be unique, be better", *MIT Sloan Management Review*, Summer, pp. 23-26.

Batchelor, J., Bates, H. and Croom, S. (2001), "Retaining architectural knowledge within automotive design chains", *International Journal of Automotive Technology and Management*, Vol. 1, Nos. 2/3, pp. 217-235.

Bates, H., Holweg, M., Lewis, M. and Oliver, N. (2007), "Motor vehicle recalls: trends, pattern and emerging issues", *OMEGA – The International Journal of Management Science*, Vol. 35, No. 2, 202-210.

Bauer, M.W. (2000), "Classical content analysis: a review", in Bauer, M.W. and Gaskell, G. (Eds.), *Qualitative Researching with Text, Image and Sound: A Practical Handbook*, 3rd ed., Sage, London, pp. 131-151.

Bayona, C., Garcia-Marco, T. and Huerta, E. (2001), "Firms' motivations for cooperative R&D: an empirical analysis of Spanish firms", *Research Policy*, Vol. 30, No. 8, pp. 1289-1307.

Beach, R., Muhlemann, A.P., Price, D.H.R., Paterson, A. and Sharp, J.A. (2001), "The role of qualitative methods in production management research", *International Journal of Production Economics*, Vol. 74, Nos. 1-3, pp. 201-121.

Beck, R.N. (1979), *Handbook in Social Philosophy*, McMillan, New York.

Becker, H.S. (1971), "Whose side are we on?", in: Filstead, W.J. (Ed.), *Qualitative Methodology: Firsthand Involvement with the Social World*, Markham Publishing, Chicago, pp. 15-26.

Becker, M.C. and Zirpoli, F. (2003), Organizing new product development: knowledge hollowing-out and knowledge integration – the Fiat auto case", *International Journal of Operations & Production Management*, Vol. 23, No. 9, pp. 1033-1061.

Becker, W. and Dietz, J. (2004), "R&D cooperation and innovation activities of firms – evidence for the German manufacturing industry", *Research Policy*, Vol. 33, No. 2, pp. 209-223.

Beckman, C.M., Haunschild, P.R. and Phillips, D.J. (2004), "Friends or strangers? Firm-specific uncertainty, market uncertainty, and network partner selection", *Organization Science*, Vol. 15, No. 3, pp. 259-275.

Benbasat, I., Goldstein, D.K. and Mead, M. (1987), "The case research strategy in studies of information systems", *MIS Quarterly*, Vol. 11, No. 3, pp. 369-386.

Bennett, D. and Dekkers, R. (2005), "Industrial networks of the future – a critical commentary on research and practice", *Proceedings of 12th International Annual EurOMA Conference*, Corvinus University, Budapest, 19-22 June, pp. 677-686.

Bensaou, M. (1999), "Portfolios of buyer-supplier relationships", *Sloan Management Review*, Summer, pp. 35-44.

Berlak, J. and Weber, V. (2004), "How to configure cyber chains via competence networks", *Business Process Management Journal*, Vol. 10, No. 3, pp. 291-299.

Bessant, J., Kaplinsky, R. and Lamming, R.C. (2003), "Putting supply chain learning into practice", *International Journal of Operations & Production Management*, Vol. 23, No. 2, pp. 167-184.

Bettis, R.A. (1998), "Commentary on 'Redefining industry structure for the information age' by J.L. Sampler", *Strategic Management Journal*, Vol. 19, No. 4, pp. 357-361.

Binder, M. and Clegg, B.T. (2005a), "The modular enterprise: a new governance architecture for inter-firm collaboration", *Proceedings of the 12th International Annual EurOMA Conference*, Corvinus University, Budapest, 19-22 June, pp. 1385-1394.

Binder, M. and Clegg, B.T. (2005b), "Partial Evolutionary Multiplicity: an approach to managing the dynamics of supply structures", *Proceedings of the 18th International Conference on Production Research*, Università di Salerno, Fisciano, 31 July – 4 August.

Binder, M. and Clegg, B.T. (2006a), "A conceptual framework for enterprise management", *International Journal of Production Research*, Vol. 44, Nos. 18/19, pp. 3813-3829.

Binder, M. and Clegg, B.T. (2006b), "Enterprise Management: a collaborative approach to managing modern supply networks", *Proceedings of the 17th Annual Conference of Production & Operations Management Society*, Boston, 28 April – 01 May.

Binder, M. and Clegg, B.T. (2007), "Enterprise management: a new frontier for organisations", *International Journal of Production Economics*, (in press).

Binder, M. and Gust, P. (2006), "Gastkommentar: Als Partner auftreten - nachhaltige Erfolge in der automobilen Wertschöpfungskette erreichen" [Guest commentary: Appear as partners - achieving sustainable success in automotive supply networks], *ZulieferMarkt*, October 2006, p. 10.

Bititci, U.S., Martinez, V., Albores, P. and Mendibil, K. (2003), "Creating and sustaining competitive advantage in collaborative systems: the what and the how", *Production Planning & Control*, Vol. 14, No. 5, pp. 410-424.

Bititci, U.S., Martinez, V., Albores, P. and Parung, J. (2004), "Creating and managing value in collaborative networks", *International Journal of Physical Distribution & Logistics Management*, Vol. 34, Nos. 3/4, pp. 251-268.

Blaikie, N. (2003), *Analyzing Quantitative Data*, Sage, London.

Blankenburg Holm, D., Eriksson, K. and Johanson, J. (1999), "Creating value through mutual commitment to business network relationships", *Strategic Management Journal*, Vol. 20, No. 5, pp. 467-486.

Blomqvist, K., Hara, V., Koivuniemi, J. and Äijö, T. (2004), "Towards networked R&D management: the R&D approach of Sonera Corporation as an example", *R&D Management*, Vol. 34, No. 5, pp. 591-603.

Boardman, J.T. and Clegg, B.T. (2001), "Structured engagement in the extended enterprise", *International Journal of Operations & Production Management*, Vol. 21, Nos. 5/6, pp. 795-811.

Boer, H. (2003), "Guest editorial: new challenges in operations management", *International Journal of Operations & Production Management*, Vol. 23, No. 10, pp. 1108-1113.

Boje, D.M. and Whetten, D.A. (1981), "Effects of organizational strategies and contextual constraints on centrality and attributions of influence in interorganizational networks", *Administrative Science Quarterly*, Vol. 26, No. 3, pp. 378-395.

Bonaccorsi A. and Lipparini, A. (1994), "Strategic partnerships in new product development: an Italian case study", *Journal of Product Innovation Management*, Vol. 11, No. 2, pp. 134–145.

Borys, B. and Jemison, D.B. (1989), "Hybrid arrangements as strategic alliances: theoretical issues in organizational combinations", *Academy of Management Review*, Vol. 14, No. 2, pp. 234-249.

Bowersox, D.J., Closs, D.J. and Stank, T.P. (2000), "Ten mega-trends that will revolutionize supply chain logistics", *Journal of Business Logistics*, Vol. 21, No. 2, pp. 1-16.

Bratzel, S. and Tellermann, R. (2006), "Automotive Performance 2005/2006", *Research Study,* FHDW Center of Automotive, Bergisch Gladbach.

Briscoe, G., Dainty, A.R.J. and Millet, S. (2001), "Construction supply chain partnerships: skills, knowledge and attitudinal requirements", *European Journal of Purchasing & Supply Management*, Vol. 7, No. 4, pp. 243-255.

Bruner, R. and Spekman, R. (1998), "The dark side of alliances: lessons from Volvo-Renault", *European Management Journal*, Vol. 16, No. 2, pp. 136-150.

Bryman, A. (2004), *Social Research Methods*, 2nd ed., Oxford University Press, New York.

Bullinger, H.-J., Auernhammer, K. and Gomeringer, A. (2004), "Managing innovation networks in the knowledge-driven economy", *International Journal of Production Research*, Vol. 42, No. 17, pp. 3337-3353.

Burgess, K., Singh, P.J. and Koroglu, R. (2006), "Supply chain management: a structured literature review and implications for future research", *International Journal of Operations & Production Management*, Vol. 26, No. 7, pp. 703-729.

Burns, T. and Stalker, G. (1961), *The Management of Innovation*, Tavistock, London.

Burrell, G. and Morgan, G. (1979), *Sociological Paradigms and Organisational Analysis,* Heinemann, London.

Burt, R. (1992), *Structural Holes: The Social Structure of Competition*, Harvard University Press, Cambridge.

Byrne, J.A. and Brandt, R. (1993), "The virtual corporation", *Business Week*, February 8, pp. 36 – 41.

Calabrese, G. (2001), "Editorial: Buyer-supplier partnerships in product development and innovation technology", *International Journal of Automotive Technology and Management*, Vol. 1, Nos. 2/3, pp. 161-168.

Camps, T., Diederen, P., Hofstede, G.J. and Vos, B. (2004), *The Emerging World of Chains and Networks: Bridging Theory and Practice*, Reed Business Information, Gravenhage.

Camuffo, A. (2001), "Rolling out a 'World Car': globalisation, outsourcing and modularity in the auto industry", *IMVP Working Paper*, available at: http://imvp.mit.edu/papers.

Cánez, L.E., Platts, K.W. and Probert, D.R. (2000), "Developing a framework for make-or-buy decisions", *International Journal of Operations & Production Management*, Vol. 20, No. 11, pp. 1313-1330.

Caniëls, M.C.J. and Gelderman, C.J. (2005), "Purchasing strategies in the Kraljic matrix – a power and dependence perspective", *Journal of Purchasing & Supply Management*, Vol. 11, Nos. 2/3, pp. 141-155.

Caputo, M. and Zirpoli, F. (2001), "A new organisation for supplier involvement in vehicle design: the Italian automotive industry case", *International Journal of Automotive Technology and Management*, Vol. 1, Nos. 2/3, pp. 301-320.

Caputo, M. and Zirpoli, F. (2002), "Supplier involvement in automotive component design: outsourcing strategies and supply chain management", *International Journal of Technology Management*, Vol. 23, Nos. 1/2/3, pp. 129-154.

Carr, A.S. and Smeltzer, L.R. (1999), "The relationship of strategic purchasing to supply chain management", *European Journal of Purchasing & Supply Management*, Vol. 5, No. 1, pp. 43-51.

Carter, C.R. (2005), "Purchasing social responsibility and firm performance: the key mediating roles of organizational learning and supplier performance", *International Journal of Physical Distribution & Logistics Management*, Vol. 35, No. 3, pp. 177-194.

Carter, C.R. and Jennings, M. (2004), "The role of purchasing in the socially responsible management of the supply chain: a structural equation analysis", *Journal of Business Logistics*, Vol. 25 No. 1, pp. 145-86.

Cassell, C. and Symon, G. (1994), "Qualitative research in work contexts", in Cassell, C. and Symon, G. (Eds.). *Qualitative Methods in Organizational Research: A Practical Guide*, Sage, London, pp. 1-13.

Chang, Y.-C. (2003), "Benefits of co-operation on innovative performance: evidence from integrated circuits and biotechnology firms in the UK and Taiwan", *R&D Management*, Vol. 33, No. 4, pp. 425-437.

Checkland, P. (1999), *Systems Thinking, Systems Practice*, Wiley, Chichester.

Chen, I.J. and Paulraj, A. (2004), "Understanding supply chain management: critical research and a theoretical framework", *International Journal of Production Research*, Vol. 42, No. 1, pp. 131-163.

Chen, I.J., Paulraj, A. and Lado, A.A. (2004), "Strategic purchasing, supply management, and firm performance", *Journal of Operations Management*, Vol. 22, No. 5, pp. 505-523.

Chen, K.S. and Chen, K.L. (2006), "Supplier selection by testing the process incapability index", *International Journal of Production Research*, Vol. 44, No. 3, pp. 589-600.

Chesbrough, H.W. and Teece, D.J. (1996), "Organizing for innovation: when is virtual virtuous?", *Harvard Business Review*, January – February, pp. 65-73.

Chiesa, V. and Toletti, G. (2004), "Network of collaborations for innovation: the case of biotechnology", *Technology Analysis & Strategic Management*, Vol. 16, No. 1, pp. 73-96.

Chiesa, V., Manzini, R. and Tecilla, F. (2000), "Selecting sourcing strategies for technological innovation: an empirical case study", *International Journal of Operations & Production Management*, Vol. 20, No. 9, pp. 1017-1037.

Child, J. (1972), "Organizational structure, environment, and performance: the role of strategic choice", *Sociology*, Vol. 6, No. 1, pp. 1-22.

Choi, T.Y. and Krause, D.R. (2006), "The supply base and its complexity: implications for transaction costs, risks, responsiveness, and innovation", *Journal of Operations Management*, Vol. 24, No. 5, pp. 637-652.

Choi, T.Y., Dooley, K.J. and Rungtusunatham, M. (2001), "Supply networks and complex adaptive systems: control versus emergence", *Journal of Operations Management*, Vol. 19, No. 3, pp. 351-366.

Christopher, M. (1992), *Logistics and Supply Chain Management: Strategies for Reducing Costs and Improving Services*, Pitman, London.

Christopher, M. (1998), *Logistics and Supply Chain Management*, Prentice Hall, Englewood Cliffs.

Cigolini, R., Cozzi, M. and Perona, M. (2004), "A new framework for supply chain management: conceptual model and empirical test", *International Journal of Operations & Production Management*, Vol. 24, No. 1, pp. 7-41.

Clegg, B.T. (2003), "The extended enterprise: a matrix framework for effective strategic operations management", *Proceedings of the 20th International Manufacturing Conference* (IMC 20), Cork Institute of Technology, Cork, September 3-5.

Clegg, B.T. and Binder, M. (2004), "New thoughts on changing enterprise structures: vertical, virtual and extended", *Proceedings of the 11th International Annual EurOMA Conference*, INSEAD, Fontainebleau, 27-29 June, Vol. 1, pp. 125-134.

Coase, R. (1937), "The nature of the firm", *Economica*, Vol. 4, pp. 386-405.

Cohen, W. and Levinthal, D. (1990), "Absorptive capacity: a new perspective on learning and innovation", *Administrative Science Quarterly*, Vol. 35, No. 1, pp. 129–152.

Colombo, M.G. (2003), "Alliance form: a test of the contractual and competence perspectives", *Strategic Management Journal*, Vol. 24, No. 12, pp. 1209-1229.

Cooper, M.C., Ellram, L.M., Gardner, J.T. and Hanks, A.M. (1997b), "Meshing multiple alliances", *Journal of Business Logistics*, Vol. 18, No. 1, pp. 67-89.

Cooper, M.C., Lambert, D.M. and Pagh, J.D. (1997a), "Supply chain management: more than a new name for logistics", *The International Journal of Logistics Management*, Vol. 8, No. 1, pp. 1-13.

Corbett, C. and Van Wassenhove, L. (1993), "Trade-offs? What trade-off? Competence and competitiveness in manufacturing strategy", *California Management Review*, Summer, pp. 107-122.

Cousins, P.D. (2002), "A conceptual model for managing long-term inter-organisational relationships", *European Journal of Purchasing & Supply Management*, Vol. 8, No. 2, pp. 71-82.

Cousins, P.D. and Crone, M.J. (2003), "Strategic models for the development of obligation based inter-firm relationships: A study of the UK automotive industry", *International Journal of Operations & Production Management*, Vol. 23, No. 11, pp. 1447-1474.

Cousins, P.D. and Spekman, R. (2003), "Strategic supply and the management of inter- and intra-organisational relationships", *Journal of Purchasing & Supply Management*, Vol. 9, No. 1, pp. 19-29.

Cousins, P.D. and Stanwix, E. (2001), "It's only a matter of confidence! A comparison of relationship management of Japanese- and UK non-Japanese-owned vehicle manufacturers", *International Journal of Operations & Production Management*, Vol. 21, No. 9, pp. 1160-1179.

Cousins, P.D., Lawson, B. and Squire, B. (2006), "An empirical taxonomy of purchasing functions", *International Journal of Operations & Production Management*, Vol. 26, No. 7, pp. 775-794.

Cox, A. (1996), "Relational competence and strategic procurement management", *European Journal of Purchasing & Supply Management*, Vol. 2, No. 1, pp. 57-70.

Cox, A. (2004), "The art of the possible: relationship management in power regimes and supply chains", *Supply Chain Management: An International Journal*, Vol. 9, No. 5, pp. 346-356.

Cox, A., Lonsdale, C., Watson, G. and Qiao, H. (2003), "Supplier relationship management: a framework for understanding managerial capacity and constraints", *European Business Journal*, Vol. 15, No. 3, pp. 135-145.

Coyne, K.P. (1986), "Sustainable competitive advantage – what it is, what it isn't", Business Horizon, January-February, pp. 54-61.

Crabtree, B.J. and Miller, W.L. (1999a), "Clinical research: A multimethod typology and qualitative roadmap", in: Crabtree, B.J. and Miller, W.L. (Eds.), *Doing Qualitative Research*, 2nd ed., Sage, Thousand Oaks, pp. 3-30.

Crabtree, B.J. and Miller, W.L. (1999b), "Using codes and code manuals: a template organizing style of interpretation", in Crabtree, B.J. and Miller, W.L. (Eds.). *Doing Qualitative Research*, 2nd ed., Sage, Thousand Oaks, pp. 163-178.

Creswell, J.W. (1994), *Research Design: Qualitative & Quantitative Approaches*, Sage, Thousands Oaks.

Croom, S., Romano, P. and Giannakis, M. (2000), "Supply chain management: an analytical framework for critical literature review", *European Journal of Purchasing & Supply Management*, Vol. 6, No. 1, pp. 67-83.

Croom, S.R. (2001), "The dyadic capabilities concept: examining the process of key supplier involvement in collaborative product development", *European Journal of Purchasing & Supply Management*, Vol. 7, No. 1, pp. 29-37.

Cusumano, M.A. and Takeishi, A. (1991), "Supplier relations and management: a survey of Japanese, Japanese-transplant, and U.S. auto plants", *Strategic Management Journal*, Vol. 12, No. 8, pp. 563-588.

Dhanaraj, C. and Parkhe, A. (2006), "Orchestrating innovation networks", *Academy of Management Review*, Vol. 31, No. 3, pp. 659-669.

D'Aveni, R.A. (1994), *Hyper-competition – Managing the Dynamics of Strategic Manoeuvring*, Free Press, New York.

Das, A., Narasimhan, R. and Talluri, S. (2006), "Supplier integration – finding an optimal configuration", *Journal of Operations Management*, Vol. 24, No. 5, pp. 563-582.

Das, T.K. and Teng, B.-S. (1999), "Managing risks in strategic alliances", *Academy of Management Executive*, Vol. 13, No. 4, pp. 50-62.

Das, T.K. and Teng, B.-S. (2000), "A resource-based theory of strategic alliances", *Journal of Management*, Vol. 26, No. 1, pp. 31-61.

Davidow, W.H. and Malone, M.S. (1992), *The Virtual Corporation: Structuring and Revitalizing the Corporation for the 21st Century*, Harper Collins, New York.

Davis, E.W. and Spekman R.E. (2003), *The Extended Enterprise: Gaining Competitive Advantage Through Collaborative Supply Chains*, Financial Times Prentice Hall, London.

De Toni and Tonchia (2003), "Strategic planning and firms' competencies: traditional approaches and new perspectives", *International Journal of Operations & Production Management*, Vol. 23, No. 9, pp. 947-976.

Dekkers, R., Sauer, A., Schönung, M. and Schuh, G. (2004), "Collaborations as complex systems", *Proceedings of the 9th Annual Cambridge International Manufacturing Symposium*, IMNet/CIM, Cambridge, pp. 60-77.

Delanty, G. (2002), *Social Science. Beyond Constructivism and Realism*, Open University Press, Buckingham.

Delanty, G. and Strydom, P. (2003), *Philosophies of Social Science: The Classic and Contemporary Readings*, Open University Press, Maidenhead.

Deming, W.E. (1986), *Out of the Crisis: Quality, Productivity and Competitive Position*, Cambridge University Press, Cambridge.

Dillman, D.A. (1983), "Mail and other self-administered questionnaires", in Rossi, P.H., Wright, J. and Anderson, A. (Eds.), *Handbook of Survey Research*, Academic Press, Orlando.

Dommermeyer, C.J. and Moriarty, E. (2000), "Comparison of two forms of an e-mail survey: embedded vs. attached", *International Journal of Market Research*, Vol. 42, No. 1, pp. 39-50.

Doran, D. (2003), "Supply chain implications of modularisation", *International Journal of Operations & Production Management*, Vol. 23, No. 3, pp. 316-326.

Drago, W.A. (1997), "When strategic alliances make sense", *Industrial Management & Data Systems*, Vol. 97, No. 2, pp. 53-57.

Draulans, J., deMan, A.-P. and Volberda, H.W. (2003), "Building alliance capability: management techniques for superior alliance performance", *Long Range Planning*, Vol. 36, No. 2, pp. 151-166.

Drejer, A. and Gudmundson, A. (2002), "Towards multiple product development", *Technovation*, Vol. 22, No. 12, pp. 733-745.

Drejer, A., Bennett, D. and Sohal, A. (2002), "Impacts and relationships between three evolving disciplines", *International Journal of Technology Management*, Vol. 23, Nos. 1/2/3, pp. 2-20.

Drucker, P.F. (1985), *Innovation and Entrepreneurship: Practices and Principles*, Harper & Row, New York.

Drucker, P.F. (1996), "Nonprofit prophet", *The Alliance Analyst*, available at: www.allianceanalyst.com.

Dubois, A. and Pedersen, (2002), "Why relationships do not fit into purchasing portfolio models – a comparison between the portfolio and industrial network approaches", *European Journal of Purchasing & Supply Management*, Vol. 8, No. 1, pp. 35-42.

Dudenhöffer, F. (2002), "On the structure of industries: findings from the automotive branch", *CAR – working paper*, No. 9, Rechklinghausen, pp. 1-17.

Dudenhöffer, F. (2003), "Gastkommentar: Was machen BMW und Mercedes besser?" [Guest commentary: What do BMW and Mercedes better?], *Automotive Engineering Partners*, No. 1, pp. 4.

Dudenhöffer, F. (2005), "Zeiten für Automobilbauer in Deutschland werden härter" [Times for car manufacturers in Germany become harder], *VDI-Nachrichten*, 8 July 2005, pp. 1-3.

Dull, S.F., Mohn, W.A. and Norén, T. (1995), "Partners", *The McKinsey Quarterly*, No. 4, pp. 63-72.

Dussauge, P. and Garrette, B. (1998), "Anticipating the evolutions and outcomes of strategic alliances between rival firms", *International Studies of Management & Organization*, Vol. 27, No. 4, pp. 104-126.

Dyer Jr., W.G. and Wilkins, A. L. (1991), "Better stories, not better constructs, to generate better theory: a rejoinder to Eisenhardt", *Academy of Management Review*, Vol. 16, No. 3, pp. 613-619.

Dyer, J.H. (1996a), "Specialised supplier networks as a source of competitive advantage: evidence from the auto industry", *Strategic Management Journal*, Vol. 17, No. 4, pp. 271-291.

Dyer, J.H. (1996b), "How Chrysler created an American keiretsu", *Harvard Business Review*, July-August, pp. 42-56.

Dyer, J.H. (1996c), "Does governance matter? *Keiretsu* alliances and asset specificity as sources of Japanese competitive advantage", *Organization Science*, Vol. 7, No. 6, pp. 649-666.

Dyer, J.H. (1997), "Effective interfirm collaboration: How firms minimize transaction costs and maximize transaction value", *Strategic Management Journal*, Vol. 18, No. 7, pp. 535-556.

Dyer, J.H. (2000), *Collaborative Advantage: Winning through Extended Enterprise Supplier Networks*, Oxford University Press, New York.

Dyer, J.H. and Hatch, N.W. (2004), "Using supplier networks to learn faster", *MIT Sloan Management Review*, Spring, pp. 57-63.

Dyer, J.H. and Nobeoka, K. (2000), "Creating and managing a high-performance knowledge-sharing network: the Toyota case", *Strategic Management Journal*, Vol. 21, No. 3, pp. 345-367.

Dyer, J.H. and Ouchi, W.G. (1993), "Japanese-style partnerships: giving companies a competitive edge", *Sloan Management Review*, Fall, pp. 51-63.

Dyer, J.H. and Singh, H. (1998), "The relational view: cooperative strategy and sources of interorganizational competitive advantage", *Academy of Management Review*, Vol. 23, No. 4, pp. 660-679.

Dyer, J.H., Cho, D.S. and Chu, W. (1998), "Strategic supplier segmentation: the next 'best practice' in supply chain management", *California Management Review*, Vol. 40, No. 2, pp. 57-77.

Dyer, J.H., Kale, P. and Singh, H. (2001), "Value creation and success in strategic alliances: alliancing skills and the role of alliance structure and systems", *European Management Journal*, Vol. 17, No. 5, pp. 463-471.

Eccles, R.G. (1981), "The quasifirm in the construction industry", *Journal of Economic Behavior & Organization*, Vol. 2, No. 4, pp. 335-357.

Eisenhardt, K. (1989), "Building theories from case study research", *Academy of Management Review*, Vol. 14, No. 4, pp. 532-550.

Eisenhardt, K. (1991), "Better stories and better constructs: The case for rigor and comparative logic", *Academy of Management Review*, Vol. 16, No. 3, pp. 620-627.

Eisenhardt, K.M. and Martin, J. (2000), "Dynamic capabilities: what are they?", *Strategic Management Journal*, Vol. 21, Nos. 10/11, pp. 1105-1121.

Eisenhardt, K.M. and Tabrizi, B. (1995), "Accelerating adaptive processes: Product innovation in the global computer industry", *Administrative Science Quarterly*, Vol. 40, No. 1, pp. 84–110.

Ellegaard, C. Johansen, J. and Drejer, A. (2003), "Managing industrial buyer-supplier relations – the case for attractiveness", *Integrated Manufacturing Systems*, Vol. 14, No. 4, pp. 346-356.

Ellram, L.M. (1993), "Total cost of ownership: elements and implementation", *International Journal of Purchasing and Materials Management*, Vol. 29, No. 4, pp. 3-12.

Ellram, L.M. (1996), "The use of the case study method in logistics research", *Journal of Business Logistics*, Vol. 17, No. 2, pp. 93-138.

Ellram, L.M. and Cooper, M.C. (1990), "Supply chain management, partnerships, and the shipper-third party relationship", *The International Journal of Logistics Management*, Vol. 1, No. 2, pp. 1-10.

Emden, Z., Calantone, R.J. and Droge, C. (2006), "Collaborating for new product development: selecting the partner with maximum potential to create value", *Journal of Product Innovation Management*, Vol. 23, No. 4, pp. 330-341.

European Commission (2003), "Commission recommendation of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises", *Official Journal of the European Union*, C(2003) 1422, L124/36-41.

Filstead, W.J. (1971), "Introduction", in: Filstead, W.J. (Ed.), *Qualitative Methodology: Firsthand Involvement with the Social World*, Markham Publishing, Chicago, pp. 1-11.

Fine, C.H. (1998), *Clockspeed: Winning Industry Control in the Age of Temporary Advantage*, Perseus Books, New York.

Fine, C.H. (2000), "Clockspeed-based strategies for supply chain design", *Production and Operations Management*, Vol. 9, No. 3, pp. 213-221.

Fine, C.H., Vardan, R., Pethick, R. and El-Hout, J. (2002), "Rapid-response capability in value-chain design", *MIT Sloan Management Review*, Winter, pp. 69-75.

Fisher, M.L. (1997), "What is the right supply chain for your product?", *Harvard Business Review*, March-April, pp. 105-116.

Fleming, L. and Sorensen, O. (2001), "The dangers of modularity", *Harvard Business Review*, September, pp. 20-21.

Flynn, B.B., Sakakibara, S., Schroeder, R.G., Bates, K.A. and Flynn, E.J. (1990), "Empirical research methods in operations management", *Journal of Operations Management*, Vol. 9, No. 2, pp. 250-284.

Ford, D. (1990), "An interaction approach", in Ford, D. (Ed.), *Understanding Business Markets: Interaction, Relationships and Networks*, Academic Press, London, pp. 7-26.

Forger, G. (2000), "Collaboration – the supply chain's defining factor?", *Supply Chain Management Review*, July-August, pp. 97-99.

Frankel, R.M. (1999), "Standards of qualitative research", in: Crabtree, B.J. and Miller, W.L. (Eds.), *Doing Qualitative Research*, 2nd ed., Sage, Thousand Oaks, pp. 333-346.

Fritsch, M. and Lukas, R. (2001), "Who cooperates on R&D?", *Research Policy*, Vol. 30, No. 2, pp. 297-312.

Fusco, J.P. and Spring, M. (2003), "Flexibility versus robust networks: the case of the Brazilian automotive sector", *Integrated Manufacturing Systems*, Vol. 14, No. 1, pp. 26-35.

Fynes, B., Voss, C. and de Búrca, S. (2005), "The impact of supply chain relationship quality on quality performance", *International Journal of Production Economics*, Vol. 96, No. 3, pp. 339-354.

Gadde, L.-E. and Hakansson, H. (1994), "The changing role of purchasing: reconsidering three strategic issues", *European Journal of Purchasing & Supply Management*, Vol. 1, No. 1, pp. 27-35.

Galunic, D.C. and Eisenhardt, K.M. (2001), "Architectural innovation and modular corporate forms", *Academy of Management Journal*, Vol. 44, No. 6, pp. 1229-1249.

Garel, G. and Midler, C. (2001), "Front-loading problem solving in co-development: managing the contractual, organizational and cognitive dimensions", *International Journal of Automotive Technology and Management*, Vol. 1, Nos. 2/3, pp. 236-251.

Geffen, C.A. and Rothenberg, S. (2000), "Suppliers and environmental innovation: the automotive paint process", *International Journal of Operations & Production Management*, Vol. 20, No. 2, pp. 166-186.

Gelderman, C.J. and Van Weele, A.J. (2003), "Handling measurement issues and strategic directions in Kraljic's purchasing portfolio model", *Journal of Purchasing & Supply Management*, Vol. 9, No. 5/6, pp. 207-216.

Gersick, C. (1991), "Revolutionary change theories: a multi-level exploration of the punctuated equilibrium paradigm", *Academy of Management Review*, Vol. 16, No. 1, pp. 10–36.

Gerwin, D. and Ferris, J.S. (2004), "Organizing new product development projects in strategic alliances", *Organization Science*, Vol. 15, No. 1, pp. 22-37.

Gioia, D.A. and Pitre, E. (1990), "Multiparadigm perspectives on theory building", *Academy of Management Review*, Vol. 15, No. 4, pp. 584-602.

Gittell, J.H. and Weiss, L. (2004), "Coordination networks within and across organisations: a multi-level framework", *Journal of Management Studies*, Vol. 41, No. 1, pp. 127-153.

Giunipero, L., Handfield, R.B. and Eltantawy, R. (2006), "Supply management's evolution: key skill sets for the supply manager of the future", *International Journal of Operations & Production Management*, Vol. 26, No. 7, pp. 822-844.

Glaser, B.G. (1978), *Theoretical Sensitivity*, Sociology Press, Mill Valley.

Glaser, B.G. (1994), "The constant comparative method of qualitative analysis", in Glaser, B.G. (Ed.), *More Grounded Theory Methodology: A Reader*, Sociology Press, Mill Valley, pp. 182-196.

Glaser, B.G. and Strauss, A.L. (1967), *The Discovery of Grounded Theory: Strategies for Qualitative Research*, Aldine, New York.

Glaser, B.G. and Strauss, A.L. (1971), "Discovery of substantive theory: A basic strategy underlying qualitative research", in: Filstead, W.J. (Ed.), *Qualitative Methodology: Firsthand Involvement with the Social World*. Markham Publishing, Chicago, pp. 288-304.

Goffin, K., Lemke, F. and Szwejczewski, M. (2006), "An exploratory study of 'close' supplier-manufacturer relationships", *Journal of Operations Management*, Vol. 24, No. 2, pp. 189-209.

Goffin, K., Szwejczewski, M. and New, C. (1997), "Managing suppliers: when fewer can mean more", *International Journal of Physical Distribution & Logistics Management*, Vol. 27, No. 7, pp. 422-436.

Goh, C.H., Holsapple, C.W., Johnson, Ellis, L. and Tanner, J.R. (1997), "Evaluating and classifying POM journals", *Journal of Operations Management*, Vol. 15, No. 2, pp. 123-138.

Gomes-Casseres, B. (1994), "Group versus group: how alliance networks compete", *Harvard Business Review*, July – August, pp. 62-74

Goshal, S. and Moran, P. (1996), "Bad for practice: a critique of the transaction cost theory", *Academy of Management Review*, Vol. 21, No. 1, pp. 13-47.

Gottschalk, B. (2001), "Die Deutsche Automobilzulieferindustrie – durch Innovationen zur Weltspitze" [The German automotive supplier industry – to the top of the world through innovation], *ZfAW*, No. 1, pp. 6-11.

Graham, G. and Ahmed, P. (2000), "Buyer-supplier management in the aerospace value chain", *Integrated Manufacturing Systems*, Vol. 11, No. 7, pp. 462-468.

Grandori, A. and Soda, G. (1995), "Inter-firm networks: antecedents, mechanisms and forms", *Organization Studies*, Vol. 16, No. 2, pp. 183-214.

Granovetter, M. (1992), "Problems of explanation in economic sociology", in Nohria, N. and Eccles, R. (Eds.), *Networks and Organizations: Structure, Form and Action*, Harvard Business School Press, Boston, pp. 25–56.

Grant, R.M. (1991), "The resource-based theory of competitive advantage: implications for strategy formulation", *California Management Review*, Spring, pp. 114-135.

Grant, R.M. (1996), "Toward a knowledge-based theory of the firm", *Strategic Management Journal*, Vol. 17, Special Issue: Knowledge and the firm, pp. 109-122.

Grant, R.M. and Baden-Fuller, C. (2004), "A knowledge accessing theory of strategic alliances", *Journal of Management Studies*, Vol. 41, No. 1, pp. 61-84.

Gulati, R. (1995), "Does familiarity breed trust? The implications of repeated ties for contractual choice in alliances", *Academy of Management Journal*, Vol. 38, No. 1, pp. 85-112.

Gulati, R. (1998), "Alliances and networks", *Strategic Management Journal*, Vol. 19, No. 4, pp. 293-317.

Gulati, R. (1999), "Network location and learning: the influence of network resources and firm capabilities on alliance formation", *Strategic Management Journal*, Vol. 20, No. 5, pp. 397-420.

Gulati, R., Nohria, N. and Zaheer, A. (2000), "Strategic networks", *Strategic Management Journal*, Vol. 21, No. 3, pp. 203-215.

Hagedoorn, J. (1993), "Understanding the rationale of strategic technology partnering: interorganizational modes of cooperation and sectoral differences", *Strategic Management Journal*, Vol. 14, No. 5, pp. 371-385.

Hakansson, H. (1982), *Industrial Marketing and Purchasing of Industrial Goods – An Interaction Approach*, Wiley, New York.

Hakansson, H. (1987), "Introduction", in Hakansson, H. (Ed.), *Industrial Technological Development: A Network Approach*, Croom Helm, London, pp. 3-25.

Hakansson, H. and Snehota, I. (1989), "No business is an island: the network concept of business strategy", *Scandinavian Journal of Management*, Vol. 5, No. 3, pp. 187-200.

Hakansson, P., Kjellberg, H. and Lundgren, A. (1993), "Strategic alliances in global biotechnology – a network approach", *International Business Review*, Vol. 2, No. 1, pp. 65-82.

Halldórsson, Á. and Aastrup, J. (2003), "Quality criteria for qualitative inquiries in logistics", *European Journal of Operational Research*, Vol. 144, No. 2, pp. 321-332.

Halldórsson, À. And Skjøtt-Larsen, T. (2004), "Developing logistics competencies through third party logistics relationships", *International Journal of Operations & Production Management*, Vol. 24, No. 2, pp. 192-206.

Hallikas, J., Virolainen, V.-M. and Tuominen, M. (2002), "Understanding risk and uncertainty in supplier networks – a transaction cost approach", *International Journal of Production Research*, Vol. 40, No. 15, pp. 3519-3531.

Hamel, G. (1991), "Competition for competence and inter-partner learning within international strategic alliances", *Strategic Management Journal*, Vol. 12, Special Issue: Global Strategy, pp. 83-103.

Hamel, G. and Prahalad, C.K. (1994), *Competing for the Future*, Harvard Business School Press, Boston.

Hamel, G., Doz, Y.L. and Prahalad, C.K. (1989), "Collaborate with your competitors – and win", *Harvard Business Review*, January – February, pp. 133-139.

Handfield, R., Ragatz, G., Petersen, K. and Monczka, R. (1999), "Involving suppliers in new product development", *California Management Review*, Vol. 42, No. 1, pp. 59–82.

Handfield, R.B. and Bechtel, C. (2002), "The role of trust and relationship structure in improving supply chain responsiveness", *Industrial Marketing Management*, Vol. 31, No. 4, pp. 367-382.

Handfield, R.B. and Melnyk, S.A. (1998), "The scientific theory-building process: a primer using the case of TQM", *Journal of Operations Management*, Vol. 16, No. 4, pp. 321-339.

Hannan, M.T. and Freeman, J. (1977), "The population ecology of organizations", *American Journal of Sociology*, Vol. 82, pp. 929-964.

Harland, C.M. (1996), "Supply chain management: relationships, chain and networks", *British Journal of Management*, Vol. 7, Special Issue, pp. 63-80.

Harland, C.M. and Knight, L.A. (2001), "Supply network strategy: Role and competence requirements", *International Journal of Operations & Production Management*, Vol. 21, No. 4, pp. 476-489.

Harland, C.M., Brenchley, R. and Walker, H. (2003), "Risk in supply networks", *Journal of Purchasing & Supply Management*, Vol. 9, No. 2, pp. 51-62.

Harland, C.M., Lamming, R.C. and Cousins, P.D. (1999), "Developing the concept of supply strategy", *International Journal of Operations & Production Management*, Vol. 19, No. 7, pp. 650-673.

Harmsen, H., Grunert, K.G. and Bove, K. (2000), "Company competencies as a network: the role of product development", *Journal of Product Innovation Management*, Vol. 17, No. 3, pp. 194-207.

Hauschildt, J. (2004), *Innovationsmanagement* [Innovation Management], 3rd ed., Vahlen, München.

Hayes, R.H. (2000), "Toward a 'new architecture' for POM", *Production and Operations Management*, Vol. 9, No. 2, pp. 105-110.

Henderson, R.M. and Clark, K.B. (1990), "Architectural innovation: The reconfiguration of existing product technologies and the failure of established firms", *Administrative Science Quarterly*, Vol. 35, No. 1, pp. 9–30.

Henke Jr., J.W. (2000), "Strategic selling in the age of modules and systems", *Industrial Marketing Management*, Vol. 29, No. 3, pp. 271-284.

Hickson, D.J., Pugh, D.S. and Pheysey, D.C. (1969), "Operations technology and organization structure: an empirical reappraisal", *Administrative Science Quarterly*, Vol. 14, No. 3, pp. 378-397.

Hillebrand, B. and Biemans, W.G. (2003), "The relationship between internal and external cooperation: literature review and propositions", *Journal of Business Research*, Vol. 56, No. 9, pp. 735-743.

Hines, P. (1994), *Creating World Class Suppliers: Unlocking Mutual Competitive Advantage*, Pitman Publishing, London.

Hines, P. and Rich, N. (1997), "The seven value stream mapping tools", *International Journal of Operations & Production Management*, Vol. 17, No. 1, pp. 46-64.

Ho, D.C.K., Au, K.F. and Newton, E. (2002), "Empirical research on supply chain management: a critical review and recommendations", *International Journal of Production Research*, Vol. 40, No. 17, pp. 4415-4430.

Hoetker, G. (2006), "Do modular products lead to modular organizations", *Strategic Management Journal*, Vol. 27, No. 6, pp. 501-518.

Holweg, M. and Pil, F.K. (2004), *The Second Century: Reconnecting Customer and Value Chain Through Build-to-order: moving beyond mass and lean production in the auto industry*, MIT Press, Cambridge.

Hoyt, J. and Huq, F. (2000), "From arms-length to collaborative relationships in the supply chain: an evolutionary process", *International Journal of Physical Distribution & Logistics Management*, Vol. 30, No. 9, pp. 750-764.

Hult, G.T.M., Ketchen Jr., D.J., Cavusgil, S.T. and Calantone, R.J. (2006), "Knowledge as a strategic resource in supply chains", *Journal of Operations Management*, Vol. 24, No. 5, pp. 458-475.

Hurmelinna, P., Peltola, S., Tuimala, J. and Virolainen, V.-M. (2002), "Attaining world-class R&D by benchmarking buyer-supplier relationships", *International Journal of Production Economics*, Vol. 80, No. 1, pp. 39-47.

IBM (2006), "Expanding the innovation horizon", *The Global CEO Study 2006*, IBM Global Business Services, Somers.

Ilinitch, A.Y., D'Aveni, R.A. and Lewin, A.Y. (1996), "New organizational forms and strategies for managing in hypercompetitive environments", *Organization Science*, Vol. 7, No. 3, pp. 211-220.

Inkpen, A.C. and Ross, J. (2001), "Why do some strategic alliances persist beyond their useful life?", *California Management Review*, Fall, pp. 132-148.

Inkpen, A.C. and Tsang, E.W.K. (2005), "Social capital, networks, and knowledge transfer", *Academy of Management Review*, Vol. 30, No. 1, pp. 146-165.

Ireland, R.D., Hitt, M.A. and Vaidyanath, D. (2002), "Alliance management as a source of competitive advantage", *Journal of Management*, Vol. 28, No. 3, pp. 413-446.

Itami, H. (1987), *Mobilizing Invisible Assets*, Harvard Business School Press, Cambridge.

Jacobides, M.G. and Winter, S.G. (2005), "The co-evolution of capabilities and transaction costs: explaining the institutional structure of production", *Strategic Management Journal*, Vol. 26, No. 5, pp. 395-413.

Jahn, H. (1988), "*Erzeugnisqualität, die logische Folge von Arbeitsqualität*" [Product quality, a logical consequence of work quality], VDI-Z, pp. 130-134.

Jarillo, J.C. (1988), "On strategic networks", *Strategic Management Journal*, Vol. 9, No. 1, pp. 31-41.

Jick, T.D. (1979), "Mixing qualitative and quantitative methods: Triangulation in action", *Administrative Science Quarterly*, Vol. 24, No. 4, pp. 602-611.

Johansson, C., Legge, D. and Wäppling, A. (2000), "Factors in the supply chain supporting three-way partnerships", *International Journal of Logistics: Research and Applications*, Vol. 3, No. 2, pp. 147-156.

Johnsen, T. and Ford, D. (2005), "At the receiving end of supply network intervention: the view from an automotive first tier supplier", *Journal of Purchasing & Supply Management*, Vol. 11, No. 4, pp. 183-192.

Johnsen, T., Wynstra, F., Zheng, J., Harland, C. and Lamming, R. (2000), "Networking activities in supply networks", *Journal of Strategic Marketing*, Vol. 8, No. 2, pp. 161-181.

Johnson, P. and Duberley, J. (2000), *Understanding Management Research: An Introduction to Epistemology*, Sage, London.

Johnston, D.A., McCutcheon, D.M., Stuart, F.I. and Kerwood, H. (2004), "Effects of supplier trust on performance of cooperative supplier relationships", *Journal of Operations Management*, Vol. 22, No. 1, pp. 23-38.

Jones, C., Hesterly, W.S. and Borgatti, S.P. (1997), "A general theory of network governance: exchange conditions and social mechanisms", *Academy of Management Review*, Vol. 22, No. 4, pp. 911-945.

Jones, D. and Womack, J. (2002), *Seeing the Whole: Mapping the Extended Value System*, LEI, Brookline.

Jürgens, U. (2000), "Towards new product and process development networks: the case of the German car industry", in Jürgens, U. (Ed.), *New Product Development and Production Networks*, Springer Verlag, Berlin, pp. 107-148.

Jürgens, U. (2004), "Characteristics of the European automotive system: is there a distinctive European approach?", *International Journal of Automotive Technology and Management*, Vol. 4, Nos. 2/3, pp. 112-136.

Jürgens, U., Malsch, T. and Dohse, K. (1993), *Breaking from Taylorism: Changing Forms of Work in the Automobile Industry*, Cambridge University Press, Cambridge.

Kahn, K.B. and Mentzer, J.T. (1998), "Marketing's integration with other departments", *Journal of Business Research*, Vol. 42, No. 1, pp. 53-62.

Kale, P., Dyer, J.H. and Singh, H. (2002), "Alliance capability, stock market response, and long-term alliance success: the role of the alliance function", *Strategic Management Journal*, Vol. 23, No. 8, pp. 747-767.

Kale, P., Singh, H. and Perlmutter, H. (2000), "Learning and protection of proprietary assets in strategic alliances: building relational capital", *Strategic Management Journal*, Vol. 21, No. 3, pp. 217-237.

Kalwani, M.U. and Narayandas, N. (1995), "Long-term manufacturer-supplier relationships: do they pay off for supplier firms?", *Journal of Marketing*, Vol. 59, No. 1, pp. 1-16.

Kanter, R.M. (1994), "Collaborative advantage: the art of alliances", *Harvard Business Review*, July-August, pp. 96-108.

Kanter, R.M. (1999), "Change is everyone's job: managing the extended enterprise in a globally connected world", *Organizational Dynamics*, Vol. 28, No. 1, pp. 6-23.

Karlsson, C. (2003), "The development of industrial networks: challenges to operations management in an extraprise", *International Journal of Operations & Production Management*, Vol. 23, No. 1, pp. 44-61.

Katzensteiner, T. (2004), "Festgebissen" [Totally absorbed], *Wirtschaftswoche*, No. 50, 2.12.2004, pp. 66-68.

Kauffman, S. (1993), *The Origins of Order: Self-Organisation and Selection in Evolution*, Oxford University Press, Oxford.

Kaufman, A., Wood, C.H. and Theyel, G. (2000), "Collaboration and technology linkages: a strategic supplier technology", *Strategic Management Journal*, Vol. 21, No. 6, pp. 649-663.

KBA (2005), *Annual Report 2005*, Kraftfahrt-Bundesamt, Flensburg.

Kelly, M.J., Schaan, J.-L. and Joncas, H. (2002), "Managing alliance relationships: key challenges in the early stages of collaboration", *R&D Management*, Vol. 32, No. 1, pp. 11-22.

Kemppainen, K. and Vepsäläinen, A.P.J. (2003), "Trends in industrial supply chains and networks", *International Journal of Physical Distribution & Logistics Management*, Vol. 33, No. 8, pp. 701-719.

Kessler, E.H., Bierly, P.E. and Gopalakrishnan, S. (2000), "Internal vs. external learning in new product development: effects on speed, costs and competitive advantage", *R&D Management*, Vol. 30, No. 3, pp. 213-223.

Ketchen, D.J. and Giunipero, L.C. (2004), "The intersection of strategic management and supply chain management", *Industrial Marketing Management*, Vol. 33, No. 1, pp. 51-56.

Khanna, T. (1998), "The scope of alliances", *Organization Science*, Vol. 9, No. 3, pp. 340-355.

King, N. (1994), "The qualitative research interview", in Symon, G. and Cassell, C. (Eds.), *Qualitative Methods in Organizational Research: A Practical Guide*, Sage, London, pp. 14-36.

King, N. (1998), "Template analysis", in Symon, G. and Cassell, C. (Eds.), *Qualitative Methods and Analysis in Organizational Research: A Practical Guide*, Sage, London, pp. 118-134.

Kirk, J. and Miller, M.L. (1986), *Reliability and Validity in Qualitative Research*, Sage, Beverly Hills.

Kodama, M. (2005), "Knowledge creation through networked strategic communities: case studies on new product development in Japanese companies", *Long Range Planning*, Vol. 38, No. 1, pp. 27-49.

Koehler, A. (2006), "Fliegende Autos" [Flying cars], *Wirtschaftswoche*, Nos. 1/2, 5.1.2006, pp. 36-42.

Kogut, B. (2000), "The network as knowledge: generative rules and the emergence of structure", *Strategic Management Journal*, Vol. 21, No. 3, pp. 405-425.

Kopczak, L.R. and Johnson, M.E. (2003), "The supply-chain management effect", *MIT Sloan Management Review*, Spring, pp. 27-34.

Kornelius, L. and Wamelink, J.W.F. (1998), "The virtual corporation: learning from construction", *Supply Chain Management: An International Journal*, Vol. 3, No. 4, pp. 193-202.

Kotler, P. (1997), *Marketing Management*, 9th ed., Prentice-Hall, Englewood Cliffs.

Koufteros, X., Vonderembse, M. and Jayaram, J. (2005), "Internal and external integration for product development: the contingency effects of uncertainty, equivocality, and platform strategy", *Decision Sciences*, Vol. 36, No. 1, pp. 97-133.

Kraljic, P. (1983), "Purchasing must become supply management", *Harvard Business Review*, September-October, pp. 109-117.

Krause, D.R. and Ellram, L.M. (1997), "Critical elements of supplier development: the buying-firm perspective", *European Journal of Purchasing & Supply Management*, Vol. 3, No. 1, pp. 21-31.

Krippendorff, K. (2004), *Content Analysis: An Introduction to its Methodology*, 2nd ed., Sage, Thousand Oaks.

Krishnan, V. and Loch, C.H. (2005), "A retrospective look at *Production and Operations Management* articles on new product development", *Production and Operations Management*, Vol. 14, No. 4, pp. 433-441.

Kuhn, T.S. (1970), *The Structure of Scientific Revolutions*, 2nd ed., University of Chicago Press, Chicago.

Kumar, N., Stern, L.W. and Anderson, J.C. (1993), "Conducting interorganizational research using key informants", *Academy of Management Journal*, Vol. 36, No. 6, pp. 1633-1651.

Kumar, S. and Seth, A. (1998), "The design of coordination and control mechanisms for managing joint venture-parent relationships", *Strategic Management Journal*, Vol. 19, No. 6, pp. 579-599.

Lai, K.-H., Cheng, T.C.E. and Yeung, A.C.L. (2005), "Relationship stability and supplier commitment to quality", *International Journal of Production Economics*, Vol. 96, No. 3, pp. 397-410.

Lakemond, N., Berggren, C. and Van Weele, A. (2006), "Coordinating supplier involvement in product development projects: a differentiated coordination typology", *R&D Management*, Vol. 36, No. 1, pp. 55-66.

Lambert, D.M. and Cooper, M.C. (2000), "Issues in supply chain management", *Industrial Marketing Management*, Vol. 29, No. 1, pp. 65-83.

Lambert, D.M., Emmelhainz, M.A. and Gardner, J.T. (1996), "Developing and implementing supply chain partnerships", *The International Journal of Logistics Management*, Vol. 7, No. 2, pp. 1–17.

Lambert, D.M., Emmelhainz, M.A. and Gardner, J.T. (1999), "Building successful logistics partnerships", *Journal of Business Logistics*, Vol. 20, No. 1, pp. 165-181.

Lamming, R. (2000), "Japanese supply chain relationships in recession", *Long Range Planning*, Vol. 33, No. 6, pp. 757-778.

Lamming, R. and Cox, A. (1995), *Strategic Procurement Management in the 1990s: Concepts and Cases*, The Chartered Institute of Purchasing and Supply/Earlsgate Press, London.

Lamming, R.C., Johnsen, T., Zheng, J. and Harland, C. (2000), "An initial classification of supply networks", *International Journal of Operations & Production Management*, Vol. 20, No. 6, pp. 675-691.

Lane, P.J. and Lubatkin, M. (1998), "Relative absorptive capacity and interorganizational learning", *Strategic Management Journal*, Vol. 19, No. 5, pp. 461-477.

Lang, S.Y.T., Dickinson, J. and Buchal, R.O. (2002), "Cognitive factors in distributed design", *Computers in Industry*, Vol. 48, No. 1, pp. 89-98.

Larsson, R. (1993), "Case survey methodology: Quantitative analysis of patterns across case studies", *Academy of Management Journal*, Vol. 36, No. 6, pp. 1515-1546.

Larsson, R., Brousseau, K.R., Driver, M.J., Holmqvist, M. and Tarnovskaya, V. (2003), "International growth through cooperation: brand-driven strategies, leadership, and career development in Sweden", *Academy of Management Executive*, Vol. 17, No. 1, pp. 7-24.

Lawrence, T.B., Hardy, C. and Phillips, N. (2002), "Institutional effects of interorganizational collaboration: the emergence of proto-institutions", *Academy of Management Journal*, Vol. 45, No. 1, pp. 281-290.

Leary, M.R. (2001), *Introduction to Behavioral Research Methods*, 3rd ed., Allyn & Bacon, London.

Lee, A.S. (1991), "Integrating positivist and interpretive approaches to organizational research", *Organization Science*, Vol. 2, No. 4, pp. 342-365.

Lee, A.S. and Baskerville, R.L. (2003), "Generalizing generalisability in information systems research", *Information Systems Research*, Vol. 14, No. 3, pp. 221-243.

Leenders, M.R., Fearson, H.E., Flynn, A.E. and Johnson, P.F. (2002), *Purchasing and Supply Management*, McGraw-Hill, New York.

Leonard-Barton, D. (1990), "A dual methodology for case studies: Synergistic use of a longitudinal single site with replicated multiple sites", *Organization Science*, Vol. 1, No. 3, pp. 248-266.

Leonard-Barton, D. (1992), "Core capabilities and core rigidities: a paradox in managing new product development", *Strategic Management Journal*, Vol. 13, Special Issue: Strategy Process: Managing Corporate Self-Renewal, pp. 111-125.

Levitt, T. (1960), "Marketing Myopia", *Harvard Business Review*, July-August, pp. 45-56.

Lewis, M.A. (2003), "Analysing organisational competence: implications for the management of operations", *International Journal of Operations & Production Management*, Vol. 23, No. 7, pp. 731-756.

Li, S., Ragu-Nathan, B., Ragu-Nathan, T.S. and Subba Rao, S. (2006), "The impact of supply chain management practices on competitive advantage and organizational performance", *OMEGA – The International Journal of Management Science*, Vol. 34, No. 2, pp. 107-124.

Li, S.X. and Rowley, T.J. (2002), "Inertia and evaluation mechanisms in interorganizational partner selection: syndicate formation among U.S. investment banks", *Academy of Management Journal*, Vol. 45, No. 6, pp. 1104-1119.

Liedtka, J.M. (1996), "Collaborating across lines of business for competitive advantage", *Academy of Management Executive*, Vol. 10, No. 2, pp. 20-37.

Liedtka, J.M. (1999), "Linking competitive advantage with communities of practice", *Journal of Management Inquiry*, Vol. 8, No. 1, pp. 5-16.

Liker, J.K. (2003), *The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer*, McGraw-Hill, New York.

Liker, J.K. and Choi, T.Y. (2004), "Building deep supplier relationships", *Harvard Business Review*, December, pp. 104-113.

Liker, J.K., Kamath, R.R.., Wasti, S.N. and Nagamachi, M. (1996a), "Supplier involvement in automotive component design: are there really large US Japanese differences?", *Research Policy*, Vol. 25, No. 1, pp. 59–89.

Liker, J.K., Sobek, D.K., Ward, A.C. and Cristiano, J.J. (1996b), "Involving suppliers in product development in the United States and Japan: Evidence for set-based concurrent engineering", *IEEE Transactions on Engineering Management*, Vol. 43, No. 2, pp. 165–178.

Lincoln, Y.S. and Guba, E.G. (1985), *Naturalistic Inquiry*, Sage, Beverly Hills.

Linton, J.D. and Thongpapanl, N. (2004), "Perspective: ranking the technology innovation management journals", *Journal of Product Innovation Management*, Vol. 23, No. 2, pp. 123-139.

Littler, D., Leverick, F. and Bruce, M. (1995), "Factors affecting the process of collaborative product development: A study of UK manufacturers of information and communications technology products", *Journal of Product Innovation Management*, Vol. 12, No. 1, pp. 16–32.

Litwin, M.S. (2003), "How to assess and interpret survey psychometrics", in: Fink (Ed.), *The Survey Kit*, 2nd ed., Sage, Thousand Oaks, Kit 8.

Locke, K. (1996), "Rewriting *The Discovery of Grounded Theory* after 25 years", *Journal of Management Inquiry*, Vol. 5, No. 3, pp. 239-245.

Lorenzoni, G. and Lipparini, A. (1999), "The leveraging of interfirm relationships as a distinctive organizational capability: a longitudinal study", *Strategic Management Journal*, Vol. 20, No. 4, pp. 317-338.

Love, P.E.D., Li, H. and Mandal, P. (1999), "Rework: a symptom of a dysfunctional supply-chain", *European Journal of Purchasing & Supply Management*, Vol. 5, No. 1, pp. 1-11.

Luke, R.D., Begun, J.W. and Pointer, D.D. (1989), "Quasi firms: strategic interorganizational forms in the health care industry", *Academy of Management Review*, Vol. 14, No. 1, pp. 9-19.

Mabert, V.A. and Venkataramanan, M.A. (1998), "Special research focus on supply chain linkages: challenges for design and management in the 21st century", *Decision Sciences*, Vol. 29, No. 3, pp. 537-552.

MacBeth, D.K. (1994), "The role of purchasing in a partnering relationship", *European Journal of Purchasing & Supply Management*, Vol. 1, No. 1, pp. 19-25.

MacBeth, D.K. (2002), "Emergent strategy in managing cooperative supply chain change", *International Journal of Operations & Production Management*, Vol. 22, No. 7, pp. 728-740.

MacBeth, D.K. and Ferguson (1994), *Partnership Sourcing: an Integrated Supply Chain Management Approach*, Pitman Publishing, London.

Madhavan, R., Koka, B.R. and Prescott, J.E. (1998), "Networks in transition: how industry events (re)shape interfirm relationships", *Strategic Management Journal*, Vol. 19, No. 5, pp. 439-459.

Madhok, A. and Tallman, S.B. (1998), "Resources, transactions and rents: managing value through interfirm collaborative relationships", *Organization Science*, Vol. 9, No. 3, pp. 326-339.

Maffin, D. and Braiden, P. (2001), "Manufacturing and supplier roles in product development", *International Journal of Production Economics*, Vol. 69, No. 2, pp. 205-213.

Magretta, J. (1998), "The power of virtual integration: an interview with Dell Computer's Micheal Dell", *Harvard Business Review*, Vol. 76, March-April, pp. 73-84.

Maloni, M. and Benton, W.C. (2000), "Power influences in the supply chain", *Journal of Business Logistics*, Vol. 21, No. 1, pp. 49-73.

Maltz, A.B. and Ellram, L.M. (1997), "Total cost of relationship: an analytical framework for the logistics outsourcing decision", *Journal of Business Logistics*, Vol. 18, No. 1, pp. 45-66.

March J.G. (1991), "Exploration and exploitation in organizational learning", *Organization Science*, Vol. 2, No. 1, pp. 71–87.

Marshall, C. and Rossman, G.B. (1995), *Designing Qualitative Research*, 2nd ed., Sage, Thousand Oaks.

Martínez Sánchez, A. and Pérez Pérez, M. (2003), "Cooperation and the ability to minimize the time and cost of new product development within the Spanish automotive supplier industry", *Journal of Product Innovation Management*, Vol. 20, No. 1, pp. 57-69.

Martinez, M.T., Fouletier, P. Park. K.H. and Favrel, J. (2001), "Virtual enterprise – organisation, evolution and control", *International Journal of Production Economics*, Vol. 74, Nos. 1-3, pp. 225-238.

Martinez, V. and Bititci, U.S. (2001), "The value matrix and its evolution", *Proceedings of the of the 8th International Annual EurOMA Conference*, University of Bath, Bath, June, p. 118–130.

Masella, C. and Rangone, A. (2000), "A contingent approach to the design of vendor selection system for different types of co-operative customer/supplier relationships", *International Journal of Operations & Production Management*, Vol. 20, No. 1, pp. 70-84.

McClintock, C.C., Brannon, D. and Maynard-Moody, S. (1979), "Applying the logic of sample surveys to qualitative case studies: The case cluster method", *Administrative Science Quarterly*, Vol. 24, No. 4, pp. 612-629.

McCutcheon, D.M. and Meredith, J.R. (1993), Conducting case study research in operations management, *Journal of Operations Management*, Vol. 11, No. 3, pp. 239-256.

McCutcheon, D.M. and Stuart, F.I. (2000), "Issues in the choice of supplier alliance partners", *Journal of Operations Management*", Vol. 18, No. 3, pp. 279-301.

McEvily, S.K., Das, S. and McCabe, K. (2000), "Avoiding competence substitution through knowledge sharing", *Academy of Management Review*, Vol. 25, No. 2, pp. 294-311.

McFarlan, F. W. and Nolan, R. L. (1995), "How to manage an IT outsourcing alliance", *Sloan Management Review*, Winter, pp. 9-23.

McGrath, J.E. (1982), "Dilemmatics: The study of research choices and dilemmas", in: McGrath, J.E., Martin, J. and Kulka, R.A. (Eds.), *Judgment Calls in Research*, Sage, Beverly Hills, pp. 69-102.

McHugh, P., Merli, G. and Wheeler, G. III (1995), *Beyond Business Process Reengineering*, Wiley, Chichester.

McIvor, R. (2000), "A practical framework for understanding the outsourcing process", *Supply Chain Management: An International Journal*, Vol. 5, No. 1, pp. 22-36.

McIvor, R. and Humphreys, P. (2004), "Early supplier involvement in the design process: lessons from the electronics industry", *OMEGA – The International Journal of Management Science*, Vol. 32, No. 3, pp. 179-199.

McIvor, R. and McHugh, M. (2000), "Partnership sourcing: An organizational change management perspective", *Journal of Supply Chain Management: A Global Review of Purchasing & Supply*, Vol. 36, No. 3, pp. 12– 20.

Mentzer, J.T., DeWitt, W., Keebler, J.S., Min, S., Nix, N.W., Smith, C.D. and Zacharia, Z.G. (2001), "Defining supply chain management", *Journal of Business Logistics*, Vol. 22, No. 2, pp. 1-25.

Mercer Management Consulting (2001), "Automobiltechnologie 2010" [Automobile Technology 2010], *Study*, München.

Mercer Management Consulting (2004), "Future Automotive Industry Structure (FAST) 2015", *Study*, München.

Meredith, J.R. (1998), "Building operations management theory through case and field research", *Journal of Operations Management*, Vol. 16, No. 4, pp. 441-454.

Merton, R.K., Fiske, M. and Kendall, P.L. (1956), *The Focused Interview: A Manual of Problems and Procedures*, Free Press, New York.

Mikkola, J.H. (2003), "Modularity, component outsourcing, and inter-firm learning", *R&D Management*, Vol. 33, No. 4, pp. 439-454.

Mikkola, J.H. and Skjøtt-Larsen, T. (2003), "Early supplier involvement: implications for new product development outsourcing and supplier-buyer interdependence", *Global Journal of Flexible Systems Management*, Vol. 4, No. 4, pp. 31-41.

Miles, M.B. and Huberman, A.M. (1994), *Qualitative Data Analysis. An Expanded Sourcebook*, 2nd ed., Sage, Beverly Hills.

Miles, R.E. and Snow, C.C. (1986), "Organizations: new concepts for new forms", *California Management Review*, Vol. 28, Spring, pp. 62-73.

Miller, D. and Friesen, P. (1980), "Archetypes of organizational transition", *Administrative Science Quarterly*, Vol. 25, No. 2, pp. 268-299.

Miller, D. and Friesen, P.H. (1984), *Organizations – A Quantum View*, Prentice-Hall, Englewood Cliffs.

Mills, J., Platts, K. and Bourne, M. (2003), "Competence and resource architectures", *International Journal of Operations & Production Management*, Vol. 23, No. 9, pp. 977-994.

Mills, J., Schmitz, J. and Frizelle, G. (2004), "A strategic review of 'supply networks'", *International Journal of Operations & Production Management*, Vol. 24, No. 10, pp. 1012-1036.

Min, S. and Mentzer, J.T. (2000), "The role of marketing in supply chain management", *International Journal of Physical Distribution & Logistics Management*, Vol. 30, No. 9, pp. 765-787.

Mintzberg, H. (1979), *The Structuring of Organizations*, Prentice-Hall, Englewood Cliffs.

Mintzberg, H., Ahlstrand, B. and Lampel, J. (1998), *Strategy Safari: A Guided Tour through the Wilds of Strategic Management*, Simon & Schuster, New York.

Miotti, L. and Sachwald, F. (2003), "Cooperative R&D: why and with whom? An integrated framework of analysis", *Research Policy*, Vol. 32, No. 8, pp. 1481-1499.

Mitleton-Kelly, E. (2003), *Complex Systems and Evolutionary Perspectives on Organisations: The Application of Complexity Theory to Organisations*, Elsevier Butterworth-Heinemann, Oxford.

Mohr, J. and Spekman, R. (1994), "Characteristics of partnership success: partnership attributes, communication behavior, and conflict resolution techniques", *Strategic Management Journal*, Vol. 15, No. 2, pp. 135-152.

Möller, K.E. and Svahn, S. (2003), "Managing strategic nets: a capability perspective", *Marketing Theory*, Vol. 3, No. 2, pp. 209-234.

Möller, K.E. and Törrönen, P. (2003), "Business suppliers' value creation potential: a capability-based analysis", *Industrial Marketing Management*, Vol. 32, No. 2, pp. 109-118.

Møller, M.M., Johansen, J. and Boer, H. (2003), "Managing buyer-supplier relationships and inter-organisational competence development", *Integrated Manufacturing Systems*, Vol. 14, No. 4, pp. 369-379.

Monczka, R.M., Petersen, K.J., Handfield, R.B. and Ragatz, G.L. (1998), "Success factors in strategic supplier alliances: the buying company perspective", *Decision Sciences*, Vol. 29, No. 3, pp. 553-577.

Montgomery, C.A. (1995), "Of diamonds and rust: a new look at resources", in Montgomery, C.A. (Ed.), *Resource-Based and Evolutionary Theories of the Firm*, Kluwer, Boston, pp. 251-268.

Moody, P.E. (2001), "Strategic purchasing remains an oxymoron", *MIT Sloan Management Review*, Winter, pp. 18.

Morgan, D.L. (1998), "Planning focus groups", in Morgan, D.L. and Krueger (Eds.), *The Focus Group Kit*, Sage, Thousand Oaks, Kit 2.

Morgan, G. (1979), "Response to Mintzberg", *Administrative Science Quarterly*, Vol. 24, No. 1, pp. 137-139.

Morris, D. (1969), *The Human Zoo*, Jonathan Cape, London.

Morton, S.C., Dainty, A.R.J., Burns, N.D., Brookes, N.J. and Backhouse, C.J. (2006), "Managing relationships to improve performance: a case study in the global aerospace industry", *International Journal of Production Research*, Vol. 44, No. 16, pp. 3227-3241.

Mowery, D.C., Oxley, J.E. and Silverman, B.S. (1996), "Strategic alliances and interfirm knowledge transfer", *Strategic Management Journal*, Vol. 17, Special Issue: Knowledge and the Firm, pp. 77-91.

Murmann, J.P. (2003), *Knowledge and Competitive Advantage: The Coevolution of Firms, Technology, and National Institutions*, Cambridge University Press, Cambridge.

Nalebuff, B.J. and Brandenburger, A.M. (1997), *Co-opetition*, Paperback ed., Harper Collins, London.

Narasimhan, R. and Nair, A. (2005), "The antecedent role of quality, information sharing and supply chain proximity on strategic alliance formation and performance", *International Journal of Production Economics*, Vol. 96, No. 3, pp. 301-313.

Nassimbeni, G. (1998), "Network structures and co-ordination mechanisms: a taxonomy"; *International Journal of Operations & Production Management*, Vol. 18, No. 6, pp. 538-554.

Nellore, R. and Söderquist, K. (2000), "Portfolio approaches to procurement: analysing the missing link to specifications", *Long Range Planning*, Vol. 33, No. 2, pp. 245-267.

Nellore, R., Söderquist, K. and Eriksson, K.A. (1999), "A specification model for product development", *European Management Journal*, Vol. 17, No. 1, pp. 50-63.

Neubert, R., Görlitz, O. and Teich, T. (2004), "Automated negotiations of supply contracts for flexible production networks", *International Journal of Production Economics*, Vol. 89, No. 2, pp. 175-187.

Noori, H. and Lee, W.B. (2004), "Collaborative design in a networked enterprise: the case of the telecommunication industry", *International Journal of Production Research*, Vol. 42, No. 15, pp. 3041-3054.

Normann, R. and Ramirez, R. (1993), "From value chain to value constellation: designing interactive strategy", *Harvard Business Review*, July-August, pp. 65-77.

Obstfeld, D. (2005), "Social networks, the *tertius iungens* orientation, and involvement in innovation", *Administrative Science Quarterly*, Vol. 50, No. 1, pp. 100-130.

Oliver, N. and Delbridge, R. (2002), "The characteristics of high performing supply chains", *International Journal of Technology Management*, Vol. 23, Nos. 1/2/3, pp. 60-73.

Olsen, R.F. and Ellram, L.M. (1997a), "Buyer-supplier relationships: alternative research approaches", *European Journal of Purchasing & Supply Management*, Vol. 3, No. 4, pp. 221-231.

Olsen, R.F. and Ellram, L.M. (1997b), "A portfolio approach to supplier relationships", *Industrial Marketing Management*, Vol. 26, No. 2, pp. 101-113.

Otto, A. and Kotzab, H. (2003), "Does supply chain management really pay? Six perspectives to measure the performance of managing a supply chain", *European Journal of Operational Research*, Vol. 144, No. 2, pp. 306-320.

Ouchi, W.G. (1980), "Markets, bureaucracies, and clans", *Administrative Science Quarterly*, Vol. 25, No. 1, pp. 129-142.

Oxley, J.E. and Sampson, R.C. (2004), "The scope and governance of international R&D alliances", *Strategic Management Journal*, Vol. 25, Nos. 8/9, pp. 723-749.

Pannirselvam, G.P., Ferguson, L.A., Ash, R.C. and Siferd, S.P. (1999), "Operations management research: an update for the 1990s", *Journal of Operations Management*, Vol. 18, No. 1, pp. 95-112.

Parise, S. and Casher, A. (2003), "Alliance portfolios: designing and managing your network of business-partner relationships", *Academy of Management Executive*, Vol. 17, No. 4, pp. 25-39.

Parker, D. and Hartley, K. (1997), "The economics of partnership sourcing versus adversarial competition: a critique", *European Journal of Purchasing & Supply Management*, Vol. 3, No. 2, pp. 115-125.

Parkhe, A. (1993), "Strategic alliance structuring: A game theoretic and transaction cost examination of interfirm cooperation", *Academy of Management Journal*, Vol. 36, No. 4, pp. 794–829.

Parkhe, A., Wasserman, S. and Ralston, D.A. (2006), "New frontiers in network theory development", *Academy of Management Review*, Vol. 31, No. 3, pp. 560-568.

Parry, G., Graves, A. and James-Moore, M. (2006), "The threat to core competence posed by developing closer supply chain relationships", *International Journal of Logistics: Research and Applications*, Vol. 9, No. 3, pp. 295-305.

Patton, M.Q. (2002), *Qualitative Research & Evaluation Methods*, 3rd ed., Sage, Thousand Oaks.

Persson, M. and Ahlström, P. (2006), "Managerial issues in modularising complex products", *Technovation*, Vol. 26, No. 11, pp. 1201-1209.

Peteraf, M. (1993), "The cornerstones of competitive advantage: a resource-based view", *Strategic Management Journal*, Vol. 14, No. 3, pp. 179-192.

Petersen, K.J., Handfield, R.B. and Ragatz, G.L. (2003), "A model of supplier integration into new product development", *Journal of Product Innovation Management*, Vol. 20, No. 4, pp. 284-299.

Petersen, K.J., Handfield, R.B. and Ragatz, G.L. (2005), "Supplier integration into new product development: coordinating product, process and supply chain design", *Journal of Operations Management*, Vol. 23, Nos. 3/4, pp. 371-388.

Petroni, A. and Panciroli, B. (2002), "Innovation as a determinant of suppliers' roles and performances: an empirical study in the food machinery industry", *European Journal of Purchasing & Supply Management*, Vol. 8, No. 3, pp. 135-149.

Pettigrew, A.M. (1990), "Longitudinal field research on change: Theory and practice", *Organization Science*, Vol. 1, No. 3, pp. 267-292.

Pfeffer, J. and Salancik, G.R. (1978), *The External Control of Organizations: A Resource Dependency Perspective*, Harper & Row, New York.

Podolny, J.M. and Page, K.L. (1998), "Network forms of organization", *Annual Review of Sociology*, Vol. 24, No. 1, pp. 57–76.

Porter, M.E. (1980), *Competitive Strategy*, Free Press, New York.

Porter, M.E. (1985), *Competitive Advantage: Creating and Sustaining Superior Performance*, Free Press, New York.

Porter, M.E. and Fuller, M.B. (1989), "Koalition und globale Strategie", in Porter, M.E. (Ed.), *Globaler Wettbewerb* [Global Competition], Gabler, Wiesbaden, pp. 363-399.

Powell, W.W. (1998), "Learning from collaboration: knowledge and networks in the biotechnology and pharmaceutical industries", *California Management Review*, Vol. 40, No. 3, pp. 228-240.

Powell, W.W., Koput, K.W. and Smith-Doerr, L. (1996), "Interorganizational collaboration and the locus of innovation: networks of learning in biotechnology", *Administrative Science Quarterly*, Vol. 41, No. 1, pp. 116-145.

Prahalad, C.K. and Hamel, G. (1990), The core competence of the corporation", *Harvard Business Review*, May, pp. 79-91.

Prajogo, D.I. and Sohal, A.S. (2006), "The integration of TQM and technology/R&D management in determining quality and innovation performance", *OMEGA – The International Journal of Management Science*, Vol. 34, No. 3, pp. 296-312.

Price, H. (1996), "The anthropology of the supply chain: Fiefs, clans, witch-doctors and professors", *European Journal of Purchasing & Supply Management*, Vol. 2, Nos. 2/3, pp. 87-105.

Primo, M.A.M. and Amundson, S.D. (2002), "An exploratory study of the effects of supplier relationships on new product development outcomes", *Journal of Operations Management*, Vol. 20, No. 1, pp. 33-52.

Proff, H. (2000), "Hybrid strategies as a strategic challenge – the case of the German automotive industry", *OMEGA – The International Journal of Management Science*, Vol. 28, No. 5, pp. 541-553.

Provan, K.G. (1993), "Embeddedness, interdependence, and opportunism in organisational supplier-buyer networks", *Journal of Management*, Vol. 19, No. 4, pp. 841-856.

Quélin, B. and Duhamel, F. (2003), "Bringing together strategic outsourcing and corporate strategy: outsourcing motives and risks", *European Management Journal*, Vol. 21, No. 5, pp. 647-661.

Quinn, J.B. (2000), "Outsourcing innovation: the new engine of growth", *Sloan Management Review*, Summer, pp. 13-28.

Quinn, J.B. and Hilmer, F.G. (1994), "Strategic outsourcing", *Sloan Management Review*, Summer, pp. 43-55.

Quintana-Garcia, C. and Benavides-Velasco, C.A. (2004), "Cooperation, competition, and innovative capability: a panel data of European dedicated biotechnology firms", *Technovation*, Vol. 24, No. 12, pp. 927-938.

Ragatz, G. L., Handfield, R. B., and Petersen, K. J. (2002), "Benefits associated with supplier integration into new product development under conditions of technology uncertainty", *Journal of Business Research*, Vol. 55, No. 5, pp. 389– 400.

Rayport, J.F. and Sviokla, J.J. (1995), "Exploiting the Virtual Value Chain", *Harvard Business Review*, November-December, pp. 75-85.

Reeve, T. (1990), "The firm as a nexus of internal and external contracts", in Aoki, M., Gustafsson, B. and Williamson, O.E. (Eds.), *The Firm as a Nexus of Treaties*, Sage, London, pp. 133-161.

Rich, N. and Hines, P. (1997), "Supply-chain management and time-based competition: the role of the supplier association", *International Journal of Physical Distribution & Logistics Management*, Vol. 27, Nos. 3/4, pp. 210-225.

Richards, T. (2002), "An intellectual history of NUD*ist and Nvivo", *International Journal of Social Research Methodology*, Vol. 5, No. 3, pp. 199-214.

Ring, P.S. and Van de Ven, A.H. (1992), "Structuring cooperative relationships between organizations", *Strategic Management Journal*, Vol. 13, No. 7, pp. 483-498.

Ritter, T. (1999), "The networking company: antecedents for coping with relationships and networks effectively", *Industrial Marketing Management*, Vol. 28, No. 5, pp, 467-479.

Ritter, T. and Gemünden, H.G. (2003a), "Interorganizational relationships and networks: an overview", *Journal of Business Research*, Vol. 56, No. 9, pp. 691-697.

Ritter, T. and Gemünden, H.G. (2003b), "Network competence: its impact on innovation success and its antecedents", *Journal of Business Research*, Vol. 56, No. 9, pp. 745-755.

Ritter, T., Wilkinson, I.F. and Johnston, W.J. (2004), "Managing complex business networks", *Industrial Marketing Management*, Vol. 33, No. 3, pp. 175-183.

Roland Berger Strategy Consultants (1999), "Eight mega-trends re-shaping the automotive supplier industry – a trend study to 2010", *Study*, München.

Roland Berger Strategy Consultants (2006), "Die Supply Chain im Griff: Wie Organisationstalente ihre Supply Chain organisieren" [A grip on the supply chain: how organisation talents organise their supply chains], *Study*, Stuttgart.

Romano, P. and Vinelli, A. (2001), "Quality management in a supply chain perspective: strategic and operative choices in a textile-apparel network", *International Journal of Operations & Production Management*, Vol. 21, No. 4, pp. 446-460.

Rommel, G.K., Kempis, R.D. and Kaas, H.W. (1994), "Does quality pay?"; *The McKinsey Quarterly*, No. 1, pp. 51-63.

Rossetti, C. and Choi, T.Y. (2005), "On the dark side of strategic sourcing: experiences from the aerospace industry", *Academy of Management Executive*, Vol. 19, No. 1, pp. 46-60.

Saad, S.M. and Lassila, A.M. (2004), "Layout design in fractal organizations", *International Journal of Production Research*, Vol. 42, No. 17, pp. 3529-3550.

Sako, M. and Murray, F. (1999), "Modular strategies in cars and computers", *Financial Times*, No. 6, December.

Sampler, J. L. (1998), "Redefining industry structure for the information age", *Strategic Management Journal*, Vol. 19, No. 4, pp. 343-355.

Sanchez, R. and Mahoney, J.T. (1996), "Modularity, flexibility, and knowledge management in product and organisation design", *Strategic Management Journal*, Vol. Special Issue: Knowledge and the Firm, pp. 63-76.

Savage, C.M. (1990), *Fifth Generation Management*, Digital Press, Woburn.

Schaudwet, C. (2004), "Unforeseen strengths", *Wirtschaftswoche*, Nr. 46, 4.11.2004, pp. 75-77.

Schilling, M.A. and Steensma, H.K. (2001), "The use of modular organizational forms: an industry-level analysis", *Academy of Management Journal*, Vol. 44, No. 6, pp. 1149-1168.

Schumpeter, J.A. (1934), *Theorie der wirtschaftlichen Entwicklung* [The theory of economic development], 4th ed., Duncker und Humblot, Berlin.

Selznick, P. (1957), *Leadership in Administration - A Sociological Interpretation*, Harper & Row, New York.

Silverman, D. (2000), *Doing Qualitative Research: A Practical Handbook*, Sage, London.

Silvestro, R. and Westley, C. (2002), "Challenging the paradigm of the process enterprise: a case-study analysis of BPR implementation", *OMEGA – The International Journal of Management Science*, Vol. 30, No. 3, pp. 215-225.

Singh, P.J., Smith, A. and Sohal, A.S. (2005), "Strategic supply chain management issues in the automotive industry: an Australian perspective", *International Journal of Production Research*, Vol. 43, No. 16, pp. 3375-3399.

Slack, N., Lewis, M. and Bates, H. (2004), "The two worlds of operations management research and practice: can they meet, should they meet?", *International Journal of Operations & Production Management*, Vol. 24, No. 4, pp. 372-387.

Slater, S.F. and Narver, J.C. (1995), "Market orientation and the leading organization", *Journal of Marketing*, Vol. 59, No. 3, pp. 63-74.

Smith, A. (1776), *The Wealth of Nations*, Reprint: 1982, Penguin Books, New York.

Smith, J.K. and Deemer, D.K. (2000), "The problem of criteria in an age relativism", in Denzin, N.K. and Lincoln, Y.S. (Eds.), *Handbook of Qualitative Research*, 2nd ed., Sage, Thousand Oaks, pp. 877-896.

Snow, C.C. and Thomas, J.B. (1994), "Field research methods in strategic management. Contributions to theory building and testing", *Journal of Management Studies*, Vol. 31, No. 4, pp. 457-480.

Snow, C.C., Miles, R.E. and Coleman Jr., H.J. (1992), "Managing 21st century network organisations", *Organizational Dynamics*, Winter, pp. 5-20.

Spekman, R.E. and Carraway, R. (2006), "Making the transition to collaborative buyer-seller relationships: an emerging framework", *Industrial Marketing Management*, Vol. 35, No. 1, pp. 10-19.

Spekman, R.E., Kamauff Jr., J.W. and Salmond, D.J. (1994), "At last purchasing is becoming strategic", *Long Range Planning*, Vol. 27, No. 2, pp. 76–84.

Spekman, R.E., Kaumauff, J. and Spear, J. (1999), "Towards more effective sourcing and supplier management", *European Journal of Purchasing & Supply Management*, Vol. 5, No. 2, pp. 103-116.

Spekman, R.E., Spear, J. and Kamauff, J. (2002), "Supply chain competency: learning as a key component", *Supply Chain Management: An international Journal*, Vol. 7, No. 1, pp. 41-55.

Stabell, C.B. and Fjeldstad, O.D. (1998), "Configuring value for competitive advantage: on chains, shops, and networks", *Strategic Management Journal*, Vol. 19, No. 5, pp. 413-437.

Stacey, R.D. (1995), "The science of complexity: an alternative perspective for strategic change processes", *Strategic Management Journal*, Vol. 16, No. 6, pp. 477-495.

Stake, R.E. (1995), *The Art of Case Study Research*, Sage, Thousand Oaks.

Stalk, G., Evans, P. and Shulman, L.E. (1992), "Competing on capabilities: the new rules of corporate strategy", *Harvard Business Review*, March-April, pp. 57-69.

Stewart, D.W. and Shamdasani, P.N. (1990), *Focus Groups: Theory and Practice*, Sage, Newbury Park.

Strauss, A.L. (1987), *Qualitative Analysis for Social Scientists*, Cambridge University Press, Cambridge.

Strauss, A.L. (1994), "Discovering new theory from previous theory: an exercise in theoretical sampling", in Glaser, B.G. (Ed.), *More Grounded Theory Methodology: A Reader*, Sociology Press, Mill Valley, pp. 369-388.

Strauss, A.L. (2004), "Reading M: qualitative analysis for social scientists", in Yates, S.J. (Ed.), *Doing Social Science Research*, Sage, London, pp. 197-210.

Strauss, A.L. and Corbin, J. (1998), *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*, 2nd ed., Sage, Thousand Oaks.

Suddaby, R. (2006), "From the editors: what grounded theory is not", *Academy of Management Journal*, Vol. 49, No. 4, pp. 633-642.

Surana, A., Kumara, S., Greaves, M. and Raghavan, U.N. (2005), "Suppli-chain networks: a complex adaptive systems perspective", *International Journal of Production Research*, Vol. 43, No. 20, pp. 4235-4265.

Svensson, G. (2003), "Holistic and cross-disciplinary deficiencies in the theory generation of supply chain management", *Supply Chain Management: An International Journal*, Vol. 8, No. 4, pp. 303-316.

Svensson, G. (2004), "Supplier segmentation in the automotive industry: a dyadic approach of a managerial model", *International Journal of Physical Distribution & Logistics Management*, Vol. 34, No. 1, pp. 12-38.

Swink, M.L. and Mabert, V.A. (2000), "Product development partnerships: balancing the needs of OEMs and suppliers", *Business Horizons*, May-June, pp. 59-68.

Sydow, J. (1992), *Strategische Netzwerke: Evolution und Organisation* [Strategic networks: evolution and organisation], Gabler, Wiesbaden.

Symon, G. and Cassell, C. (1998), "Reflections on the use of qualitative methods", in Symon, G. and Cassell, C. (Eds.), *Qualitative Methods and Analysis in Organizational Research: A Practical Guide*, Sage, London, pp. 1-9.

Szwejczewski, M., Lemke, F. and Goffin, K. (2005), "Manufacturer-supplier relationships: an empirical study of German manufacturing companies", *International Journal of Operations & Production Management*, Vol. 25, No. 9, pp. 875-897.

Takeishi, A. (2001), "Bridging inter- and intra-firm boundaries: management of supplier involvement in automobile product development", *Strategic Management Journal*, Vol. 22, No. 5, pp. 403-433.

Takeishi, A. and Fujimoto, T. (2001), "Modularisation in the auto industry: interlinked multiple hierarchies pf product, production and supplier systems", *International Journal of Automotive Technology and Management*, Vol. 1, No. 4, pp. 379-396.

Tan, K.C., Handfield, R.B. and Krause, D.R. (1998), "Enhancing firm's performance through quality and supply base management: an empirical study", *International Journal of Production Research*, Vol. 36, No. 10, pp. 2813-2837.

Tan, K.C., Lymon, S.B. and Wisner, J.D. (2002), "Supply chain management: a strategic perspective", *International Journal of Operations & Production Management*, Vol. 22, No. 6, pp. 614-631.

Tang, C.S. (1999), "Supplier relationship map", *International Journal of Logistics: Research & Application*, Vol. 2, No. 1, pp. 39-56.

Teece, D.J. (1987), *The Competitive Challenge: Strategies for Industrial Innovation and Renewal*, Ballinger, Cambridge.

Teece, D.J., Pisano, G. and Shuen, A. (1997), "Dynamic capabilities and strategic management", *Strategic Management Journal*, Vol. 18, No. 7, pp. 509-533.

Tesch, R. (1990), *Qualitative Research: Analysis Types and Software Tools*, Falmer, New York.

Thomke, S. and Fujimoto, T. (2000), "The effect of 'front-loading' problem-solving on product development performance", *Journal of Product Innovation Management*, Vol. 17, No. 1, pp. 128-142.

Thorelli, H.B. (1986), "Networks: between markets and hierarchies", *Strategic Management Journal*, Vol. 7, No. 1, pp. 37-51.

Trienekens, J.H. and Beulens, A.J.M. (2001), "View on inter-enterprise relationships", *Production Planning & Control*, Vol. 12, No. 5, pp. 466-477.

Twigg, D. (1998), "Managing product development within a design chain", *International Journal of Operations & Production Management*, Vol. 18, No. 5, pp. 508-524.

Ulrich, K.T. and Eppinger, S.D. (1995), *Product Design and Development*, McGraw-Hill, New York.

Usdiken, B., Sozen, Z. and Enbiyaoglu, H. (1988), "Strategies and boundaries: subcontracting in construction", *Strategic Management Journal*, Vol. 9, No. 6, pp. 633-637.

Van de Ven, A.H. (1989), "Nothing is quite so practical as a good theory", *Academy of Management Review*, Vol. 14, No. 4, pp. 486-489.

Van de Vrande, V., Lemmens, C. and Vanhaverbeke, W. (2006), "Choosing governance modes for external technology sourcing", *R&D Management*, Vol. 36, No. 3, pp. 347-363.

Van der Valk, W. and Wynstra, F. (2005), "Supplier involvement in new product development in the food industry", *Industrial Marketing Management*, Vol. 34, No. 7, pp. 681-694.

Van Eijkelenburg, S. (1995), "On the rhetoric of qualitative research – a rejoinder", *Journal of Management Inquiry*, Vol. 4, No. 2, pp. 209-210.

Van Gils, M.R. (1984), "Interorganizational relations and networks", in Drenth, P.J.D., Thierry, H., Willems, P.J. and de Wolff, C.J. (Eds.), *Handbook of Work and Organizational Psychology*, Wiley, Chichester, pp. 1073-1100.

Van Hoek, R. and Chapman, P. (2006), "From tinkering around the edge to enhancing revenue growth: supply chain-new product development", *Supply Chain Management: An International Journal*, Vol. 11, No. 5, pp. 385-389.

Van Maanen, J. (1979), "The fact of fiction in organisational ethnography", *Administrative Science Quarterly*, Vol. 24, No. 4, pp. 539-550.

Vastag, G. and Montabon, F. (2002), "Journal characteristics, rankings and social acculturation in operations management", *OMEGA – The International Journal of Management Science*, Vol. 30, No. 2, pp. 109-126.

VDA (2006), *Annual Report 2006*, Verband der Deutschen Automobilindustrie, Frankfurt.

Von Corswant, F. and Fredriksson, P. (2002), "Sourcing trends in the car industry – a survey of car manufacturers' and suppliers' strategies and relations", *International Journal of Operations & Production Management*, Vol. 22, No. 7, pp. 741-758.

Vonderembse, M.A., Uppal, M., Huang, S.H. and Dismukes, J.P. (2006), "Designing supply chains: towards theory development", *International Journal of Production Economics*, Vol. 100, No. 2, pp. 223-238.

Voss, C. (1995), "Operations management - from Taylor to Toyota – and beyond", *British Journal of Management*, Vol. 6, No. 6, pp. 17-30.

Voss, C., Tsikriktsis, N. and Fohlich, M. (2002), "Case research in operations management", *International Journal of Operations & Production Management*, Vol. 22, No. 2, pp. 195-219.

Wacker, J.G. (1998), "A definition of theory: research guidelines for different theory-building research methods in operations management", *Journal of Operations Management*, Vol. 16, No. 4, pp. 361-385.

Wagner, S.M. and Hoegl, M. (2006), "Involving suppliers in product development: insights from R&D directors and project managers", *Industrial Marketing Management*, Vol. 35, No. 8, pp. 936-943.

Walsh, M. (2002), "Teaching qualitative analysis using QSR NVIVO", *The Qualitative Report*, Vol. 8, No. 2, pp. 251-256, http://www.nova.edu/ssss/QR/QR8-2/walsh.pdf, accessed 20.04.2006.

Walter, A., Ritter, T. and Gemünden, H.G. (2001), "Value creation in buyer-seller relationships: theoretical considerations and empirical results from a supplier's perspective", *Industrial Marketing Management*, Vol. 30, No. 4, pp. 365-377.

Walters, D. (2004), "New economy – new business models – new approaches", *International Journal of Physical Distribution & Logistics Management*, Vol. 34, Nos. 3/4, pp. 219-229.

Watson, T.J. (2003), *Sociology, Work, and Industry*, 4th ed., Routledge, New York.

Weisenfeld, U., Reeves, J.C. and Hunck-Meiswinkel, A. (2001), "Technology management and collaboration profile: virtual companies and industrial platforms in the high-tech biotechnology industries", *R&D Management*, Vol. 31, No. 1, pp. 91-100.

Wernerfelt, B. (1984), "A resource-based view of the firm", *Strategic Management Journal*, Vol. 5, No. 2, pp. 171-180.

Whetten, D.A. (1989), "What constitutes a theoretical contribution?", *Academy of Management Review*, Vol. 14, No. 4, pp. 490-495.

Williams, J.R. (1992), "How sustainable is your competitive advantage?", *California Management Review*, Spring, pp. 29-51.

Williamson, O.E. (1975), *Market and Hierarchies: Analysis and Antitrust Implications*, Free Press, New York.

Williamson, O.E. (1979), "Transaction-cost economics: the governance of contractual relations", *Journal of Law and Economics*, Vol. 12, pp. 233-250.

Williamson, O.E. (1981), "The economics of organization: the transaction cost approach", *American Journal of Sociology*, Vol. 87, No. 3, pp. 548-577.

Williamson, O.E. (1990), "The firm as a nexus of treaties: An introduction", in Aoki, M., Gustafsson, B. and Williamson, O.E. (Eds.), *The Firm as a Nexus of Treaties*, Sage, London, pp. 7-8.

Winter, S.G. (2000),"The satisficing principle in capability learning", *Strategic Management Journal*, Vol. 21, Nos. 10/11, pp. 981-996.

Winter, S.G. (2003), "Understanding dynamic capabilities", *Strategic Management Journal*, Vol. 24, No. 10, pp. 991-995.

Wolters, H. and Schuller, F. (1997), "Explaining supplier-buyer partnerships: a dynamic game theory approach", *European Journal of Purchasing & Supply Management*, Vol. 3, No. 3, pp. 155-164.

Womack, J.P. and Jones, D.T. (1994), "From lean production to the lean enterprise", *Harvard Business Review*, March-April, pp. 93-103.

Womack, J.P., Jones, D.T. and Roos, D. (1991), *The Machine That Changed the World*, Paperback ed., HarperPerennial, New York.

Wong, A., Tjosvold, D. and Zhang, P. (2005), "Developing relationships in strategic alliances: commitment to quality and cooperative interdependence", *Industrial Marketing Management*, Vol. 34, No. 7, pp. 722-731.

Wood, D.J. and Gray, B. (1991), "Toward a comprehensive theory of collaboration", *Journal of Applied Behavioral Science*, Vol. 27, No. 2, pp. 139-162.

Woodward, J. (1965), *Industrial Organization: Theory and Practice*, Oxford University Press, London.

Wu, N. and Sun, J. (2002), "Grouping the activities in virtual enterprise paradigm", *Production Planning & Control*, Vol. 13, No. 4, pp. 407-415.

Wynstra, F. and Pierick, E. ten (2000), "Managing supplier involvement in new product development: a portfolio approach", *European Journal of Purchasing & Supply Management*, Vol. 6, No. 1, pp. 49-57.

Wynstra, F., Van Weele, A. and Weggemann, M. (2001), "Managing supplier involvement in product development: three critical issues", *European Management Journal*, Vol. 19, No. 2, pp. 157-167.

Yasuda, H. (2005), "Formation of strategic alliances in high-technology industries: comparative study of the resource-based theory and the transaction-cost theory", *Technovation*, Vol. 25, No. 7, pp. 763-770.

Yin, R.K. (2003), *Case Study Research: Design and Methods*, Applied social research methods series. Vol. 5, 3rd ed., Sage, Beverly Hills.

Zaheer, A. and Bell, G.G. (2005), "Benefiting from network position: firm capabilities, structural roles, and performance", *Strategic Management Journal*, Vol. 26, No. 9, pp. 809-825.

ZEW (2005), "Mannheim Innovation Panel 2005", *Research Study*, Zentrum für Europäische Wirtschaftsforschung, Mannheim.

Zhao, Y. and Calantone, R.J. (2003), "The trend toward outsourcing in new product development: case studies in six firms", *International Journal of Innovation Management*, Vol. 7, No. 1, pp. 51-66.

Zeng, M. and Chen, X.-P. (2003), "Achieving cooperation in multiparty alliances: a social dilemma approach to partnership management", *Academy of Management Review*, Vol. 28, No. 1, pp. 587-605.

Zirpoli, F. and Caputo, M. (2002), "The nature of buyer-supplier relationships in co-design activities: the Italian auto industry case", *International Journal of Operations & Production Management*, Vol. 22, No. 12, pp. 1389-1410.

# APPENDIX

## Appendix A: Classification of inter-firm relationship literature

| Theme | Author(s) | Focus of study / contribution | Unit of analysis | Theoretical perspective | Applied Methodology |
|---|---|---|---|---|---|
| Building and developing inter-firm relationships (supplier selection, evaluation, segmentation, etc.) | Ahuja (2000) | Identifies three accumulated resources that affect a firm's opportunities to form linkages | Individual firm | RBV, Social network theory | Longitudinal data set / Correlation analysis |
| | Aitken *et al.* (2003) | Supply chains need to be engineered to match product characteristics and customer requirements | Buyer firm | Product life cycle | Case study |
| | Anderson *et al.* (1994) | Argue that dyadic relationships have to be built within the context of the business network in which the relationships take place | Dyad | Social network theory | Validity assessment |
| | Araujo *et al.* (1999) | Buyer needs a variety of supplier interfaces | Buyer firm | RBV | Case study |
| | Beckman *et al.* (2004) | Partnering choices, i.e. the type of partnership, are contingent on the uncertainty firms are facing | Individual firm | Organisational learning, Social network theory | Database / Correlation and regression analysis |
| | Bensaou (1999) | A portfolio of relationships is necessary to be adaptive to product and market characteristics | Buyer firm | Contingency theory, Portfolio modelling | Questionnaire survey |
| | Caniëls and Gelderman (2005), Gelderman and Van Weele (2003) | Develop distinct purchasing strategies within each quadrant of Kraljic matrix based on relative power and total interdependence | Buyer firm | Resource dependency theory, Power | Questionnaire survey / correlation analysis |
| | Chen and Chen (2006) | Offers a tool for evaluating supplier quality performance as the main criterion for supplier selection due to the influence on overall product quality | Buyer firm | TQM | Conceptual / Case application |
| | Chiesa *et al.* (2000) | Develop a framework to support the identification of the most appropriate organisational form for technology collaboration | Buyer firm | Contingency theory | Conceptual / Case application |
| | Cigolini *et al.* (2004) | Develops a framework that helps to identify best supply chain strategy (i.e. governance of inter-firm relationships) based on three key drivers (product life cycle, complexity, supply chain type) | Buyer firm | Contingency theory | Conceptual / Case application |
| | Colombo (2003) | Examines effect of technological proximity on choice of organisational form of alliance | Dyad | TCE, RBV | Database / Econometric model |
| | Cousins and Crone (2003) | Argues that obligation based contracting should be used an exchange mode in an uncertain and dynamic environment | Dyad | Game theory, TCE | Interviews |
| | Cox (1996) | Argues that a certain relationship constellation is not fit for purpose in every and all supply circumstances. It rather depends on the relational competence of the partners. | Dyad | Relational view, Competence theory | Conceptual |
| | Das and Teng (2000) | Discusses how resource characteristics influence the formation of alliances and determine their structure | Individual firm | RBV, Resource dependency, Contingency theory | Conceptual |
| | Das *et al.* (2006) | Argues for an optimal level of supplier integration that leads to maximal performance through the configuration of internal and external integration practices | Buyer firm | Contingency theory | Questionnaire survey / Interviews / Correlation and regression analysis |
| | Emden *et al.* (2006) | Identifies four phases in the partner selection process of collaborative NPD in order to create competitive products | Buyer firm | Not specified | Case study interviews |
| | Fine (1998 and 2000) | Develops framework for strategic sourcing under banner of three dimensional concurrent engineering (3-DCE) combining product, process and supply chain issues | Buyer firm | SCM | Conceptual / Case applications |
| | Gerwin and Ferries (2004) | Analyse the organisation of new product development projects in inter-firm relationships and develops project organisation options (governance mode) | Network (project) | TCE, Network theory | Conceptual |

| | | | | | |
|---|---|---|---|---|---|
| | Goffin *et al.* (2006) | Identify attributes for the establishment of close relationships | Buyer firm | Partnerships concept, Relational view | Interviews |
| | Hallikas *et al.* (2002) | Suggests a partner portfolio matrix based on the current transactional effectiveness and the future potential value of the partner | Buyer firm | Contingency theory | Conceptual |
| | Hoetker (2006) | Investigates the relation between modular product design and organisational modularity showing that product modularity leads to more reconfigurable organisations | Focal firm | TCE, Knowledge based view | Database, / Correlation analysis |
| | Kaufman *et al.* (2000) | Develop a supplier typology based on the link between collaboration and technology dimensions | Buyer firm | TCE, Strategic sourcing | Questionnaire survey / correlation analysis |
| | Kraljic (1983) | Introduces purchasing portfolio matrix for identifying the right supply strategy | Buyer firm | Contingency theory, Portfolio modelling | Conceptual / Case study |
| | Lambert *et al.* (1999) | Model to determine most appropriate degree of partnering | Dyad | Contingency theory | Case study interviews |
| | Li and Rowley (2002) | Considers inertia as rationale for partner selection | Individual firm | Organisation behaviour | Database / Correlation and regression analysis |
| | Masella and Rangone (2000) | Suggests a contingency approach to the design of vendor selection systems | Buyer firm | Contingency theory | Conceptual |
| | McIvor and Humphreys (2004) | Strategic factors that influence the degree of early supplier involvement | Dyad | Not specified | Case study / Questionnaire survey |
| | Mikkola and Skjøtt-Larsen (2003) | Identifies points of early supplier involvement in product development | Buyer firm | Resource interdependence | Case studies |
| | Miles and Snow (1986) | Relationship structures and strategies need to change dependent on new competitive situations | Dyad | Contingency theory | Conceptual |
| | Miotti and Sachwald (2003) | Argues that the selection of partners for R&D collaboration mainly depends on the possession of complementary resources | Buyer firm | RBV | Questionnaire survey / correlation analysis |
| | Möller and Törrönen (2003) | Develop an evaluation framework that links a supplier's capability profile with the suitability for creation of various types of value | Buyer firm | RBV | Conceptual |
| | Nellore and Söderquist (2000) | Combines purchasing portfolio idea with product specifications to identify most appropriate suppliers | Buyer firm | Contingency theory | Case studies |
| | Parise and Casher (2003) | Offers portfolio approach to alliance design and management | Buyer firm | Portfolio model | Interviews / Questionnaire surveys |
| | Petersen *et al.* (2003) | Develop model on supplier integration based on activities for successful involvement of suppliers in NPD. Supplier involvement is important when the technology is complex or the buying company does not have enough internal expertise | Buyer firm | TCE, Relational view, Social network theory, Organisational design | Case studies / Questionnaire survey / Structural equation modelling |
| | Petroni and Panciroli (2002) | Buyer assigns different roles to supplier in product development depending on innovative capabilities | Supplier firm | RBV | Questionnaire survey / Structural equation modelling |
| | Ring and Van de Ven (1992) | Argue for risk and reliance on trust as main criteria for the choice of governance mode in inter-firm relationships | Buyer firm | TCE, Trust | Conceptual |
| | Takeishi and Fujimoto (2002) | Argues that modularisation links product, process and supplier system architectures | Buyer firm | Not specified | Case study / Questionnaire survey |
| | Tang (1999) | Suggests types of buyer-supplier relationships in a supplier relationship map based on the strategic importance of the part to the buyer and the buyer's bargaining power | Buyer firm | Contingency theory | Conceptual |
| | Van de Vrande *et al.* (2006) | Examines the effects of exogenous uncertainty and transactions costs on the choice of governance modes for inter-firm relationships | Buyer firm | TCE, Real options | Conceptual |
| | Vonderembse (2006) | Identify different supply chain strategies based on product characteristics and stages of product life cycle | Network | Contingency theory | Case studies |
| | Weisenfeld *et al.* (2001) | Investigates how the suitability of collaboration forms (defined by collaboration profile) varies with the stages of technology development | Dyad | Contingency theory | Conceptual / Case application |

| | | | | | |
|---|---|---|---|---|---|
| | Wynstra and Pierick (2000) | Introduces supplier involvement portfolio to distinguish degrees of supplier involvement in development projects | Buyer firm | Contingency theory | Case study |
| | Wynstra *et al.* (2001) | Outlines three key issues for supplier involvement: cross-functional, organisational and human aspects | Buyer firm | Relational view | Conceptual |
| | Yasuda (2005) | Explains forms of technology driven strategic alliances | Buyer firm | RBV, TCE | Case studies |
| Managing inter-firm relationships (supplier development, management, involvement, etc.) | Ballou *et al.* (2000) | Recognises that the management of inter-firm relationships requires intra-functional, inter-functional and inter-organisational coordination | Buyer firm | SCM | Conceptual |
| | Bititci *et al.* (2003) | Argue for the necessity of a meta level management process in order to create and sustain competitive advantage for collaborative systems | Network | Competence theory | Case study |
| | Blomqvist *et al.* (2004) | Management of inter-firm relationships is emphasised as meta-capability for innovation | Buyer firm | DCV | Case study |
| | Boje and Whetten (1981) | Shows that central position in interorganisational networks is beneficial as it positively influences the actor's ability to influence resource transactions in the network | Focal firm | Social network theory, Resource dependency theory | Interviews / Correlation, regression and path analysis |
| | Bullinger *et al.* (2004) | Suggests an innovation roadmapping tool to align innovation activities within inter-firm relationships | Network | RBV | Conceptual |
| | Choi *et al.* (2001) | Argue for a balance between control and emergence in managing inter-firm relationships | Network | Complexity theory | Conceptual |
| | Cousins (2002) | Argues for viewing relationships as processes rather entities that have to manage the trade-off between the level of dependency and the level of certainty | Dyad (product, process) | Game theory | Conceptual / Case applications |
| | Cox *et al.* (2003), Cox (2004) | Develops framework for supplier relationship management based on various types of buyer-supplier relations | Dyad | Concept of power | Conceptual / Case application |
| | Croom (2001) | In managing interactions with suppliers, relational capabilities have a significant impact on collaborative product development performance | Buyer firm | RBV | Interviews / Observation |
| | Das and Teng (1999) | Propose a framework for the management of risk in alliances | Buyer firm | Relational view | Conceptual |
| | Gittell and Weiss (2004) | Develop a framework that links intra- and inter-organisational coordination in inter-firm relationships | Buyer firm | Network theory, Organisation design | Case study |
| | Gulati (1999) | Shows that a firm relationship capabilities influences its decision to form alliances and relationships with other firms | Individual firm | RBV | Longitudinal data set / Correlation analysis |
| | Harland and Knight (2001) | Identify specific roles for network management | Buyer firm | SCM | Action research / Case study |
| | Hillebrand and Biemans (2003) | Argue that internal cooperation is a prerequisite for efficient and effective external cooperation | Buyer firm | Organisational learning | Conceptual |
| | Inkpen and Ross (2001) | Identify reasons why organizations may persist with failing alliances and suggested some mechanisms for countering these forces | Buyer firm | Organisational behaviour, Path dependency | Case studies |
| | Inkpen and Tsang (2005) | Argue that the characteristics of the network type influence the transfer of knowledge between the partners | Dyad | Social network theory | Conceptual |
| | Johnsen *et al.* (2000) | Identify networking activities important for the management of inter-firm relationships | Network | Relational view | Conceptual / Case applications |
| | Kale *et al.* (2000) | Alliance management can help a firm to achieve learning critical skills, capabilities, or information from the partner and at the same time protecting one from losing core proprietary assets to the partner. | Dyad | Relational view | Questionnaire survey /Structural equation modelling |
| | Kale *et al.* (2002) | The creation of a dedicated alliance function facilitates the development of alliance capability and hence enables the realisation of greater success | Individual firm | RBV, Organisational learning | Questionnaire survey / Regression analysis |
| | Kelly *et al.* (2002) | Identifies challenges of collaboration particularly at early stages | Buyer firm | Not specified | Interviews / Questionnaire survey |

| | | | | | |
|---|---|---|---|---|---|
| | Koufteros *et al.* (2005) | Concurrent engineering is regarded as the early involvement of an internal cross-functional team in new product development process. This is an important enabler of external integration with a supplier or a customer | Buyer firm | Contingency theory | Questionnaire survey /Structural equation modelling |
| | Krause and Ellram (1997) | Explores critical elements of supplier development and reveals that two-way communication, cross-functional teams, and long-term collaboration perspectives are important | Buyer firm | Strategic sourcing | Questionnaire survey / Descriptive statistics |
| | Lakemond *et al.* (2006) | Discusses various forms of supplier involvement in product development and the managerial implications related to their coordination | Buyer firm | Contingency theory | Case studies |
| | Lambert and Cooper (2000) | Successful supply chain management requires integrating business processes with key members of the supply chain | Buyer firm | Relational view | Interviews |
| | Maloni and Benton (2000) | Investigate the influence of power on supply chain integration and management | Buyer firm | Concept of power | Questionnaire survey / Structural equation modelling |
| | McEvily *et al.* (2000) | Knowledge sharing and locking in suppliers and customers can delay competence substitution | Individual firm | RBV | Conceptual |
| | McIvor and McHugh (2000) | To avoid problems during the development process, cultural changes in both companies must accompany successful collaborative relationships. Success requires a change in mind-set understanding, trust, and commitment to the partnership | Dyad | Trust | Case study |
| | Möller and Svahn (2003) | Proposes a classification of different types of relationships and the different types of capabilities needed to manage these | Network | Industrial network theory, DCV | Conceptual |
| | Monczka *et al.* (1998) | Most important action to be taken in the development of inter-firm relationships is to foster and nurture a sense of trust | Buyer firm | Trust | Questionnaire survey / Regression analysis |
| | Mowery *et al.* (1996) | Shows that absorptive capability is important for knowledge transfer within alliances and depends on the overlap of the partners technology | Individual firm | Knowledge based view | Database / Correlation analysis |
| | Noori and Lee (2004) | Develops principles to manage complexity in inter-firm product development | Network | Social network theory | Case studies |
| | Obstfeld (2005) | Introduces the *tertius iungens* strategy that involves coordination of relationships without adversarial tension | Buyer firm | Social network theory | Questionnaire survey / Ethnographic study |
| | Olsen and Ellram (1997b) | Suggests portfolio model approach to managing relationships | Buyer firm | Portfolio model, Contingency theory | Conceptual |
| | Oxley and Sampson (2004) | Argues that the reduction of alliance scope is a means to managing the trade-off between open knowledge exchange and a loss of proprietary competencies | Dyad | Knowledge based view, TCE | Database / Correlation and regression analysis |
| | Petersen *et al.* (2005) | Investigates managerial practices important to effectiveness in new product development through the involvement of suppliers | Dyad | New product development, Strategic sourcing | Questionnaire survey / Structural equation modelling |
| | Provan (1993) | Causality between opportunistic behaviour and embeddedness in relationship | Supplier firm | TCE | Conceptual |
| | Quintana-Garcia and Benavides-Velasco (2004) | Recognise the importance of co-opetition dynamics, i.e. simultaneous competition and cooperation, of partners in alliances for performance in new product development | Dyad | TCE, RBV, Game Theory | Database / Correlation analysis |
| | Ritter (1999) | Introduce the concept of network competence, a company specific capability to build and use inter-organisational relationships | Buyer firm | RBV | Standardised interviews / Regression analysis |
| | Ritter and Gemünden (2003b) | Introduce the concept of network competence, a company specific capability to build and use inter-organisational relationships | Buyer firm | RBV | Standardised interviews / Structural equation modelling |
| | Ritter *et al.* (2004) | Identifies key abilities necessary to manage complex inter-firm relationships | Buyer firm | RBV | Conceptual |
| | Spekman *et al.* (1999) | Outline ten principles that lead to effective sourcing and supplier management | Buyer firm | Strategic sourcing | Questionnaire survey / descriptive statistics |

| | | | | | |
|---|---|---|---|---|---|
| | Swink and Mabert (2000) | Offer then commandments for OEMs and suppliers in managing inter-firm relationships | Dyad | Not specified | Conceptual |
| | Takeishi (2001) | Shows that capabilities for internal and external coordination are necessary for superior performance | Buyer firm | RBV | Interviews / Questionnaire survey / Regression analysis |
| | Wagner and Hoegl (2006) | Supplier involvement needs not only to be managed on the organisational but more importantly on the project level | Buyer firm | Relational view | Case study / Interviews |
| | Wong *et al.* (2005) | Commitment of relationship partners to quality leads to collaborative goal interdependence that facilitates long-term relationships | Dyad | Goal interdependence theory | Questionnaire survey / Structural equation modelling |
| | Zaheer and Bell (2005) | Network capabilities enable firms to bridge structural holes within the network and thereby enable better collaboration and innovative performance | Focal firm | RBV, Resource dependency theory | Questionnaire survey / Correlation and regression analysis |
| | Zeng and Chen (2003) | Adopts a social dilemma approach (between cooperation and competition) to the management of inter-firm relationships | Dyad | Social dilemma | Conceptual |
| Impacts / benefits of inter-firm relationships (competitive advantage, risk sharing, learning, trust, sustainability, etc.) | Afuah (2000) | Demonstrates the need to view a resource as residing in a network and not the individual firm | Dyad | RBV | Database / Correlation analysis |
| | Anderson and Jap (2005) | Looking at the dark side of relationships, i.e. stable relationships that are vulnerable to destruction | Dyad | Opportunism | Questionnaire survey |
| | Blankenburg Holm *et al.* (1999) | Establishes causality between business network connection through mutual commitment and dependency to value creation in relationships | Dyad | Mutuality, Resource dependency | Standardised interviews / Structural equation modelling |
| | Carr and Smeltzer (1999) | Indicates that strategic purchasing positively impacts on the level of cooperation and coordination of partners in the relationship | Buyer firm | Strategic sourcing | Questionnaire survey / Regression analysis |
| | Carter (2005) | Shows that purchasing acting socially responsible (purchasing social responsibility) improves supplier performance and thereby reduces cost | Buyer firm | RBV, Organisational learning | Questionnaire survey / Structural equation modelling |
| | Chang (2003) | The firm level innovation performance varies with the level of inter-organisational collaboration which depends on a firm's networking ability to cooperate | Individual firm | Dynamic capabilities view, Innovation network theory | Questionnaire survey / Regression analysis |
| | Chen *et al.* (2004) | Strategic purchasing and supply management leads to sustainable competitive advantage through close, long-term and strategic relationships and open communication therein | Buyer firm | Competence theory, Strategic sourcing | Questionnaire survey / Structural equation modelling |
| | Das and Teng (2000) | Discusses how partner resource alignment contributed to alliance performance | Dyad | RBV, Resource dependency, Contingency approach | Conceptual |
| | Draulans *et al.* (2003) | The success of relationship depends on the capability of the partners to manage the relationship | Dyad | Knowledge based view | Interviews / Questionnaire survey / correlation analysis |
| | Dyer and Singh (1998) | Argue for the relationship as source for competitive advantage based on relations assets, knowledge sharing routines, complementary resources and effective governance | Dyad | Relational view | Conceptual |
| | Fynes *et al.* (2005) | Indicates the impact of supply chain relationship quality on quality performance | Buyer firm | Industrial Marketing and Purchasing Model | Questionnaire survey / Structural equation modelling |
| | Gulati (1995) | Repeated long-term ties between alliance partners lead to increasing trust and more equity based relationship types | Dyad | Trust | Database / Correlation and regression analysis |
| | Halldórsson and Skjϕtt-Larsen (2004) | Competence development in logistics relationship | Dyad | RBV | Case studies |
| | Hult *et al.* (2006) | The fit between knowledge elements and relationship strategy determines the performance of the relationship | Buyer firm | RBV | Questionnaire survey / Correlation and regression analysis |

| | | | | | |
|---|---|---|---|---|---|
| | Ireland *et al.* (2002) | Competitive advantage in relationships depends on the alliance management skills | Buyer firm | TCE, RBV, Social network theory | Conceptual |
| | Johansson *et al.* (2000) | Three way partnerships can reduce development lead up to 50% | Buyer firm | SCM | Case studies |
| | Johnston *et al.* (2004) | Supplier involvement that leads to positive outcomes is partially a function of the trust that the target suppliers have in the buyer firm | Dyad | Trust | Questionnaire survey / Structural equation modelling |
| | Jones *et al.* (1997) | Shows that network form of governance has advantages over market and hierarchy modes in cases of complexity and uncertainty through the structural embeddedness of transactions to safeguard exchanges | Network | TCE, Social network theory | Conceptual |
| | Kalwani and Narayandas (1995) | Indicates that suppliers in long-term relationships gain higher profitability through reducing their discretionary expenses than suppliers in adversarial transactional relationships | Supplier firm | Relational view | Database / Wilcoxson test |
| | Kessler *et al.* (2000) | More external sourcing is negatively related to competitive success, innovation speed and development cost | Buyer firm | Learning | Questionnaire survey / correlation analysis |
| | Khanna (1998) | Argues that the benefits of alliance partners are dependent upon the alliance scope, i.e. which activities are included in the alliance | Dyad | Learning | Conceptual |
| | Kodama (2005) | The formation of networked strategic communities enables success through the creation of knowledge and innovation across organisational boundaries | Buyer firm | Knowledge based view, Learning | Case studies |
| | Kogut (2000) | Network as vehicle for creation of firm value | Supplier firm | RBV | Case study |
| | Lai *et al.* (2005) | Shows that relationship stability is positively linked to the suppliers' commitment to quality | Supplier firm | TCE | Questionnaire survey |
| | Lane and Lubatkin (1998) | The capacity for learning out of relationships (absorptive capacity) depends on the similarity between the firms in the relationship (relative absorptive capacity) | Dyad | Organisational learning | Questionnaire survey / Correlation and regression analysis |
| | Lawrence *et al.* (2002) | High level of involvement and embeddedness among relationship partners can have an institutional effect and lead to the generation of proto-institutions | Dyad | Institutional theory, Organisational structuration theory | Longitudinal case studies |
| | Li *et al.* (2006) | Higher levels of SCM practice (e.g. strategic supplier partnership) lead to higher levels of competitive advantage and organisational performance | Buyer firm | SCM, Strategic sourcing | Questionnaire survey / Structural equation modelling |
| | Lorenzoni and Lipparini (1999) | Argue that capability to interact with other companies (relational capability) accelerates the lead firm's knowledge access and transfer which affects its competitiveness | Buyer firm | RBV | Longitudinal cases |
| | Madhok and Tallman (1998) | Considers relationships as a resource for value creation and realisation | Dyad | TCE, RBV | Conceptual |
| | Martínez Sánchez and Pérez Pérez (2003) | Cooperation increases the ability to reduce time and cost of new product development through the use of related NPD practices | Supplier firm | Contingency approach | Questionnaire survey / Regression analysis |
| | Mohr and Spekman (1994) | Identify various factors for partnership success | Dyad | Contingency approach | Questionnaire survey / Regression analysis |
| | Møller *et al.* (2003) | Develops a framework that highlight four different types of competence development in relationships | Buyer firm | RBV, Contingency approach | Conceptual / Case application |
| | Morton *et al.* (2006) | Develop a tool to support the evaluation of relationship impact on firm performance | Buyer firm | Relational view | Action research case study |
| | Narasimhan and Nair (2005) | Supply chain proximity formed by means of information sharing between partners has positive influence on supply chain performance | Buyer firm | SCM | Database / Structural equation modelling |
| | Parkhe (1993) | The performance of a strategic alliance is negatively related to the extent to which the partners perceive each other behaving opportunistically | Dyad | Game theory, TCE | Questionnaire survey |
| | Parry *et al.* (2006) | Close relationships increase the exchange of proprietary information but also increase the potential loss of core competencies | Buyer firm | Competence theory | Case study |

| | | | | | |
|---|---|---|---|---|---|
| | Petersen *et al.* (2005) | Supplier involvement in product development facilitates better decision making and leads to better design quality | Dyad | New product development, Strategic sourcing | Questionnaire survey / Structural equation modelling |
| | Primo and Amundson (2002) | Impact of supplier involvement on product quality, project development and project cost | Buyer firm | Contingency Theory | Survey / Structural equation modelling |
| | Ragatz *et al.* (2002) | Conceptual model of the effects of elements of supplier integration process on cost, quality, and time under conditions of technology uncertainty | Buyer firm | Strategic sourcing | Conceptual |
| | Rich and Hines (1997) | Addresses the role of supplier associations as a medium for the achievement of time-based competitive advantage | Buyer firm | Network sourcing model | Conceptual |
| | Romano and Vinelli (2001) | Shows that a coordinated perspective to managing relationships can lead to improvements in quality and customer responsiveness for the whole supply network as opposed to traditional arms length relationships | Buyer firm | Relational view | Case study |
| | Rossetti and Choi (2005) | Shows that misapplying the tenets of strategic sourcing can weaken the buyer's long-term competitiveness | Buyer firm | Strategic sourcing | Case study |
| | Tan *et al.* (1998) | Investigates how firms exploit their suppliers' capabilities to gain competitive advantage | Buyer firm | SCM, Strategic sourcing | Case study |
| | Tan *et al.* (2002) | Shows that supplier evaluation practices are correlated to firm performance | Buyer firm | SCM, Strategic sourcing | Questionnaire survey / Factor analysis |
| | Van der Valk and Wynstra (2005) | Benchmarking study reveals that supplier involvement in product development can have positive effects on performance but largely depends on the management of the relationship | Buyer firm | SCM, Strategic sourcing | Case studies |
| | Walter *et al.* (2001) | Relationships are conceptualised as direct and indirect value creating functions that contribute to the value perceived by the supplier | Supplier firm | Relational view | Interviews / Questionnaire survey / Factor analysis |
| Inter-firm relationships in automotive industry | Ali *et al.* (1997) | Investigate the influence of Japanese-style practices on the development of relationships in Western automotive industry | Dyad | Relational view | Case study of Jaguar and Nippondenso / Interviews |
| | Batchelor *et al.* (2001) | Outsourcing on a modular level bears the risk of loosing knowledge and control over the product | Buyer firm | Modularity, Knowledge based view | Conceptual |
| | Becker and Zirpoli (2003) | Argue for a negative long-term effect of outsourcing on the knowledge base of the company | Buyer firm | RBV, Resource dependency theory | Case study of FIAT |
| | Bruner and Spekman (1998) | Identify six factors that alliances seem to be vulnerable to | Dyad | Path dependency | Case study of Volvo-Renault, interviews |
| | Caputo and Zirpoli (2001) | Argue for the importance of a modular organisational structure in the context of modular product development which facilitates supplier involvement at earlier stages of the process | Buyer firm | Modularity, Strategic sourcing | Case study of Fiat / Interviews |
| | Caputo and Zirpoli (2002) | Argue that OEMs do not need to fear know how migration to suppliers if they possess a strong competence as system integrator and apply modern supply chain management | Buyer firm | Knowledge based view | Case study |
| | Cousins and Stanwix (2001) | Develops a conceptual model for mutually advantageous relationships based on trust | Dyad | Trust | Interviews / Questionnaire survey / Factor analysis |
| | Cusumano and Takeishi (1991) | Shows that Japanese suppliers perform better in dimensions such as quality and price compared to US suppliers | Buyer firm | Relational view | Questionnaire survey / Interviews / Correlation analysis |
| | Doran (2003) | Shows the implications of modularisation on the organisation of the supply chain, in particular the re-organisation of first tier suppliers | Supplier firm | Modularity, SCM | Case studies |
| | Dyer (1996a) | Reveals that co-specialisation between partners in a relationships (OEM and supplier) positively influence performance (quality and new model cycle time) | Dyad | TCE | Interview / Questionnaire survey in U.S. and Japan |

| | | | | | |
|---|---|---|---|---|---|
| | Dyer (1996b) | Transfer of Japanese style relationship model to U.S. | Buyer firm | Relational view | Case study of Chrysler |
| | Dyer (1996c) | Argues for trust as highly efficient governance mechanisms to reduce transaction cost | Buyer firm | TCE | Interviews / Questionnaire survey / correlation analysis |
| | Dyer (1997) | Reveals that high asset specificity and low transaction cost can be achieved simultaneously based on effective interfirm relationships | Buyer firm | TCE | Interviews |
| | Dyer and Hatch (2004) | Argues that sharing knowledge in close partnerships can be a source of competitive advantage | Buyer firm | Organisational learning, Knowledge based view | Case study of Toyota |
| | Dyer and Nobeoka (2000) | A network with its greater diversity in knowledge is more effective than the firm at the generation, transfer and recombination of knowledge | Network | Social network theory, Knowledge based view | Case study of Toyota |
| | Dyer and Ouchi (1993) | Outlines advantages of Japanese partnership approach and suggests ways of how to adopt it | Buyer firm | TCE | Interviews / Questionnaire survey |
| | Garel and Midler (2001) | Demonstrates that co-development in relationships plays a major role in reducing the number and cost of modifications in the development process | Buyer firm | Concurrent engineering, Strategic sourcing | Case studies |
| | Geffen and Rothenberg (2000) | Strong partnerships are a significant element of the successful development of innovation | Buyer firm | Strategic sourcing, Relational view | Case studies |
| | Johnsen and Ford (2005) | Shows negative effects of intervention strategies of OEMs within inter-firm relationships | Supplier firm | Power, Interdependence | Case study |
| | Liker and Choi (2004) | Deep supplier relationships as basis for competitive success | Buyer firm | Relational view | Case studies of Toyota and Honda |
| | Mikkola (2003) | Outsourcing based on modular product architectures creates interdependence between buyer and supplier and thereby potential for inter-firm learning | Buyer firm | Modularity, Organisational learning | In depth case study of Chrysler |
| | Svensson (2004) | Develops a phase model for the selection of an appropriate relationships strategy towards suppliers | Buyer firm | Not specified | Interview / Questionnaire survey / Correlation analysis |
| | Wolters and Schuller (1997) | Purchasing based on complete systems rather than parts to improve competitiveness | Buyer firm | Game theory | Conceptual / Case applications |
| | Zirpoli and Caputo (2002) | Argues for a hybrid approach to buyer-supplier relationship in product development | Buyer firm | Strategic sourcing | Case study of Fiat |

**Table A.1: Classification of inter-firm relationship literature**

## Appendix B: Research protocol

### 1. Research topic and objectives

Explore how an appropriate governance of inter-firm (R&D) relationships (in the automotive industry) can lead sustainable competitive success for the whole partnership as well as its individual member companies.

- Explore the current practice of R&D collaboration within inter-firm relationships in German automotive industry
- Determine strategic factors and contingencies that influence the creation and management of inter-firm R&D relationships and the development and management of the related inter-organisational governance structure
- Determine operative practices and tools that influence R&D transactions and collaborative activities within inter-firm relationships
- Develop guidelines for achieving sustainable competitive success of inter-firm R&D relationships

### 2. Data collection – semi-structured interviews

- ***Select sites and subjects*** (convenience sample based on contacts in German automotive industry and using further contacts in a snowballing manner; aiming for polar types, e.g. OEMs, systems suppliers, part suppliers, etc.)
- ***Develop interview guide*** based on basic literature about new organisational phenomena and the realisation that inter-disciplinary research is necessary leading to three main sections of interview guide: Empirical context, organisational / company context, and collaboration context
- ***Pilot test interview guide*** in two interviews in July 2004 leading to refinement of interview guide
- ***Carry out interviews*** (28 interviews including the 2 pilot ones, 31 interviewees, 16 companies) from December 2004 until March 2005
- ***Transcription of interviews*** resulting in over 300 pages of transcript roughly from April until May 2005
- ***Approval and data validation of interview transcripts*** by interviewees (face validity). Interview transcript, short initial summary and form of consent were sent out to interview participants (from 31 interviewees 30 signed forms were received, 1 notification that a written approval is against company regulations but transcript was amended; 2 transcripts with major changes, 9 with minor changes, 17 with no changes)

### 3. Data analysis – computerised contextual analysis (content analysis) with QSR NVIVO 2.0 (from June 2005 until November 2005)

- ***Thematic coding:*** develop abstract themes based on research objectives in a top-down approach (relationship governance with the elements (i) relationship status quo, (ii) relationship design, (iii) relationship management, and (iv) relationship success)

- *Rough pre-selection of relevant text* by organising text in thematic units based on the abstract themes developed within thematic coding (marking relevant passages in red and writing blue memos)
- *Open coding:* coding the interviews by identifying repeating ideas (codes or nodes) of each interview document individually (within-case analysis) in a bottom-up approach resulting in an initial code list with 237 items and their description
- *Categorising:* identify repeating ideas across all documents (cross-case analysis) by condensing, aggregating, and clustering the initial codes into superior and more abstract categories and sub-categories. The results are five empirical core categories in alignment with the abstract themes from the thematic coding: (i) industrial impact, (ii) collaborator portfolio, (iii) collaboration, (iv) competence, and (v) holistic competitive advantage; as well as 9 categories with various subcategories including 156 basic codes (8 original codes are left as free nodes). This is structured in a Coding Master Table that includes the code name, a definition / description, an illustrative example of representative text, and an indication of the interviews the respective code occurred in (frequency count)
- *Re-coding:* double-check individual interview documents based on the final codes and categories and re-code (i.e. un-code or code) where appropriate and necessary eventually leading to new codes and an exact reference list (frequency count) for each code in the Coding Master Table
- *Validating coding:* validation of the coding (i.e. nature of categories, the type of codes, the way how they are organised in the Master Table, as well as the way in which the text was coded) by experts and peers; backward translation of examples used for codes
- *Theoretical narrative:* write up a detailed story of each of the five core categories reflecting connections between categories and their codes using the subjective perspective of interviewees
- *Hypothesising:* develop a set of tentative propositions summarising the main aspects of the theoretical narratives

4. **Data validation – questionnaire survey** (from December 2005 until February 2006)
   - *Develop questionnaire* (5 point Likert scale; two dimensions: agreement and importance) with tentative propositions clustered in five main sections according to five core categories
   - *Validate questionnaire* by back-translating the translated German version into English by a second person in order to avoid subjectivity
   - *Pilot test questionnaire* with about 5-10 respondents and clarify time, clarity, perception, etc. (beginning December 2006)
   - *Evaluate proposition* for their robustness depending on the responses from the questionnaire respondents. Eliminate propositions that are not considered important by respondents. Convenience sample based on contacts in German automotive industry and using further contacts in a snowballing manner. 110 valid responses from 52 different companies were received.

5. **Enfolding literature**
   - *Review relevant theoretical literature and confront with empirical findings*

6. **Development of new conceptual governance framework**
   - ***Develop theoretical constructs*** around abstract and empirical core categories leading to a new governance framework (theory extension)

7. **Framework validation – industrial workshop or focus group** (July 2006)
   - ***Evaluate framework*** on its applicability to industrial practice and on the potential for improving competitiveness of inter-firm relationship. Five participants from 4 different companies (semi-natural sample).
   - ***Develop guidelines*** how to apply and use framework in practice

## Appendix C: Interview guide

# Interview Guide

The study underlying this interview explores how future organisational structures (networks of companies) in the automotive industry can gain competitive advantage within their industry by efficiently exploiting inter-firm collaborations based on a new governance architecture.

The interview is semi-structured and should not exceed 1.5 to 2 hours in total. The following is a set of typical question on various topics, which does not represent an exclusive catalogue but consists enough structure to reveal the necessary data. This should enable both parties, the interviewee as well as the interviewer, to expand and alternate questions within the given topics.

Section 1: Industrial context

- Industrial environment
  - Current industrial landscape
    - Major constraints
    - Company's reaction
  - Main players and distribution of power among them
    - Customers
    - Competitors
    - Suppliers
    - Role of the company itself
  - Changes over the past
    - Reasons / causes
    - Drivers / Responsibilities (Who, What)
    - Objectives (cost, quality, efficiency, responsiveness, other)
    - Company's adaptation
  - Future trends
    - Reasons / causes
    - Drivers / Responsibilities (Who, What)
    - Objectives
    - Company's possible reaction
  - Ideal situation

Section 2: Company context

- Basic background
  - Company figures
  - Strategic goals
  - Product and services (market segments → premium)
- Describe the basis upon which you deliver products and services (e.g. quality, speed, flexibility, dependability, cost, range, others)
- How does this deliver value to your customers / why would they choose you
- Depending on different types of projects are different aspects important
- How does it enable you to differentiate from your competitors

- Would you consider these as your core competencies
- Why is it a core competence rather than a support function
- What specifies a core competence to you
- How did you develop your competencies
- What opportunities do they give you for the future
- What are possible threats to your competencies
- How important are competencies for business in automotive sector
- Does competence determine strategy or vice versa

Section 3: Collaboration in R&D context

- Value system in joint R&D and product development
    - Process steps
    - Participants / value members
    - Contribution of participants
- Considering outsourcing of business to suppliers
    - What are your main reasons / motives for outsourcing and collaboration
    - What are your individual experiences
    - How does outsourcing impact on relationship (e.g. are suppliers more integrated)
- On which basis are suppliers selected / on which basis do you think the OEM selects its suppliers
- When do you consider a supplier / partner to be the most competent one
- How does the nomination and selection process look like
    - What sort of data do you use / is there a classification framework (ABC supplier, etc.)
    - In what way do you use the data
    - Does it have particular influence on the selection of suppliers
    - Is there a relation between certain customer requirements and the selection of suppliers
    - If yes, how does the general causality look like
    - Is there a standardised approach
- What risks are involved in selecting the right supplier
- Database
- How can collaboration between OEM and supplier be characterised
    - What are the basic collaborative steps in a project
    - How close would you evaluate your collaborative relationship (e.g. degree of integration, involvement, etc.)
    - Does partnership exist on the organisational level and not only on personal one
    - How do you perceive the negotiations / how are decisions made
    - How deep is supplier involved in the learning process of the OEM
    - How are resources shared (e.g. tools, processes, etc.)
    - How does it impact on competence development and deployment
    - What are main challenges / difficulties in collaborating
        - Reasons
        - How to solve it
    - What effect does IT have in this
    - Does the industry landscape aid or constrain this
    - Does the 'Lopes-effect' still have an impact
- What makes good collaboration for you

- What benefits would you expect of collaboration
- What was the evolutionary development of your collaborative activities
  - Stages
  - Drivers / responsibilities (who, what)
  - Objectives (cost, quality, efficiency, responsiveness, other)
  - Necessary effort /commitment
- What has changed because of collaboration
  - Results (customer satisfaction, speed, efficiency, flexibility, new positions created, others)
  - Effects on company (organisational culture, way of working, etc.)
  - Effects on industry landscape
- Has there been a particular effect on the success of the company
  - Measurement (how do you measure success)

Section 4: Stories and narratives

## Appendix D: Consent form for interviews

### Zustimmungserklärung / Statement of Consent

Hiermit bestätige ich die Richtigkeit der Angaben und Informationen in dem zugrundeliegenden Interview. Die Aussagen reflektieren jedoch lediglich meine subjektive Einschätzung und nicht die allgemeine Position des Unternehmens. Die Daten dürfen unter der Wahrung der unten angeführten Vertraulichkeitsbedingungen zu Forschungszwecken verwendet werden.

I declare the correctness of data and information given in the underlying interview. However, the given statements only reflect my subjective evaluation and is not the general position of the company. The data and information can be used for research purposes based on the adherence of the conditions outlined in the Statement of Confidentiality below.

Datum / Date Unterschrift Teilnehmer / Signature Participant

### Vertraulichkeitserklärung / Statement of Confidentiality

Hiermit erkläre ich mich bereit, die Identität der Person und des Unternehmens als Beteiligte des zugrundeliegenden Interviews vertraulich zu behandeln und nur in anonymisierter Weise zu verwenden, es sei denn es wird von der Person und/oder dem Unternehmen eine schriftliche Erlaubnis für eine individualisierte Veröffentlichung der Daten und Informationen (z.B. in Form von Zitaten oder Fallstudien) erteilt.

I declare to respect the identity of the person and the company involved in the underlying interview and to grant anonymity, unless the use of individualised data and information (e.g. in the form of quotes or case studies) is permitted by the person and/or company.

Datum / Date Unterschrift Interviewer / Signature Interviewer

**Appendix E: Questionnaire**

ASTON
BUSINESS SCHOOL

ASTON ACADEMY FOR
RESEARCH IN MANAGEMENT

Aston University
Aston Triangle
Birmingham B4 7ET
United Kingdom

Tel +44 (0)121 204 3219
email: abs-res@aston.ac.uk
http://www.abs.aston.ac.uk

Mario Binder
Doctoral Researcher
Operations & Information Management Group
Aston Business School
Birmingham B4-7ET
United Kingdom

Tel: +44 121 204 3163
Email: binderm@aston.ac.uk

## QUESTIONNAIRE SURVEY

Dear Participant,

As part of my doctoral research within the Operations & Information Management Group at Aston Business School in Birmingham, UK, I am conducting a study on Supply Chain Management and Collaborative Business in the German and UK automotive industry.

The attached questionnaire is a part of an ongoing research project. It consists of a list of statements based on insights gained from around 30 interviews in the German and UK automotive industry. It is the aim, to validate those insights using the attached questionnaire.

I would like to ask you to spend about 20 minutes of your time to complete the questionnaire using the attached Word document and send it back to me via email. I would also kindly request that you forward this to your colleagues, co-workers, business partner, etc. within or outside your company.

The data will be anonymised during analysis and interpretation. Your feedback is very important and will help to shape the future of strategic thinking in the automotive industry.

I would be happy to send you a summary of the results after completion of analysis. For any inquiries please do not hesitate to contact me.

I would like to thank you for your help and effort in advance and wish you a pleasant Christmas and a happy New Year.

Yours sincerely,
Mario Binder

## INSTRUCTIONS

In the following questionnaire, a number of statements about inter-firm collaboration in the automotive industry will be presented to you. It is your task to assess each statement based on your practical experience by measuring:

AGREEMENT: State how strongly you agree or disagree with the statement using the given scale from 'strongly agree' to 'strongly disagree'.

IMPORTANCE: State how important you think the statement is for your daily business operations using the given scale from 'Very high' to 'Very low'.

For each dimension please tick one box only! There are no right and wrong answers. Please evaluate the statements as honestly and openly as you can. At the end, a brief section on demographical information is also included.

An example for illustration is given below.

| 0 | **Private businesses must make profit** |
|---|---|

| **AGREEMENT** | **Strongly agree** | **Agree** | **Neutral** | **Disagree** | **Strongly disagree** |
|---|---|---|---|---|---|
| | X | | | | |
| **IMPORTANCE** | **Very high** | **High** | **Medium** | **Low** | **Very low** |
| | X | | | | |

Please send the filled in questionnaire to: binderm@aston.ac.uk

We very much appreciate your help – **THANK YOU!**

## STATEMENTS

| 1 | Change in the automotive industry is driven by a combination of general industrial forces and internal company issues |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 2 | Increasing complexity, cost pressure and shorter product development lead times have led to more inter-firm collaboration based on product modularisation |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 3 | Car manufacturer are changing their adversarial pricing policies in supplier selection towards more strategic sourcing policies |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 4 | The challenge for a collaborative supply network is to maintain competitiveness without applying adversarial forces |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 5 | Focusing on core competencies is becoming increasingly important in order to drive the development and management of inter-firm collaboration in the supply network |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 6 | Structure of the supply network is determined by the strategy of the car manufacturer |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 7 | Product modularisation affects how a supply network is structured |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 8 | Different relationships and collaborative practices exist for different inter-company (car manufacturer and supplier) projects in the supply network |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 9 | The role of an organisation in the supply network is mainly determined by what competencies are offered by it |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 10 | The role of an organisation in the supply network is partly determined by the stages of the product development process |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 11 | Relationships between companies in the supply network change over time |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 12 | An individual company can collaborate in more than one project within the supply network at the same time |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 13 | An inter-firm collaboration in the supply network needs to be formed on the basis of technical competencies and mutual exchange of knowledge |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 14 | There is the need for a coordinator and leader within the supply network that has the competence to evaluate and manage the interfaces in a collaboration |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 15 | The co-ordinator of the supply network should have its own core competencies and encourage those of other organisations to participate |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 16 | Competencies of separate organisations participating in a collaboration within the supply network need to be linked via cross-company project infrastructures |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 17 | Different projects in the supply network have to be managed differently |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 18 | Overly stable relationships between companies in the supply network can lead to a loss of innovativeness |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 19 | New inter-firm collaborations produce innovative solutions |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 20 | Car manufacturers still retain overall responsibility for the management of the whole supply network |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 21 | To become more influential in the supply network a company must take responsibility for integrating other companies and their products |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 22 | Early and intense integration of strategic collaborators facilitates the successful delivery of a project |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 23 | At early stages of the collaboration process technical and social rather than monetary aspects have to be measured and compared |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 24 | Strategic and long term thinking for the whole supply network increases the chance of successful inter-firm collaboration |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 25 | The boundaries of responsibilities between collaborating parties need to be clearly defined to deliver a successful inter-firm project within the supply network |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 26 | Functional and short-term thinking within an organisation produces sub-optimisation for the supply network |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 27 | The existence of cross-functional units that can act autonomously from other parts of the same company facilitate inter-firm collaboration |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 28 | To operate autonomously within the organisation and to integrate in the supply network cross-functional units must have both unique resources and interface capabilities |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 29 | The more mature, attractive and transferable a competence is the more potential value it can create for the supply network |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 30 | Competencies can be developed and deployed through collaboration with other companies in the supply network |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 31 | For each new inter-firm project a new appropriate supply base has to be selected and managed |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 32 | There is a positive correlation between the extent of inter-firm collaboration and the sustainable success of the supply network and its individual companies |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 33 | Establishing inter-firm collaboration is an effective way of improving quality and innovation of products as well as reducing development lead-times and cost in a supply network |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 34 | The short term success of inter-firm collaboration in the supply network is related to cost and lead time reduction |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

| 35 | The long term success of inter-firm collaboration in the supply network is related to quality and innovation improvement |
|---|---|

| AGREEMENT | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| | | | | | |
| IMPORTANCE | Very high | High | Medium | Low | Very low |
| | | | | | |

## DEMOGRAPHICS

1. Have you been participating in the interviews? (Please tick one box only)

| | |
|---|---|
| YES | |
| NO | |

2. How long have you been working in the automotive industry? (Please indicate figure)

| | |
|---|---|
| YEARS | |

3. Which type(s) of company have you had experience working in? (Please tick as many boxes as appropriate)

| | |
|---|---|
| CAR MANUFACTURER | |
| SYSTEMS SUPPLIER | |
| MODULE SUPPLIER | |
| PART / COMPONENT SUPPLIER | |
| ASSEMBLY SERVICE PROVIDER | |
| LOGISTICS SERVICE PROVIDER | |
| ENGINEERING SERVICE PROVIDER | |
| OTHER (PLEASE SPECIFY) | |

4. Approximately how big is the company you are working for now? (Please indicate figures)

| | |
|---|---|
| EMPLOYEES | |
| TURNOVER | |

5. In which function(s) have you had experience working in? (Please tick as many boxes as appropriate)

| | |
|---|---|
| R&D / STYLING | |
| PURCHASING | |
| QUALITY ASSURANCE | |
| PRODUCTION / MANUFACTURING | |
| LOGISTICS | |
| MARKETING / SALES | |
| STRATEGY / DIRECTORSHIP | |
| OTHER (PLEASE SPECIFY) | |

6. What organisational responsibility level do you currently occupy? (Please tick one box only)

| | |
|---|---|
| CLERK LEVEL | |
| JUNIOR MANAGEMENT LEVEL | |
| MIDDLE MANAGEMENT LEVEL | |
| SENIOR MANEGEMENT LEVEL | |
| TOP MANAGEMENT / EXECUTIVE LEVEL | |
| OTHER (PLEASE SPECIFY) | |

Please send the filled in questionnaire to: binderm@aston.ac.uk

We very much appreciate your help – **THANK YOU**!

**Appendix F: Pilot test evaluation sheet**

## Pilot test Evaluation Sheet

Dear participant,

Thanks you for agreeing to participate in the evaluation of this questionnaire. Your task is to fill in the questionnaire and assess it based on this evaluation sheet. This is to ensure that the questionnaire meets its intended purpose. We are very much reliant on your evaluation. **Thank you very much**.

Please evaluate the questionnaire (**after completion)** considering the following aspects:

1. How long did it take you to process the questionnaire (including reading the instructions and filling in the questionnaire)?

   **Duration (in minutes):**

   | YOUR COMMENTS | |
   |---|---|

2. Are the instructions understandable?

   | | |
   |---|---|
   | YES | |
   | NO | |

   | YOUR COMMENTS | |
   |---|---|

3. What is your general impression of the questionnaire?

   | | |
   |---|---|
   | GOOD | |
   | BAD | |

   | YOUR COMMENTS | |
   |---|---|

4. Is any particular statement unclear?

   **Which one(s) (refer to number of statement):**

   | YOUR COMMENTS | |
   |---|---|

5. Is the choice of scales for the dimension 'Agreement' appropriate?

   | | |
   |---|---|
   | YES | |
   | NO | |

| YOUR COMMENTS | |
|---|---|

6. Is the choice of scales for the dimension 'Importance' appropriate?

| | |
|---|---|
| YES | |
| NO | |

| YOUR COMMENTS | |
|---|---|

Please send the filled in questionnaire and evaluation sheet to:
binderm@aston.ac.uk

We very much appreciate your help – **THANK YOU**!

**Appendix G: Summary of initial questionnaire survey results**

ASTON
BUSINESS SCHOOL

ASTON ACADEMY FOR
RESEARCH IN MANAGEMENT

Aston University
Aston Triangle
Birmingham B4 7ET
United Kingdom

Tel +44 (0)121 204 3219
email: abs-res@aston.ac.uk
http://www.abs.aston.ac.uk

Mario Binder
Doctoral Researcher
Operations & Information Management Group
Aston Business School
Birmingham B4-7ET
United Kingdom

Tel: +44 121 204 3163
Email: binderm@aston.ac.uk

Study

on

**„Inter-organisational R&D collaboration in supply networks of the German automotive industry"**

**Summary of survey results**

Dear participant,

I would like to thank you again for your participation in this research study.

With your participation and support you contributed to the success of the questionnaire survey thereby facilitating a better understanding of collaboration within automotive supply networks. This helped to define the necessary strategic orientation of the German automotive industry for the future.

I would like to share the results of this questionnaire survey with you which are included in the following summary.

Please do not hesitate to contact me in case of any further queries.

Kind regards,
Mario Binder

## 1. Project background

This study was conducted in the context of a doctoral research project at Aston Business School that takes place in the time period October 2003 until October 2006. It deals with the governance of inter-organisational R&D collaboration within supply networks in the German automotive industry. Specifically it investigates the status quo and current practice in collaborating as well as the identification of aspects that influence collaboration in order to guide future inter-firm collaboration in automotive supply networks.

In the time period December 2004 until March 2005 a set of 28 semi-structured interviews with 31 experienced managers involving 16 companies (4 car manufacturers and 12 supplier firms) was conducted. The interviews lasted between 1h and 2,5h and covered exogenous aspects (such as the company's industrial and competitive environment), endogenous aspects (such as the company's value system or the company's competence context), and finally the basic collaboration context of OEMs and their suppliers (such as relationship building and managing). The interviews were conducted face-to-face and, unless disproved by the participants, taped and transcribed, and submitted to the participants for confirmation.

The resulting 300 transcribed pages were analysed from July 2005 until November 2005. The emerging data sets were subsequently condensed and aggregated into 35 tentative propositions (hypotheses). These proposition were summarised in a questionnaire to pursue a quantitative validation of the qualitative findings from the interviews. The questionnaire was pilot tested at the beginning of December 2005 and after a few minor changes sent out to a wide audience of practitioners.

## 2. Descriptive analysis based on demographic factors

In the period from Dec 2005 until Feb 2006 (12 weeks) 110 responses were received coming from 52 different companies (compared to 16 from interviews) with each respondent having an average of 11.27 years working experience in the automotive industry. An overview of the basic characteristics of the questionnaire survey sample based on the demographic factors is given in Table 1:

*Company type*: The composition of 20% car manufacturers and 80% supplier firms approximately reflects the distribution of companies from the interviews (25% vs. 75%). The category 'other' includes firms in branches such as consulting, software, or machine and tool making.

*Work area*: The high proportion of experience in the work area of ‚R&D / Design' (38%) reflects the focus of the study in R&D collaboration. Furthermore, relatively high proportions in the areas of 'Marketing / Sales' (18%) and 'Strategy / Directorship' (13%) (both mainly within supplier firms) lead to sound results on inter-firm R&D collaboration as these work areas are located at the organisational interface between a car manufacturer and its suppliers within the supply network.

*Management level*: The high proportion of experienced managers – junior + middle management (56%) and senior + top management (23%) – compared to a notable lower proportion of respondents on the clerk level (16,5%) equip the study with a high strategic significance. Within the category 'other' the respondents from consulting firms were subsumed who were not allocated to a management level.

| Company role | Responses | | Functional experience[36] | Responses | | Management level | Responses | |
|---|---|---|---|---|---|---|---|---|
| | No | % | | No. | % | | No. | % |
| **Car manufacturer** | 38 | 19.5 | R&D / Styling | 75 | 37.8 | **Clerk**[37] | 18 | 16.4 |
| **Systems supplier** | 52 | 26.7 | **Purchasing** | 15 | 7.5 | **Junior Management** | 27 | 24.5 |
| **Module supplier** | 33 | 17 | **Quality assurance** | 13 | 6.5 | **Middle Management** | 35 | 31.8 |
| **Parts / component supplier** | 30 | 15.4 | **Production / manufacturing** | 15 | 7.5 | **Senior Management** | 22 | 20 |
| **Assembly service provider** | 4 | 2 | **Logistics** | 7 | 3.5 | **Top Management** | 3 | 2.7 |
| **Logistics service provider** | 2 | 1 | **Marketing / Sales** | 36 | 18.1 | **Other** | 5 | 4.6 |
| **Engineering service provider** | 27 | 13.8 | **Strategy / directorship** | 25 | 12.6 | | | |
| **Other** | 9 | 4.6 | **Other** | 13 | 6.5 | | | |
| | $\Sigma$=195 | 100 | | $\Sigma$=199 | 100 | | $\Sigma$=110 | 100 |

**Table G.1: Characteristics of questionnaire survey sample**

## 3. Descriptive analysis based on 35 propositions

Each respondent was asked to assess the tentative propositions on a 5-point Likert scale to indicate their perceptions of whether they agreed or disagreed with the proposition (**Agreement**) and the importance of the proposition for daily business activities (**Importance**). Each dimension was numerically coded to allow for a descriptive analysis of the data by calculating measures of central tendencies, such as mean, median, and modus to represent its characteristics:

- Agreement (strongly agree = 2, agree = 1, neutral = 0, disagree = -1, strongly disagree = -2)

- Importance (very high = 5, high = 4, medium = 3, low = 2, very low = 1).

In Table 2 an overview of the calculated means for both dimensions of each proposition is given based on the overall sample of 110 respondents.

[36] The number of responses for company role and functional experience is greater than the total number of respondents (110) because some respondents had experience of more than one company and function. The questionnaire allowed multiple entries by the respondents.
[37] Three respondents categorised themselves as 'consultants' which were counted as 'clerks'.

| Proposition | Dimension | | Proposition | Dimension | | Proposition | Dimension | |
|---|---|---|---|---|---|---|---|---|
| | A | I | | A | I | | A | I |
| #1 | 1.24 | 4.01 | #13 | 0.87 | 3.76 | #25 | 1.69 | 4.51 |
| #2 | 1.15 | 4.21 | #14 | 1.30 | 4.13 | #26 | 0.96 | 3.71 |
| #3 | -0.38 | 4.10 | #15 | 1.37 | 4.08 | #27 | 0.30 | 3.55 |
| #4 | 0.70 | 3.94 | #16 | 0.80 | 3.75 | #28 | 0.82 | 3.55 |
| #5 | 0.90 | 3.82 | #17 | 1.00 | 3.62 | #29 | 1.17 | 3.90 |
| #6 | 0.98 | 3.71 | #18 | -0.31 | 3.31 | #30 | 1.06 | 3.73 |
| #7 | 1.18 | 3.94 | #19 | 0.84 | 3.77 | #31 | 0.20 | 3.64 |
| #8 | 1.21 | 3.47 | #20 | 0.30 | 3.76 | #32 | 1.05 | 4.04 |
| #9 | 1.23 | 4.21 | #21 | 0.90 | 3.70 | #33 | 0.62 | 3.50 |
| #10 | 0.91 | 3.60 | #22 | 1.64 | 4.28 | #34 | 1.09 | 4.01 |
| #11 | 1.18 | 3.68 | #23 | 1.06 | 4.13 | #35 | 0.93 | 4.10 |
| #12 | 1.37 | 3.54 | #24 | 1.42 | 4.19 | | | |

**Table G.2: Calculated means for each proposition based on overall sample**

A graphical illustration of this is given in Figures 1 and 2.

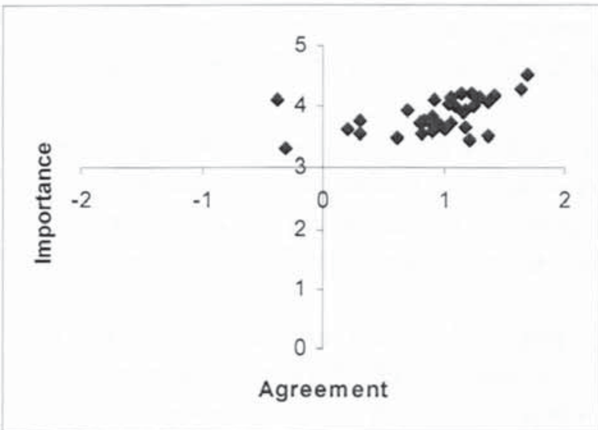


**Figure G.1: Location of propositions in scatter diagram**

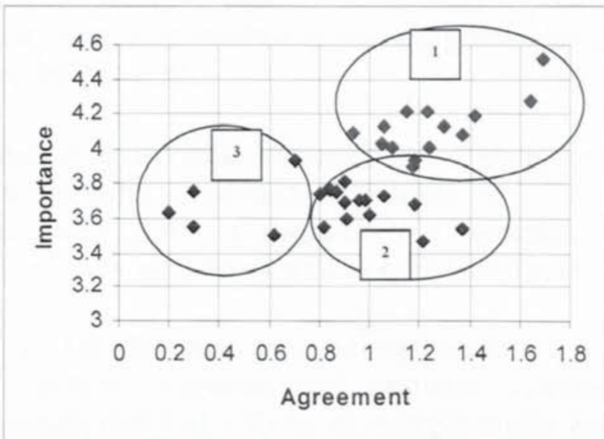


**Figure G.2: Propositions with positive agreement and medium to very high importance**

As can be seen from Figure 1, all propositions (apart from proposition #3 and #18 with negative agreement) are located in the upper right quadrant characterised by positive agreement and medium to very high importance. A refinement of this quadrant is given in Figure 2. Based on the location of the individual dots in the Agreement-Importance-Diagram three basic clusters were identified.

Propositions in **Cluster 1** (red) show a very positive 'Agreement' (between 1 and 2, i.e. 'agree' and 'strongly agree') and a high to very high 'Importance' (between 4 and 5). Propositions in **Cluster 2** (blue) predominantly show a positive 'Agreement' (around 1) and a medium to high 'Importance' (between 3 and 4). Propositions in **Cluster 3** (**black**) show a neutral to positive 'Agreement' (between 0 and 1) and a medium to high 'Importance' (between 3 and 4).

Furthermore, Table 3 and 4 (see Appendix) include overviews of the calculated means for each proposition based on various demographical factors, e.g. company type (Table 3) or management level (Table 4). Table 5 contains the full list of propositions used in the questionnaire survey.

Generally it can be observed that most of the propositions were agreed on and also considered as quite important by the respondents. This leads to the conclusion that the propositions assessed in the survey show a certain importance regarding inter-firm collaboration within automotive supply networks.

### 3.1. Basic observations

- Due to increasing customer requirements, government regulations especially in terms of safety, or stiff competition on the global market for automotive vehicles on the macro level, the (German) automotive industry faces an increasing model variety with shorter product life cycles and at the same time lower volumes per model. This leads to increasing complexity, cost pressure and shorter product development lead time on the micro level triggering an outsourcing process that is increasingly carried out on a module basis rather than parts or component basis (propositions #1 and #2).

- This influences a know how shift combined with a change in roles within the automotive industry whereas car manufacturers change towards car developers with less manufacturing content and suppliers change from parts or component suppliers towards system or module suppliers with increasing product engineering knowledge and responsibility for managing sub-supplier networks.

- Industrial change and its related restructuring is often addressed by a short-term orientated optimisation of R&D activities which led and still leads to quality problems, to adversarial relationships between OEM and supplier, to a reduction in the number of suppliers, to a consolidation in the supplier as well as OEM sector, etc.

- However, a few recent developments of OEMs show an optimisation of supply networks through the adoption of long-term orientated and strategic sourcing decisions based on proactive supply management and a focus on competencies and collaborative partnerships (proposition #3).

- It can be concluded that these aspects lead to an increased complexity of collaboration in supply networks which challenges the individual partners through increased requirements. Hence, it is necessary to develop and adopt new concepts, models and theories of collaboration for the future which take the changing industrial circumstances into consideration and thereby secure the competitiveness of the German automotive industry.

### 3.2. Specific observations on the collaboration in supply networks

- The most important insight arising from this survey is that current practice in the German automotive industry does not apply mechanisms that are considered necessary for the improvement of collaboration within supply networks. Even if it is widely accepted that an early and intense collaboration between partners in the sense of more strategic sourcing is beneficial (proposition #22) and that at these early stages competencies rather than prices have to be evaluated and assessed (proposition #23), current practice still shows a more adversarial strategy of car manufacturers in their sourcing (proposition #3). Interestingly, this issue is considered less drastic by respondents associated with car manufacturer than respondents associated with supplier firms. Whilst the former even slightly agree with a collaborative sourcing policy of the OEMs, the demographic subgroup of suppliers neglect that fact (see Table 3). However, agreement exists on the assessment of the importance of this issue, which is considered high. Because this approach abandons price competition, a challenge for a collaborative supply network is to maintain competitive prices without actually applying cost pressure (proposition #4). Similar to proposition #3 this aspect is less agreed on by representatives of OEMs (0.55) than suppliers (0.72) (also see Table 3).

- A similarly important result is the finding that competencies are considered as a major building block of inter-firm R&D collaboration. Not only that competencies rather than prices should be considered for the selection of partners (especially at the early stages of collaboration) (proposition #22), they also determine an individual firm's role in the supply network (proposition #9), i.e. the more advanced, sophisticated and unique the competence the more potential value it creates for the supply network and hence the company will occupy a more important role (proposition #29). Therefore, competencies should contain 'unique sales points' in terms of specific technical attributes (e.g. innovativeness, R&D knowledge, etc.) which enable the individual company to differentiate itself from competitors, but also contain common interfaces that enable the linking with partners via social attributes (e.g. project management, organisational structure, etc.) (proposition #28). This accounts for the fact that competencies of individual companies within a supply network have to be linked via cross-company projects for their deployment (propositions #16 and #30). This partly results from the recognition that inter-firm collaboration in the supply network is mainly formed on the basis of technical competencies and the mutual exchange of related knowledge and know how (proposition #13) and that a company must take responsibility for integrating other companies and their products to become more influential in the supply network, e.g. develop from a component supplier to a system supplier (proposition #21). Hence, it can be concluded that a focus on core competencies and their further development is becoming increasingly important in order to improve and drive the development of inter-firm collaboration in supply networks (proposition #5). Although this is more supported by OEMs than suppliers (see Table 3), it is generally agreed on and also considered as highly important (see Table 2).

- An important aspect that contributes to a successful inter-firm collaboration in supply networks is the existence of a coordinator and leader who has the competence to evaluate and manage the interfaces within the network (i.e. between the collaborating partners) (proposition #14). This is likewise true for the whole car as well as individual sub-system or module. In order to pursue this interface management efficiently and effectively, the coordinator needs to have sufficient own competencies and also encourage the participating partners to contribute with theirs by allowing them a certain degree of autonomy in terms of responsibility within the network (proposition #15). Both OEMs and supplier agree on this matter and consider it highly important. A differing opinion exists on the issue who constitutes the leading party within the supply network, i.e. who designs and manages the supply network as such. Whilst representatives of the supplier industry agree on the fact that the structure of the supply network is determined by the strategy of the car manufacturer (proposition #6) even more than representatives of the OEMs themselves, they are – on the other hand - not so convinced that the car manufacturers obtain the responsibility for the management of the whole supply network (proposition #20). At this point it is interesting to mention that respondents that have worked for both OEMs and suppliers agree with this last proposition more strongly (0.82) than the other respondents (OEMs: 0.30; suppliers: 0.16; see Table 3). Proposition #6 on the structure of the supply network can be supported by the finding that the structure is also influenced by product modularisation, which OEM and supplier respondents commonly agree on (proposition #7). Since on a general basis it can be assumed that modularisation of components to more complex systems and modules is initiated by the OEMs, it can therefore be concluded that the structure of the supply network is determined by the car manufacturer. However, the responsibility for the management of suppliers is often transferred from the OEM to prime contractors or system suppliers and hence the aspect of leadership within a supply network cannot be answered explicitly. This is even the more true because it is influenced by a variety of factors, such as the existing competence profile of OEM and supplier, product attributes, etc.

- A further important aspect of successful inter-firm collaboration in supply networks is the adoption of strategic and long-term orientated thinking of each partner for the whole network (proposition #24). This supported by the fact that a too functional thinking in terms of departments and business units within a company leads to a sub-optimisation of the whole supply network (proposition #26) because it facilitates an orientation on the individual company rather than the holistic supply network. Another factor that is considered important (see Table 2) in general is a clear definition of responsibilities of the collaborating parties within the supply network (proposition #25). This supports the finding mentioned above that a coordinator in the network is necessary who has the competence for the management of the interfaces, which in retrospect is only possible if sufficient technical competencies and social management competencies (e.g. in terms of project management skills) do exist.

- Different relationships and collaborative practices exist for different inter-firm projects within a supply network (proposition #8) that also have to be managed differently depending on the character of the project (proposition #17). The intensity of the relationships depends on a multiplicity of factors, such as the individual competence profile of the partners, the sourcing strategies of the decision makers, the decision authority within companies, company cultures, etc. These factors influence the selection process within the supply network and hence the intensity and quality of the collaboration. A further finding in the context of inter-firm projects shows that new inter-firm constellations can be a stimulus for innovation (proposition #19) but that overly stable relationships between companies in the network not automatically lead to a loss of innovativeness (proposition #18). This is confirmed by representatives of OEMs (neutral opinion with 0.00) and suppliers (disagreement on proposition #18 with –0.47; see Table 3) alike. This insight is supported through a low agreement (nearly neutral position) on the proposition that for each new inter-firm project a new appropriate supply base has to be selected (proposition #31). Respondents that have worked for both OEMs and suppliers even disagree on that statement (-0.18; see Table 3). Furthermore, the relationship between two or more partners in a supply network is not a static condition but a dynamic development in the sense that relationships change over time (proposition #11). In addition, an individual company can be involved in more than one project within the supply network at the same time (proposition #12) or eventually in no project at the moment. This is partly influenced by the power position and role a company occupies within the network. That means, that within a supply network there exist a multiplicity of different relationships and practices of collaboration which differ and change in their intensity and quality based on various impacting factors. This aspect has to be considered when designing and managing supply networks.

- A rather short-term orientated motivation for inter-firm collaboration can be seen in the reduction of cost and development lead time (proposition #34), whilst a more long-term motivation is associated with the improvement of quality and innovation (proposition #35). This is supported through the fact that establishing collaboration in supply networks is seen as an effective means of reducing cost and development lead times (proposition #32).

## 4. Quo vadis automotive industry – a strategic outlook

- Time is the most critical aspect in product development. Therefore, it is essential to identify and apply new ways and practices of collaboration between OEMs and suppliers (as well as within the supplier industry, e.g. between 1st tier and 2nd tier) in order to allow more time for product development. In this context, the OEMs need to increase the speed and quality of their decision making based on a more efficient project management, whereas the suppliers need to take more ownership and active initiate for development process. As the collaboration (especially within the R&D process) is based on specific technical knowledge and the exchange of know how, it is inevitable that the OEMs build up a sufficient level of competencies in-house, in order to manage the interfaces within the network effectively. The challenge that occurs for the leading companies of the network in this context is to allow for the migration of competencies and responsibilities to the suppliers but at the same time keep and build a sufficient level of own competencies (not only coordination competence but also specific product and process know how) in order to pursue the role of car integrator or system integrator and the related supplier management properly.

- In this light, the suppliers (especially potential system and module suppliers as 1st tiers) need to learn to manage their sub-supplier networks effectively and efficiently and integrate these smoothly into the superior networks of the OEMs (idea of plug & play suppliers).

- Short-term thinking in terms of costs often lead to adversarial OEM-supplier-relationships. In many cases a better quality and maturity of the products as well as a reduction of cost and development lead time could be achieved through more collaborative relationships in the supply networks in the sense that suppliers are integrated in the process earlier and are equipped with more responsibilities (idea of frontloading). On the other hand, the suppliers need to be willing to play a more active role in the process by taking more ownership and risk. This could be supported by the OEMs through a longer commitment towards their suppliers and an early supplier selection process not only based on adversarial forces but technical competencies.

- The challenge in the context of frontloading is to achieve competitive prices without opposing adversarial forces. On the one hand, this could be compensated by long-term and strategic thinking in terms of whole life cycle costs rather than short-term R&D costs. On the other hand, a more collaborative approach in terms of supplier selection and contracting (sourcing process) is necessary, which is beneficial for both sides (e.g. the OEMs could benefit of a better quality of the products and the suppliers could benefit from a sourcing process not only based on costs)

- For this reason, the focus of the purchasing function within the OEMs need to change from a cost based orientation to a more strategic sourcing orientation by including other aspects, such as competence, innovativeness, the ability to manage sub-suppliers, etc., in the supplier selection decision. Thereby, it is necessary to develop a strategic supplier portfolio, which considers the management of different types of OEM-supplier-relationships, e.g. a small panel of strategic and long-term commitments and an extended panel of temporary and changing suppliers with competencies for different tasks. This takes into account, that the role of the OEMs within a collaboration changes, based on the respective step of the R&D process and the type of product that is considered.

- A stronger focus on competencies across products, product segments, processes or business units, is necessary for the development of future strategies and structures within supply networks. Thereby, it is important to define ones own competencies and capabilities before engaging in cross-boundary collaboration. This then enables a better collaboration due to the clear distinction between the competencies and responsibilities of the participating companies.

# 5. Appendix

| Proposition | OEM | | OEM + Supplier | | Supplier | |
|---|---|---|---|---|---|---|
| | A | I | A | I | A | I |
| #1 | 1.45 | 4.40 | 1.24 | 4.18 | 1.18 | 3.85 |
| #2 | 1.25 | 4.10 | 1.12 | 4.12 | 1.13 | 4.26 |
| #3 | 0.15 | 4.05 | -0.24 | 3.94 | -0.57 | 4.16 |
| #4 | 0.55 | 3.70 | 0.76 | 3.71 | 0.72 | 4.07 |
| #5 | 1.15 | 3.95 | 0.71 | 3.53 | 0.88 | 3.85 |
| #6 | 0.70 | 3.55 | 0.65 | 3.53 | 1.15 | 3.81 |
| #7 | 1.15 | 4.10 | 1.12 | 3.47 | 1.21 | 4.01 |
| #8 | 1.20 | 3.30 | 1.12 | 3.53 | 1.24 | 3.50 |
| #9 | 1.25 | 4.15 | 0.94 | 3.94 | 1.29 | 4.29 |
| #10 | 0.90 | 3.50 | 0.53 | 3.24 | 1.01 | 3.72 |
| #11 | 1.10 | 3.75 | 1.18 | 3.18 | 1.21 | 3.78 |
| #12 | 1.30 | 3.35 | 1.18 | 3.18 | 1.44 | 3.69 |
| #13 | 1.15 | 3.95 | 0.65 | 3.53 | 0.84 | 3.76 |
| #14 | 1.35 | 4.10 | 1.18 | 3.94 | 1.32 | 4.19 |
| #15 | 1.35 | 4.10 | 1.29 | 3.82 | 1.40 | 4.13 |
| #16 | 0.95 | 3.90 | 0.47 | 3.47 | 0.84 | 3.78 |
| #17 | 1.00 | 3.80 | 0.76 | 3.53 | 1.06 | 3.59 |
| #18 | 0.00 | 3.25 | -0.06 | 2.88 | -0.47 | 3.44 |
| #19 | 1.00 | 3.90 | 0.65 | 3.41 | 0.84 | 3.82 |
| #20 | 0.30 | 3.90 | 0.82 | 3.76 | 0.16 | 3.72 |
| #21 | 0.65 | 3.40 | 0.76 | 3.65 | 1.00 | 3.81 |
| #22 | 1.45 | 4.10 | 1.41 | 4.00 | 1.75 | 4.40 |
| #23 | 0.70 | 3.70 | 1.29 | 4.06 | 1.10 | 4.28 |
| #24 | 1.35 | 4.10 | 1.35 | 3.82 | 1.46 | 4.31 |
| #25 | 1.75 | 4.60 | 1.47 | 4.29 | 1.72 | 4.54 |
| #26 | 1.05 | 3.70 | 0.65 | 3.18 | 1.01 | 3.85 |
| #27 | -0.05 | 3.60 | 0.47 | 3.47 | 0.35 | 3.56 |
| #28 | 0.55 | 3.40 | 0.82 | 3.65 | 0.90 | 3.57 |
| #29 | 1.10 | 3.75 | 0.94 | 3.76 | 1.25 | 3.99 |
| #30 | 1.10 | 3.70 | 0.94 | 3.47 | 1.07 | 3.81 |
| #31 | 0.25 | 3.80 | -0.18 | 3.24 | 0.28 | 3.69 |
| #32 | 1.00 | 3.90 | 0.88 | 3.76 | 1.10 | 4.15 |
| #33 | 0.35 | 3.20 | 0.82 | 3.41 | 0.65 | 3.62 |
| #34 | 0.95 | 3.80 | 1.35 | 4.24 | 1.06 | 4.01 |
| #35 | 0.85 | 4.10 | 0.82 | 4.24 | 0.99 | 4.06 |

**Table G.3: Calculated means for each proposition based on company type**

| # | C | | JM | | MM | | SM | | TM | | Other | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | I | A | I | A | I | A | I | A | I | A | I |
| #1 | 0.94 | 4.11 | 1.30 | 4.00 | 1.26 | 3.92 | 1.45 | 4.09 | 1.00 | 4.00 | 1.33 | 4.00 |
| #2 | 1.17 | 4.22 | 1.11 | 4.37 | 1.08 | 4.00 | 1.23 | 4.23 | 1.33 | 4.33 | 1.67 | 5.00 |
| #3 | -0.22 | 4.00 | -0.48 | 3.96 | -0.37 | 4.21 | -0.50 | 4.32 | -0.33 | 4.67 | 0.33 | 3.33 |
| #4 | 0.33 | 3.39 | 0.70 | 4.07 | 0.87 | 4.16 | 0.86 | 4.09 | 1.00 | 4.00 | 0.00 | 3.00 |
| #5 | 0.72 | 3.44 | 1.00 | 4.00 | 0.79 | 3.74 | 1.14 | 4.05 | 0.67 | 4.00 | 1.33 | 4.33 |
| #6 | 1.06 | 3.50 | 1.19 | 3.96 | 0.76 | 3.68 | 0.95 | 3.59 | 0.67 | 4.00 | 1.67 | 4.00 |
| #7 | 0.94 | 3.50 | 1.04 | 4.00 | 1.37 | 4.00 | 1.27 | 4.09 | 1.33 | 3.33 | 0.67 | 4.00 |
| #8 | 1.11 | 3.06 | 1.22 | 3.30 | 1.21 | 3.66 | 1.23 | 3.91 | 1.33 | 4.00 | 1.33 | 1.67 |
| #9 | 0.89 | 3.78 | 1.33 | 4.33 | 1.18 | 4.26 | 1.41 | 4.41 | 1.33 | 5.00 | 2.00 | 4.00 |
| #10 | 0.50 | 3.22 | 0.93 | 3.52 | 1.11 | 3.74 | 1.00 | 3.91 | 2.00 | 5.00 | 0.67 | 3.33 |
| #11 | 0.89 | 3.28 | 1.19 | 3.74 | 1.21 | 3.66 | 1.36 | 4.00 | 1.67 | 5.00 | 1.33 | 3.33 |
| #12 | 1.33 | 3.39 | 1.44 | 3.26 | 1.32 | 3.66 | 1.41 | 3.91 | 1.33 | 4.33 | 1.67 | 3.00 |
| #13 | 0.78 | 3.61 | 1.15 | 4.15 | 0.84 | 3.71 | 0.82 | 3.82 | 1.33 | 4.67 | -0.33 | 1.67 |
| #14 | 1.11 | 3.89 | 1.56 | 4.48 | 1.24 | 4.11 | 1.32 | 4.18 | 1.67 | 5.00 | 0.67 | 2.67 |
| #15 | 1.28 | 3.83 | 1.52 | 4.22 | 1.32 | 4.21 | 1.36 | 3.95 | 2.00 | 5.00 | 1.67 | 3.67 |
| #16 | 0.28 | 3.44 | 1.04 | 4.00 | 0.79 | 3.63 | 0.86 | 4.05 | 1.33 | 4.67 | 0.33 | 2.33 |
| #17 | 0.78 | 3.39 | 0.78 | 3.48 | 1.18 | 3.76 | 1.18 | 3.86 | 1.67 | 5.00 | 1.33 | 3.33 |
| #18 | -0.44 | 2.78 | -0.22 | 3.48 | -0.21 | 3.26 | -0.45 | 3.77 | -0.33 | 4.00 | -1.00 | 2.67 |
| #19 | 0.94 | 3.67 | 0.70 | 3.93 | 0.97 | 3.82 | 0.68 | 3.86 | 2.00 | 5.00 | 0.67 | 2.33 |
| #20 | 0.89 | 3.94 | 0.52 | 3.65 | 0.00 | 3.76 | -0.09 | 3.68 | 0.00 | 3.67 | 1.00 | 4.00 |
| #21 | 0.94 | 3.61 | 0.85 | 3.54 | 0.87 | 3.89 | 0.86 | 3.73 | 1.67 | 5.00 | 2.00 | 3.67 |
| #22 | 1.61 | 3.94 | 1.59 | 4.41 | 1.74 | 4.29 | 1.50 | 4.41 | 1.67 | 5.00 | 2.00 | 4.33 |
| #23 | 1.00 | 3.83 | 0.96 | 4.19 | 1.29 | 4.29 | 0.91 | 4.18 | 2.00 | 5.00 | 0.33 | 3.00 |
| #24 | 1.28 | 3.72 | 1.37 | 4.30 | 1.45 | 4.39 | 1.45 | 4.09 | 2.00 | 5.00 | 2.00 | 4.00 |
| #25 | 1.50 | 4.28 | 1.85 | 4.56 | 1.58 | 4.53 | 1.82 | 4.77 | 0.67 | 4.00 | 1.67 | 4.00 |
| #26 | 0.78 | 3.39 | 1.04 | 3.93 | 0.95 | 3.68 | 0.86 | 3.55 | 1.33 | 4.33 | 1.67 | 5.00 |
| #27 | 0.33 | 3.50 | 0.07 | 3.59 | 0.42 | 3.58 | 0.32 | 3.55 | 1.33 | 4.33 | 0.00 | 3.00 |
| #28 | 1.11 | 3.61 | 0.74 | 3.67 | 0.74 | 3.50 | 0.82 | 3.55 | 1.33 | 4.00 | 0.67 | 2.67 |
| #29 | 0.89 | 3.39 | 1.26 | 4.19 | 1.18 | 3.95 | 1.18 | 4.14 | 1.33 | 4.67 | 1.33 | 2.67 |
| #30 | 0.83 | 3.50 | 1.15 | 3.85 | 1.21 | 3.87 | 0.91 | 3.77 | 1.67 | 4.67 | 1.00 | 2.00 |
| #31 | -0.06 | 3.61 | 0.59 | 3.78 | 0.11 | 3.79 | 0.27 | 3.55 | 1.33 | 4.67 | -0.67 | 1.67 |
| #32 | 0.83 | 3.89 | 0.93 | 4.11 | 1.11 | 4.05 | 1.18 | 4.09 | 1.67 | 4.67 | 2.00 | 4.00 |
| #33 | 0.61 | 3.06 | 0.44 | 3.48 | 0.74 | 3.71 | 0.59 | 3.64 | 1.67 | 4.67 | 1.00 | 3.33 |
| #34 | 0.89 | 3.94 | 1.15 | 4.15 | 0.89 | 3.79 | 1.41 | 4.18 | 1.00 | 4.00 | 1.67 | 4.67 |
| #35 | 0.83 | 4.22 | 0.78 | 4.04 | 1.08 | 4.05 | 0.95 | 4.18 | 1.67 | 5.00 | 1.00 | 3.67 |

**Table G.4: Calculated means for each proposition based on management level**

| No. | Proposition |
|---|---|
| # 1 | Change in the automotive industry is driven by a combination of general industrial forces and internal company issues |
| # 2 | Increasing complexity, cost pressure and shorter product development lead times have led to more inter-firm collaboration based on product modularisation |
| # 3 | Car manufacturer are changing their adversarial pricing policies in supplier selection towards more strategic sourcing policies |
| # 4 | The challenge for a collaborative supply network is to maintain competitiveness without applying adversarial forces |
| # 5 | Focusing on core competencies is becoming increasingly important in order to drive the development and management of inter-firm collaboration in the supply network |
| # 6 | Structure of the supply network is determined by the strategy of the car manufacturer |
| # 7 | Product modularisation affects how a supply network is structured |
| # 8 | Different relationships and collaborative practices exist for different inter-company (car manufacturer and supplier) projects in the supply network |
| # 9 | The role of an organisation in the supply network is mainly determined by what competencies are offered by it |
| # 10 | The role of an organisation in the supply network is partly determined by the stages of the product development process |
| # 11 | Relationships between companies in the supply network change over time |
| # 12 | An individual company can collaborate in more than one project within the supply network at the same time |
| # 13 | An inter-firm collaboration in the supply network needs to be formed on the basis of technical competencies and mutual exchange of knowledge |
| # 14 | There is the need for a coordinator and leader within the supply network that has the competence to evaluate and manage the interfaces in a collaboration |
| # 15 | The co-ordinator of the supply network should have its own core competencies and encourage those of other organisations to participate |
| # 16 | Competencies of separate organisations participating in a collaboration within the supply network need to be linked via cross-company project infrastructures |
| # 17 | Different projects in the supply network have to be managed differently |
| # 18 | Overly stable relationships between companies in the supply network can lead to a loss of innovativeness |
| # 19 | New inter-firm collaborations produce innovative solutions |
| # 20 | Car manufacturers still retain overall responsibility for the management of the whole supply network |
| # 21 | To become more influential in the supply network a company must take responsibility for integrating other companies and their products |
| # 22 | Early and intense integration of strategic collaborators facilitates the successful delivery of a project within the supply network |
| # 23 | At early stages of the collaboration process technical and social rather than monetary aspects have to be measured and compared |
| # 24 | Strategic and long term thinking for the whole supply network increases the chance of successful inter-firm collaboration |
| # 25 | The boundaries of responsibilities between collaborating parties need to be clearly defined to deliver a successful inter-firm project within the supply network |
| # 26 | Functional and short-term thinking within an organisation produces sub-optimisation for the supply network |
| # 27 | The existence of cross-functional units that can act autonomously from other parts of the same company facilitate inter-firm collaboration |
| # 28 | To operate autonomously within the organisation and to integrate in the supply network cross-functional units must have both unique resources and interface capabilities |
| # 29 | The more mature, attractive and transferable a competence is the more potential value it can create for the supply network |
| # 30 | Competencies can be developed and deployed through collaboration with other companies in the supply network |
| # 31 | For each new inter-firm project a new appropriate supply base has to be selected and managed |
| # 32 | There is a positive correlation between the extent of inter-firm collaboration and the sustainable success of the supply network and its individual companies |
| # 33 | Establishing inter-firm collaboration is an effective way of improving quality and innovation of products as well as reducing development lead-times and cost in a supply network |
| # 34 | The short term success of inter-firm collaboration in the supply network is related to cost and lead time reduction |
| # 35 | The long term success of inter-firm collaboration in the supply network is related to quality and innovation improvement |

**Table G.5: Propositions**

## Appendix H: Consent form for focus group

### Zustimmungserklärung / Statement of Consent

Hiermit bestätige ich die Richtigkeit der Angaben und Informationen in der zugrundeliegenden Focus Group. Die Aussagen reflektieren jedoch lediglich meine subjektive Einschätzung und nicht die allgemeine Position des Unternehmens. Die Daten dürfen unter der Wahrung der unten angeführten Vertraulichkeitsbedingungen zu Forschungszwecken verwendet werden.

I declare the correctness of data and information given in the underlying Focus Group discussion. However, the given statements only reflect my subjective evaluation and is not the general position of the company. The data and information can be used for research purposes based on the adherence of the conditions outlined in the Statement of Confidentiality below.

Datum / Date Unterschrift Teilnehmer / Signature Participant

### Vertraulichkeitserklärung / Statement of Confidentiality

Hiermit erkläre ich mich bereit, die Identität der Person und des Unternehmens als Beteiligte der zugrundeliegenden Focus Group vertraulich zu behandeln und nur in anonymisierter Weise zu verwenden, es sei denn es wird von der Person und/oder dem Unternehmen eine schriftliche Erlaubnis für eine individualisierte Veröffentlichung der Daten und Informationen (z.B. in Form von Zitaten oder Fallstudien) erteilt.

I declare to respect the identity of the person and the company involved in the underlying Focus Group discussion and to grant anonymity, unless the use of individualised data and information (e.g. in the form of quotes or case studies) is permitted by the person and/or company.

Datum / Date Unterschrift Interviewer / Signature Interviewer

## Appendix I: Sample of coded transcript

In the following only an excerpt of the original transcript is shown.

| Interview | Coding |
|---|---|
| Interview No.: 28<br>Company / location: OEM 4<br>Date: 27.03.2005<br>Time: 11.00 - 12.45<br>Participant: Head of Department Body and Trim | Background information (parts of the demographic details have been excluded due to guaranteed anonymity and confidentiality to preserve the rights of the interviewee) |
| **Interviewer**: *I would like to begin with a general question for the start. How did the automotive industry change over the past and what were the driving factors for this?* | |
| **Participant**: There are a number of vital key stages along the way. The first stage of the industry was the advent of the motorcar which grew out of the carriage builders. Those carriage builders go back 200 or 300 years and a lot of the terminology used today comes out of those carriage builders' days. It was a craft based industry where everything was handmade. Then there was Ford with the Model T and the industrialisation. To be honest, the relationships that were set up by Ford and the Model T formed the industry structure that existed for the last century, i.e. mass production. | Core category = Collaborator Portfolio<br><br>Category = Collaborator Sourcing<br><br>Sub-category = Contingencies<br><br>Code(s) = Culture |
| The OEM was completely in control of the intellectual property of the products and was using suppliers only as suppliers of raw materials or suppliers of components on a very low level. | Core category = Collaborator Portfolio<br><br>Category = Strategic Roles<br><br>Sub-category = OEM<br><br>Code(s) = Incumbent |
| This was very much based on an adversarial relationship, which means the OEM would seek to buy the products at the lowest possible price and seek to have the maximum added value. That adversarial relationship existed ever since to a greater or lesser degree. We view suppliers today as somebody we need to get as much out of as possible and we view the environment as a competitive environment. | Core category = Industrial Impact<br><br>Category = Change Aspects<br><br>Sub-category = Specific Aspects<br><br>Code(s) = Adversarial Relationship |
| There is talk about strategic alliances with partners and suppliers but I think that strategic alliance is usually grown out of the supplier having intellectual property the OEM has not got. In that case the alliance is forced onto the OEM. And companies like Bosch or Siemens are very successful with that by investing enormous amounts of money into their own R&D. A good example is the Electronic Stability Control Programme of Bosch who was first on the market with it and if OEMs wanted access to that technology they had to go through that supplier. | Core category = Collaborator Portfolio<br><br>Category = Collaborator Sourcing<br><br>Sub-category = Contingencies<br><br>Code(s) = Competence profile |
| And if you run the balance between cost and quality usually cost wins because of that adversarial relationship. | Core category = Collaborator Portfolio<br><br>Category = Collaborator Sourcing<br><br>Sub-category = Criteria<br><br>Code(s) = Technical / Efficiency |
| A key part of any new product that is designed, developed or launched is the selection of suppliers for the components of this new product. | Core category = Collaboration<br><br>Category = Collaborator Activities<br><br>Sub-category = OEM |

| | |
|---|---|
| | Code(s) = Scouting & Integrating<br><br>Core category = Holistic Competitive Advantage<br><br>Code(s) = Collaborator sourcing |
| The Japanese way is slightly different as such as they genuinely set up more strategic partnerships. But those partnerships are often driven by cross funding between the partners, i.e. suppliers have a stake in the OEM and vice versa. | Core category = Collaboration<br><br>Category = Facilitators<br><br>Sub-category = Positive<br><br>Code(s) = Financial stakeholding |
| That gives the supplier the advantage of a secure and stable supply guarantee. The OEM actually get suppliers that are prepared to be best because they know that they have this long-term secure supply possibility. | Core category = Collaboration<br><br>Category = Outcomes<br><br>Sub-category = Positive<br><br>Code(s) = Stability & continuity / Motivation & ownership improvement |
| The disadvantage is that it tend to stagnate over a period of time, e.g. if a supplier comes along with a new technology or innovation the OEM's supplier does not have then the OEM would be locked in his partnership with the supplier and would need to break this partnership first before he can access the new technology. | Core category = Collaboration<br><br>Category = Outcomes<br><br>Sub-category = Negative<br><br>Code(s) = Lock in |
| ***Interviewer:** Could you imagine that there are advantages for both sides, i.e. OEM and supplier, to work together in a more collaborative way, i.e. shifting away from that strict adversarial relationship.* | |
| **Participant:** Definitely. No doubt that the development of longer term and more strategic partnerships would benefit both the OEMs and the suppliers. | Core category = Collaboration<br><br>Category = Facilitators<br><br>Sub-category = Positive<br><br>Code(s) = Type & degree of relationship |
| Where the commitment from the OEM is made up front by sourcing components to certain supplier for the foreseeable future | Core category = Collaboration<br><br>Category = Facilitators<br><br>Sub-category = Positive<br><br>Code(s) = Frontloading |
| In return, the supplier will commit to maintain best practice in terms of year by year cost reductions, investments in people, facilities, equipment and infrastructure and also take a share in the risk of new product development. It is easy to say that it clearly would be beneficial for both parties but securing that is actually very difficult. For the OEM the advantage would be a supplier that supplies quality components and that invests the right level of commitment at the right time to deliver the best possible job. The supplier gets the opportunity to invest in the future and gets the guarantee to survive in business and not constantly have to drive down cost in the short term to maintain business. | Core category = Collaboration<br><br>Category = Outcomes<br><br>Sub-category = Positive<br><br>Code(s) = Cost reductions / Risk reduction / Quality improvement / Motivation & Ownership improvement / Stability & continuity |
| ***Interviewer:** If we now would assume that an earlier selection of suppliers and a more collaborative way of working with those suppliers* | |

| | |
|---|---|
| *would lead to a better quality and maturity of the products and hence less problems in the field, why is the automotive industry not doing this. Why is it still the adversarial relationship you just described before.* | |
| **Participant:** One of the key factors is that it has always been done in this way. Trying to shift that is an incredible difficult thing to do. | Core category = Collaborator Portfolio<br><br>Category = Collaborator Sourcing<br><br>Sub-category = Contingencies<br><br>Code = Culture |
| Another reason is the way the OEMs are structured, i.e. discrete and distinct departments like engineering, logistics, manufacturing, purchasing. That means it is not necessarily holistic in its approach. The key measure of any purchasing department is the cost for commodity purchasing. That is true for all the OEMs. They look at the price of a part, benchmark it against other prices and look for the lowest possible price. It really takes an enormous leap of faith to say that we no longer go and find this part at the lowest price. | Core category = Collaboration<br><br>Category = Facilitators<br><br>Sub-category = Negative<br><br>Code(s) = Functional thinking & organisation |
| This means to apply a strategic sourcing and purchasing role by selecting a supplier at day one of a new project and then making the decision on this supplier even before we know the exact details, specifications and cost of the component. We will select the supplier based on its capability and competence and nominate him at day one as the partner for this vehicle which will comprise the development and the production. | Core category = Collaboration<br><br>Category = Facilitators<br><br>Sub-category = Positive<br><br>Code(s) = Competence orientation / Frontloading<br><br>Core category = Collaborator Portfolio<br><br>Category = Collaborator Sourcing<br><br>Sub-category = Contingencies<br><br>Code(s) = Sourcing strategies / Competence profile |
| What it also requires is an open book process and relationship where the first thing to be agreed on between the OEM and the supplier is the profit margin of the supplier. Then the project will run on an open book basis so that the real costs of the supplier will be agreed by the OEM, the real costs of the part will be agreed by the OEM, the targets will be agreed between the supplier and the OEM and where there is a difference between the actual cost status and the target this is a joint work stream between the OEM and the partner to try and achieve to produce those products at the cost target. | Core category = Collaboration<br><br>Category = Facilitators<br><br>Sub-category = Positive<br><br>Code(s) = Fairness |
| This means that effectively the risk is shared. | Core category = Collaboration<br><br>Category = Outcomes<br><br>Sub-category = Positive<br><br>Code(s) = Risk reduction |
| **Interviewer**: *So you would say that the type of relationship an OEM has with its suppliers reflects on the business success of those companies.* | |
| **Participant:** Absolutely. Yes. | Core category = Holistic Competitive Advantage<br><br>Code(s) = Collaboration |
| **Interviewer:** *But all this is really difficult to measure. That is why* | |

| | |
|---|---|
| *probably most companies are not bothered with this and just look at the price and costs of the commodities, which is easily measurable.* | |
| **Participant:** Yes. But also the Anglo-Saxon model is a very short-term model looking at the bottom line. Clearly, buying a part cheaper has an instant positive effect on the bottom line, but might actually have a negative long-term effect on the bottom line. | Core category = Collaboration<br><br>Category = Facilitators<br><br>Sub-category = Negative<br><br>Code(s) = Short-term thinking |
| The one thing to recognise in all this is that change is inevitable. You might as well get both parties engaged in discussing and implementing the change in the most efficient and effective way for both parties rather than forcing all the risk onto one or the other. | Core category = Collaboration<br><br>Category = Facilitators<br><br>Sub-category = Positive<br><br>Code(s) = Holistic and long-term thinking |
| Then we and up in a blame culture which does not work to either advantage. Unfortunately, it happens every single day. In every single relationship with a supplier that is nominated based on price that situation appears. | Core category = Collaboration<br><br>Category = Facilitators<br><br>Sub-category = Negative<br><br>Code(s) = Cost focus |

**Table I.1: Excerpt of coded transcript**

## Appendix J: Coding Master Table

| Category / Code | Definition / Description | Example [source] | Coding / Attributes |
|---|---|---|---|
| Background Information | General information about interviews and interviewees. Includes: Demographic Factors and Interview Factors | N/A | N/A |
| Demographic Factors | General information about the interviewees | N/A | N/A |
| Gender | The gender of the interviewee | N/A | Male<br>Female |
| Type of company | The type of company the interviewee is working for | N/A | Car manufacturer (OEM)<br>Supplier |
| Organisational area | The organisational area the interviewee is working in | N/A | R&D<br>Purchasing<br>Logistics<br>Marketing / Sales<br>Quality assurance<br>Production/Manufacturing<br>Strategy / Managing<br>Directorship |
| Organisational responsibility level | The organisational responsibility level the interviewee is occupying | N/A | Clerk<br>Junior Management<br>Middle Management<br>Senior Management<br>Top Management / Executive Level |
| Interview Factors | General information about the interview | N/A | N/A |
| Duration | The duration of the interview in hours | N/A | < 1h<br>≤ 1.5h<br>≤ 2h<br>> 2h |
| Number of interviewees | The number of interviewees that were present at the same time | N/A | 1<br>2<br>> 2 |

| Category / Code | Definition / Description | Example [#interview:paragraph] | Coding |
|---|---|---|---|
| Industrial Impact | Factors that describe the role of the industrial environment and its influence on practices in the context of inter-firm R&D collaboration in the German automotive industry. Includes: Change Drivers, Change Aspects, and Coping Methods | N/A | Referenced interview (number of passages therein), e.g. 2(3), 15(1) |
| Change Drivers | Factors that drive change of the industrial environment | N/A | N/A |
| Exogenous Drivers | Factors that consider macro-economic aspects that cannot be influenced by the individual company directly | N/A | N/A |
| Customer requirements 22 | Aspects that consider the increasing customer demands and requirements, i.e. from end consumer to OEM as well as from OEM to supplier | On the technical side we face increasing requirements of the end customer, e.g. in the areas of electronics, comfort, or safety [#19:21] | 2(1), 3(3), 4(2), 14(1), 15(1), 16(2), 17(1), 18(2), 19(1), 20(1), 21(2), 22(1), 23(1), 25(1), 27(2) |
| Product proliferation 21 | Aspects that consider a greater variety and segmentation of products that lead to changes in the industry | The market is extremely flooded with different models whereby the cost per model are higher than in the past due to a lower volume per model [#16:106] | 3(2), 4(3), 5(3), 8(2), 14(1), 15(2), 16(1), 19(2), 24(1), 25(1), 26(3) |
| Short Product Life Cycle (PLC) 12 | Aspects that consider the decreasing service life of a car leading to new requirements for car development | Especially through the success of the Japanese car manufacturers the German car makers realised that they have to reduce their model life cycle and introduce new models more often and quickly [#22:19] | 3(1), 4(1), 5(1), 11(1), 16(2), 17(1), 22(2), 23(1), 25(1), 27(1) |
| Competition in markets 8 | Aspects that consider an increased competition in the markets for automotive vehicles, mainly due to globalisation, overcapacities, and maturing markets | Reasons for problems can be seen in the internationalisation and maturing of markets which cause price competition for cars and their components [#19:21] | 4(1), 5(1), 11(1), 14(1), 15(1), 19(2), 26(1) |
| Government regulations 4 | Aspects that consider government regulations which drive industrial change in terms of new products, technologies, processes, etc. | For example in the area of safety we are facing constantly changing and stricter government regulations that ultimately require new processes and technologies in car development [#5:55] | 4(1), 581), 15(1), 27(1) |
| Endogenous Drivers | Factors that consider micro-economic aspects that can partly be influenced by the individual company | N/A | N/A |
| Cost pressure 53 | Aspects that consider increased cost pressure within the German automotive industry, e.g. due to higher competition on car markets or a greater product variety with less volume | On the other hand we outsourced relatively expensive processes or parts of processes to external suppliers, e.g. Third Party Logistics (3PL) Service Providers for warehousing, consignment, delivery, etc. [#16:24] | 3(2), 4(3), 5(4), 6(5), 7(2), 8(2), 9(2), 10(1), 11(1), 12(1), 13(1), 14(1), 15(3), 16(4), 17(1), 18(2), 19(5), 20(1), 21(1), 22(1), 23(4), 24(2), 25(1), 26(1), 27(1), 28(1) |
| Complexity increase 28 | Aspects that consider the increase of complexity in areas such as product, process, technology, etc. (which is partly based on exogenous factors such as customer requirements or government regulations) | Concluding I would say that the two responsible factors for changes are 1).... and 2) the detailed technology due to more complex products which the OEM cannot handle completely itself anymore [#6:25] | 4(1), 5(1), 6(4), 7(1), 9(1), 10(1), 12(1), 15(1), 16(1), 17(2), 18(6), 19(1), 20(1), 21(1), 22(1), 23(1), 27(3) |
| Short Product Development Process (PDP) 16 | Aspects that consider the shortening of the product development process leading to a shorter time to market for new developments | 10-15 years ago the development of a car took 7-8 years. Nowadays you have to come up with a new model every three years. In order to realise this time to market you have to clearly decide on what to do yourself and what to outsource [#17:21] | 3(1), 4(2), 5(1), 6(1), 8(1), 11(2), 16(1), 17(2), 22(2), 23(1), 25(1), 27(1) |
| Change Aspects | Factors that consider the resulting changes in the industrial environment based on the Change Drivers | N/A | N/A |
| Specific Aspects | Factors that consider immediate and direct changes in reference to the Change Drivers | N/A | N/A |

| | | | |
|---|---|---|---|
| Product modularisation 20 | Aspects that consider an aggregation of parts or components to superior modules or systems | In the past the OEMs knew a lot about the technology and did a lot of development on their own and hence only bought parts or components. This changed as OEMs buy complete systems or modules now [#12:19] | 3(1), 6(1), 7(1), 9(1), 11(1), 12(1), 17(2), 18(1), 19(1), 21(2), 22(1), 23(2), 24(1), 25(1), 26(1), 27(2), |
| Adversarial relationship 19 | Aspects that consider an adversarial relationship between OEM and supplier | The OEM requires of us suppliers to take over even more risks, e.g. in terms of financial investments, concerned with the development of a car in order to save time and costs [#22:19] | 1(1), 3(3), 4(1), 6(1), 7(1), 10(1), 12(1), 19(1), 20(1), 22(3), 25(3), 28(2) |
| Know how shift 19 | Aspects that consider a shift of knowledge within the automotive industry, e.g. from OEM to 1st tier supplier or from 1st tier to 2nd tier, etc. | Fact is that over the past years a lot of know how and engineering performance shifted from the OEM to the 1st tier supplier [#27:21] | 6(1), 7(1), 9(1), 10(1), 12(1), 13(1), 15(2), 16(1), 17(2), 19(1), 20(1), 22(2), 25(1), 27(2), 28(1) |
| Consolidation 17 | Aspects that consider consolidation activities within the German automotive industry, i.e. on the OEM level as well as on the supplier level | There will be a further consolidation between the OEMs. The supplier already experienced a strong consolidation over the last years [#26:81] | 1(1), 3(1), 4(2), 7(1), 9(1), 14(1), 18(1), 19(2), 20(4), 21(1), 22(1), 26(1) |
| Global sourcing 9 | Aspects that consider global sourcing in terms of purchasing products and services | We adapt our strategy and try to use global purchasing opportunities in order to achieve cost savings. That is a major issue for us [#9:21] | 9(1), 16(1), 18(1), 19(1), 22(1), 25(2), 27(2) |
| Supplier portfolio 9 | Aspects that consider a reduction in the number of suppliers either for a particular project or for the company in general | There is a work stream going on that is looking at reducing the numbers of suppliers because we have a large number considering that we are a relatively small OEM [#28:87] | 7(1), 9(2), 14(1), 15(2), 20(1), 28(2) |
| Product quality 4 | Aspects that consider a decreasing product quality due to exogenous and endogenous drivers | Due to the shortened development times the products cannot be developed as good as possible and necessary which leads to a worse quality of the overall car [#11:21] | 11(1), 12(1), 15(1), 27(1) |
| Virtualisation 2 | Aspects that consider a substitution of physical activities with virtual ones | Over the past years the virtual world developed so drastically that it is nearly possible to abandon the use of prototyping and modelling technologies completely [#4:133] | 4(1), 5(1) |
| Abstract Aspects | Factors that consider abstract and comprehensive changes in reference to the Change Drivers | N/A | N/A |
| Short-term R&D optimisation 21 | Aspects that consider short term orientated optimisation (e.g. based on cost) of the R&D activities and the PDP leading to sub-optimal solutions | Where OEMs had problems was when they randomly outsourced activities without thinking about their own core competences [#14:73] | 2(1), 5(2),6(3), 7(3), 8(2), 10(2), 12(1), 14(1), 15(1), 16(1), 19(1), 23(1), 27(1), 28(1) |
| Industrial roles 20 | Aspects that consider a change in roles of the players in the automotive market | Due to outsourcing activities of the OEMs in most R&D areas the tasks and roles of their staff changed from being a designer or developer to being a project manager [#26:27] | 2(1), 3(1), 9(2), 10(2), 11(2), 13(1), 17(1), 18(1), 19(1), 20(1), 21(2), 22(1), 23(1), 25(1), 26(1), 27(1) |
| Coping Methods | Factors that consider companies' ways and methods of coping with the changes of the industrial environment | N/A | N/A |
| Strategic sourcing 103 | Aspects that consider exogenous and endogenous factors for sourcing based on an increased strategic orientation to cope with industrial change. Exogenous aspects include: Competitive advantage, quality problems of suppliers, and market trends. Endogenous aspects include: capacity utilisation, know how loss, competence specificity, and R&D optimisation | Many OEMs that have been pursuing strong outsourcing over the past years are now on the way to do more inhouse to utilise their capacities and to cover important product segments themselves [#20:27]<br><br>There are insourcing tendencies mainly based on internal capacity utilisation but there are also areas where the OEMs will further outsource modules [#19:35] | 1(4), 2(4), 3(2), 4(2), 5(3), 6(6), 7(4), 8(2), 9(4), 10(5), 11(1), 12(3), 13(2), 14(2), 15(7), 16(4), 17(3), 18(5), 19(4), 20(6), 21(3), 22(3), 23(3), 24(5), 25(3), 26(5), 27(6), 28(2) |

| | | | |
|---|---|---|---|
| R&D decision making 99 | Aspects that consider proactive decision making for long-term R&D optimisation based on strategic aspects, such as competencies, product portfolio, or political and economical factors | Based on our know how and observable market tendencies we made strategic decisions in which market areas we want to penetrate, with our current products but also with new products that can be developed using our technological knowledge [#19:23] | 1(5), 3(3), 4(7), 5(2), 6(8), 7(2), 8(3), 9(4), 10(3), 12(1), 14(5), 15(3), 16(5), 17(3), 18(5), 19(6), 20(8), 21(1), 22(2), 23(2), 25(8), 25(7), 26(4), 27(3) |
| Competence focus & development 65 | Aspects that consider an increased focus on competencies and further competence development to cope with industrial change | Based on the industrial changes we re-defined our position by developing new competencies beyond the traditional door in order to penetrate the growing new markets of sliding doors [#19:23] | 1(1), 6(4), 7(1), 8(2), 9(3), 10(1), 11(2), 12(1), 14(4), 16(6), 17(2), 18(4), 19(5), 20(7), 21(4), 22(2), 23(1), 24(2), 25(6), 26(3), 27(4) |
| Organisational restructuring 54 | Aspects that consider a (re)designing and (re)structuring of organisational attributes of the PDP, such as departments, functions, processes, organisational form and structure, etc., to cope with industrial change | The OEM requires short reaction lead times of us, i.e. you have to have an organisational alignment with the OEM. We did this over the past years by restructuring into customer teams and key accounts respectively [#22:23] | 2(1), 3(3), 4(2), 5(3), 6(1), 7(1), 9(1), 10(2), 14(1), 15(2), 16(2), 17(1), 18(3), 19(1), 21(7), 22(5), 23(2), 24(2), 25(8), 26(4), 27(2) |
| Collaborative partnerships 36 | Aspects that consider increased collaborative activities within the automotive industry in terms of complexity as well as intensity to cope with industrial change | In order to handle the increased product variety, the OEMs were more or less forced to look for partners that perform those activities [#11:23] | 2(1), 3(4), 6(2), 7(1), 11(1), 14(2), 16(1), 17(3), 18(3), 19(1), 21(1), 22(4), 23(4), 24(3), 25(2), 26(3) |
| Standardisation 18 | Aspects that consider an establishment of supply chain- or industry-wide standards, e.g. through horizontal OEM or supplier collaboration, to cope with industrial change aspects | We try to develop products that can be applied to various car models in order to reduce the development and project cost per model by exploiting economies of scale effects [#18:92] | 2(2), 5(1), 6(1), 8(2), 9(1), 13(1), 15(1), 16(1), 18(1), 21(3), 24(2), 27(2) |
| Active supply management 14 | Aspects that consider an active management of the supplier portfolio and the R&D activities to cope with industrial change aspects | The tendency is that suppliers move closer towards the OEM who in some cases eventually manages them on-site [#16:82] | 14(1), 16(2), 17(1), 18(2), 21(3), 22(1), 23(2), 25(1), 28(1) |

| Category / Code | Definition / Description | Example [#interview:paragraph] | Coding |
|---|---|---|---|
| Collaborator Portfolio | Factors that are concerned with the design and development of an appropriate portfolio of collaborating companies in the context of inter-firm R&D collaboration in the German automotive industry. Includes: Collaborator Sourcing, Relationship Criteria, Strategic Collaborator Roles, and Relationship Interfaces | N/A | Referenced interview (number of passages therein), e.g. 2(3), 15(1) |
| Collaborator Sourcing | Factors that consider the selection and evaluation of potential collaborators for an appropriate portfolio. Includes: Sourcing Contingencies and Sourcing Criteria | N/A | N/A |
| Sourcing Contingencies | Factors that influence the selection and evaluation process leading to different degrees of relationships between the collaborators (buyer and supplier) in a portfolio | N/A | N/A |
| Product & process attributes 90 | Aspects that consider product and process attributes, such as volume, degree of innovation, or complexity, that influence the buyer's emphasis on the various sourcing criteria | The simpler the part or component the more emphasis is put on the price [#15:111] | 1(6), 2(2), 3(2), 4(1), 5(2), 6(1), 7(1), 8(3), 9(3), 10(3), 11(1), 12(1), 13(3), 14(10), 15(7), 16(3), 17(2), 18(6), 19(8), 20(1), 21(1), 22(2), 24(7), 25(5), 26(6), 27(3) |
| Competence profile 76 | Aspects that consider the possession of a specific competence and knowledge profile of the collaborating parties (buyer and supplier) | The basic powertrain, for example, is traditionally manufactured within the OEM. Therefore the development will be done inhouse as well since the OEM knows the whole process better than an external supplier and hence has an advantage in competence [#1:31] | 1(4), 2(4), 3(1), 4(3), 5(2), 6(1), 7(2), 9(1), 10(2), 11(3), 13(4), 14(5), 15(5), 16(3), 17(4), 18(2), 19(3), 20(5), 21(2), 22(3), 23(1), 24(3), 25(3), 26(5), 27(2), 28(3) |
| Sourcing strategies and activities 38 | Aspects that consider various sourcing strategies and activities of the buyer leading to a variety in structuring the PDP and hence different collaborative relationships | All OEMs will need to use system suppliers. For some products the collaboration will be more intense, for others less intense, depending on the focus and sourcing activities of the OEMs [#13:88] | 1(3), 2(1), 3(4), 5(1), 7(2), 9(2), 12(1), 13(1), 14(1), 15(5), 18(1), 19(2), 21(1), 22(3), 23(1), 24(2), 25(2), 26(4), 27(1) |
| Decision authority within buyer 31 | Aspects that consider the authority of decision making within the buyer's governance structure that influence the buyer's emphasis on the various sourcing criteria | It is a mixture in the sense that all areas participate in the evaluation process. Specific supplier evaluations are done by R&D, Purchasing, and Quality Assurance departments [#4:139] | 1(6), 2(3), 3(1), 4(2), 8(1), 12(1), 13(3), 14(3), 15(2), 16(1), 18(1), 20(2), 24(1), 27(1), 28(3) |
| Collaborator strategy 30 | Aspects that consider the individual strategies of the collaborating parties leading to different degrees of collaborative relationships between them | There is the question what you want to achieve with the product. The products you try to differentiate yourself with from the marketplace will be outsourced less likely. If you only want to be follower with the product, the strategy of using a supplier's know how quickly and efficiently is more interesting. It really depends on the specific goals [#26:29] | 1(10), 2(1), 3(1), 4(2), 5(1), 6(1), 7(1), 9(1), 10(1), 13(2), 15(2), 24(3), 25(2), 26(2) |
| Evaluation competence 26 | Aspects that consider the ability of the buyer (decision maker) to make a qualified sourcing decision which influences the criteria on which the sourcing process is based | If the OEM possesses more know how there is a chance that the supplier selection will not only be based on the price as it is more easy for him to base a decision on the supplier's competence. Thereby I see a chance that the price dominated internet auctions will loose their dominance [#12:29] | 2(3), 4(1), 7(1), 8(2), 10(1), 11(1), 12(1), 13(1), 15(2), 16(1), 17(1), 18(1), 19(2), 20(2), 22(1), 23(1), 25(2), 27(1), 28(1) |
| Collaborator dependency | Aspects that consider the reliance of one collaborator on another one influencing the their power within the collaboration | An important factor is the 'balance of power'. If you align a supply chain purely on a single supplier this creates dependencies which we try to minimise by dual sourcing or similar strategies. Regarding this issue the OEMs and 1st tier suppliers became very sensitive over the last view years [#27:39] | 2(1), 6(1), 8(2), 9(1), 11(1), 13(1), 14(1), 15(4), 16(2), 17(2), 18(1), 19(2), 20(1), 24(2), 25(1), 27(3) |

| | | | |
|---|---|---|---|
| 26 | | | |
| Stage of PDP 25 | Aspects that consider the various stages of the product development process that influence the buyer's emphasis on the various sourcing criteria and lead to different degrees of collaborative relationships | In the end it is a two-step process. At the beginning know how, ideas, and innovativeness are important. As soon as the development problems are solved and the process migrates towards the traditional manufacturing business, only the price counts anymore [#16:116] | 2(3), 4(1), 9(1), 13(1), 14(7), 15(4), 16(1), 17(1), 21(1), 22(1), 23(1), 24(1), 25(2) |
| Culture 18 | Aspects that consider internal and external cultural factors of the buyer that influence the sourcing process and its various criteria | We have a very constant management culture which ultimately influences our approach towards our suppliers [#16:97] | 6(2), 14(2), 15(2), 16(1), 18(1), 20(2), 24(5), 26(1), 28(2) |
| Customer interfaces 12 | Aspects that consider the interfaces between product and end consumer that influences the sourcing process | A good example are seats. Some of the OEMs have mainly outsourced that topic in the past but are moving it back inhouse because seats are an important interface to the end consumer [#25:86] | 1(2), 2(5), 6(1), 13(1), 15(1), 24(1), 25(1) |
| Collaborative supply strategy 11 | Aspects that consider a collaborative attitude of companies towards supply management that influences the criteria on which the selection and evaluation process is based | Volvo is a very good example of working like this. Volvo has a supplier base that is built up around the guarantee of return business. Its negotiations with suppliers are not based on price but on competence, capacity, capability, commitment [#28:31] | 3(1), 4(1), 6(1), 15(1), 21(1), 23(1), 28(5) |
| Competence fit 8 | Aspects that consider the possession of specific knowledge and competencies that complement the ones of the other collaborators | It is not necessarily the question whether a supplier is more competent than another but rather whether his competencies fit together with our profile [#14:151] | 1(1), 2(2), 6(1), 11(1), 13(1), 14(1), 23(1) |
| Sourcing Criteria | Factors that consider features and aspects on which the selection of potential collaborators for integration in the collaborator portfolio is based | N/A | N/A |
| Technical competence features 63 | Aspects considering technical competence features, such as delivery quality, innovativeness, interface management, supplier evaluation, process and product know how, product quality, etc. | We require of our systems suppliers the ability to evaluate and select their own suppliers in a qualified way because we see the collaboration in networks as the future in the automotive industry [#14:129]<br><br>The price is a criterion for the selection but similarly important is the performance and quality that the supplier delivers [#11:33]<br><br>At the moment the selection is based 60-70% on cost. The rest via competence and quality, i.e. innovativeness and technology [#6:103] | 2(7), 3(4), 4(1), 6(4), 7(5), 8(3), 9(1), 10(1), 11(1), 12(2), 13(4), 14(8), 15(5), 16(3), 17(1), 19(2), 20(2), 21(1), 22(2), 23(1), 25(1), 26(1), 27(1), 28(2) |
| Efficiency competence features 55 | Aspects considering efficiency competence features, such as cost, project management, speed, etc. | What becomes more and more important is the topic project management [#7:83]<br><br>Then we also have the purchasing aspect as a criterion, i.e. whether the price of the supplier matches our target [#13:57]<br><br>There are many dimensions, e.g. a time aspect which means who is able to deliver a certain solution quickly [#27:37] | 2(1), 3(1), 4(3), 6(5), 7(5), 8(4), 9(1), 10(1), 11(1), 12(2), 13(1), 14(3), 15(5), 16(4), 17(2), 18(1), 19(2), 20(2), 22(2), 23(4), 26(1), 27(2), 28(2) |
| Social competence features 10 | Aspects considering social competence features, such as local presence, business model, ownership, stability, plug & play ability, etc. | At BMW they also consider factors, such as communication, the execution of tasks, or the commitment and ownership in the collaboration process [#23:103]<br><br>Questions that are often asked by the OEMs before placing an order is how our sub-supply network looks like, if we provide local presence, or what our strategy looks like and where we want to go with it in the future [#3:205] | 3(3), 5(1), 14(2), 15(1), 19(1), 23(1), 28(1) |

| | | | |
|---|---|---|---|
| Other features<br>26 | Aspects considering other features, such as capacity, past mutual experience, product attributes, references, etc. | If only one specific supplier, that has not appeared as a potential supplier before, can deliver a certain technology then we have to estimate his abilities, e.g. by looking at who he worked together with already [#13:53]<br><br>I see that they [OEMs] drive back the phase of selecting the cheapest and rather go back to established suppliers with whom they made good experience in the past [#23:47] | 1(2), 3(1), 6(1), 7(3), 8(1), 10(1), 13(1), 14(2), 15(4), 16(1), 17(3), 19(1), 22(2), 23(1), 27(1), 28(1) |
| Relationship Criteria | Factors that determine the type and degree of relationships between collaborators within the portfolio | N/A | N/A |
| Foundation of relationship<br>40 | Aspects that consider attributes and features on which the collaborative relationship and its environment is based, e.g. technical, social, or efficiency competence features, degree of autonomy or responsibility, stage of PDP, product attributes, etc. | There are always two dimensions that have to be considered. Is it a technical know how, i.e. in the context of the product itself, or is it a know how that lies in the project management as for the system supplier for example. In this context we then consider other competence aspects [#2:89] | 1(2), 2(5), 3(3), 4(1), 5(2), 7(1), 8(2), 9(1), 10(2), 11(2), 13(1), 14(4), 15(1), 16(1), 17(4), 19(2), 20(1), 23(1), 24(1), 25(2), 27(1) |
| Depth of relationship<br>34 | Aspects that consider the depth of coverage, i.e. involvement and responsibility, of the product development process, e.g. whole car, systems, modules, parts, components, engineering services, etc. | The biggest responsibility for a system or system component lies within the system supplier. The module supplier has a limited responsibility as he only needs to assemble the components in the required quality but does not have much insight into the design and development of the components. The component or part supplier is only responsible for his individual part [#2:61] | 1(5), 2(4), 3(8), 5(3), 6(2), 7(1), 8(1), 14(4), 15(1), 16(2), 17(2), 24(1) |
| Evolution of relationship<br>33 | Aspects that consider attributes and features which influence the evolution of relationships, such as advancement and sophistication of competencies, dissemination of knowledge, etc. | If you do not develop further, i.e. an inability to deliver new ideas, knowledge, innovations, or solutions, it is possible that you will be demoted to the 2nd tier level and hence have to supply your parts to a bigger system supplier [#17:49] | 4(1), 5(3), 6(2), 7(4), 8(1), 9(1), 10(1), 11(1), 14(1), 15(1), 16(2), 17(4), 18(1), 19(4), 22(1), 24(2), 25(1), 27(1), 28(1) |
| Longevity of relationship<br>21 | Aspects that consider the duration and dynamics of the relationship, e.g. permanent, long-, medium, or short-term, etc. | You have to establish long-term relationships, no matter whether I am an OEM or supplier, because the automobile business is a long-term business. If you engage in a relationship for a car model this will at least be for about 5-7 years [#27:28] | 7(2), 8(1), 9(2), 10(1), 13(1), 16(2), 17(3), 19(1), 22(2), 24(1), 25(1), 27(1), 28(3) |
| Scope of relationship<br>15 | Aspects that consider the scope of coverage, i.e. involvement and responsibility, of the product development process within the relationship, e.g. product development, product fabrication, product probation | I wish that the worldwide cost pressure would not be passed on to all suppliers in general, but that the OEMs distinguish between suppliers that also supply engineering services and those that only manufacture. The development partners should be managed separately because they need to be integrated into the 'gear drive' of car development in a special way [#23:121] | 1(2), 2(3), 3(4), 5(1), 14(1), 15(1), 17(1), 23(1), 24(1) |
| Proximity of relationship<br>15 | Aspects that consider the intensity and closeness of collaborators in their relationship | Due to the increased complexity it is important to move closer together with the OEM in order to remain in charge of your part or component [#17:71] | 16(3), 17(3), 18(3), 19(2), 23(1), 25(2), 27(1) |
| Condition of relationship<br>9 | Aspects that consider the status of engagement or execution of an existing relationship, e.g. engaged vs. unengaged | On the one hand, you try to employ your established suppliers constantly and distribute workload equally. On the other hand, there are suppliers who are currently not employed by us but are still maintained in our sourcing database. Generally a supplier will only be released from the portfolio if aspects such as quality, delivery time and reliability, etc. are not acceptable anymore [#17:59] | 9(1), 15(2), 17(1), 19(2), 22(1), 25(1), 28(1) |

| | | | |
|---|---|---|---|
| Governance of relationship 5 | Aspects that consider management aspects and attitudes of the existing relationship, e.g. adversarial control and command vs. collaborative strategy and autonomy | Both cases exist. Volume products will be exhausted from a cost perspective by using adversarial competition among the suppliers which is common for all OEMs I know. For Innovations, on the other hand, you try to integrate the suppliers earlier [#9:103] | 1(1), 9(1), 10(1), 14(1), 15(1) |
| Strategic Collaborator Roles | Factors that consider different strategic roles occupied by the collaborators in the portfolio during their relationships | N/A | N/A |
| OEM | Factors that consider the strategic roles endued by the collaborating party that acts as the architect of the portfolio (buyer and decision maker) | N/A | N/A |
| Integrator 27 | A role that involves creating a more stable and strategic portfolio environment based on integration through appropriate strategic sourcing and collaborator development | The OEMs have to change their thinking from getting parts at the cheapest price towards finding and developing future partnerships that are going to benefit the business. And then they have to hand it over to the people that are effectively delivering the products [#28:49] | 2(2), 6(1), 7(4), 8(2), 9(3), 10(1), 13(1), 14(2), 19(3), 22(1), 24(2), 27(1), 28(4) |
| Incumbent 18 | A role that involves creating a corporate portfolio environment focusing on monitoring and control through corporatisation | In the past, the OEM was completely in control of the intellectual property of the products and was using suppliers only as suppliers of raw materials or suppliers of components on a very low level. This was very much based on an adversarial relationships [#28:23] | 1(2), 2(2), 4(1), 9(2), 14(2), 15(2), 17(1), 19(2), 25(1), 28(3) |
| Incubator 6 | A role that involves creating a loose and flexible portfolio environment based on innovation through appropriate collaborator scouting | Principally, the OEM should be something like a blacksmith of innovations that looks specifically for appropriate partners for their realisation [#13:41] | 4(1), 13(2), 15(1), 19(1), 25(1) |
| Supplier | Factors that consider the strategic roles endued by the collaborating party that acts as the supplier or member within the portfolio reflecting a certain cascade of tier levels | N/A | N/A |
| Prime contractor 6 | A role that involves a high degree of involvement and responsibility, i.e. development and production, in the PDP and basically requires know how of the whole car, e.g. the management of the PDP and the related sub-supply network for small car series | Prime contractors provide services from development to production. In this case we [the OEM] are only involved with a core team of about 10-20% of the usual manpower for such a project [#1:51] | 1(1), 5(1), 8(1), 24(3) |
| Systems supplier 15 | A role that involves the responsibility and coverage of the PDP, i.e. development and production, for a large and complex system by integrating sub parts or components (electronic and mechanic) and managing their respective suppliers | Nowadays, the demand is more and more for system suppliers that not only understand the system in order to achieve synergy effects but also take responsibility for the quality and functionality of the whole system across the overall supply chain [#6:31] | 1(3), 2(5), 3(1), 6(1), 7(2), 17(1), 19(1), 25(1) |
| Module supplier 5 | A role that involves the responsibility to deliver a large module through integrating sub parts or components (electronic and mechanic) and managing their suppliers | The module supplier has a limited responsibility as he only needs to assemble the components in the required quality but does not have much insight into the design and development of the components. Hence he has relatively few possibilities to solve any problems [#2:61] | 2(4), 17(1) |
| Part & component supplier 6 | A role that involves the responsibility and coverage of the PDP, i.e. development and production, for a small part or component | Because we do not have competent system suppliers for everything, we also rely on part or component suppliers that sometimes finish parts of the design and development but mainly do production. We mainly involve those in order not to develop products that are not producible at the end [#1:69] | 1(2), 2(1), 3(1), 14(1), 16(1) |
| Logistics & assembly service provider | A role that involves the responsibility for providing sufficient logistics and assembly service for parts or components | Logistics and assembly service providers do not offer engineering service but only assembly and delivery of parts or components. A typical example is the assembly of wheels where the service provider gets the rim and the tyre, assembles it , and delivers it just in time to our [OEM] assembly line [#2:61] | 2(2), 16(2) |

| | | | |
|---|---|---|---|
| 4 | | | |
| Engineering service provider 10 | A role that involves the responsibility for providing engineering know how for parts, components, systems, or whole cars up to the stage of delivering a prototype model | We are an engineering partner, i.e. we do not deliver parts like a typical supplier. However, we do deliver prototypes as happened with the Coupe of an OEM. In this case we took the responsibility for overall car design and development together with the OEM and also pursued specific design and development activities for specific areas such as interior together with a supplier [#3:53] | 1(2), 3(4), 5(1), 14(1), 19(1), 24(1) |
| Relationship Interfaces | Factors that consider interface elements between collaborators in collaborative activities of a collaborator portfolio | N/A | N/A |
| Commercial 23 | An element that considers commercial interfaces of collaborative activities within a collaborator portfolio | We then need new approaches, such as a network contract, in order to ensure and guarantee the collaboration between us [OEM] and the mega supplier, between us and the smaller suppliers, and between the mega supplier and the smaller suppliers [#14:125] | 2(2), 3(1), 4(1), 6(1), 7(1), 9(1), 11(1), 13(1), 14(6), 16(1), 19(2), 20(1), 24(2), 25(1), 28(1) |
| IT 14 | An element that considers IT interfaces of collaborative activities within a collaborator portfolio | What still has to be completed is the digital communication with our suppliers via the internet as communication platform so that small suppliers do not need to develop an own software environment [#21:29] | 1(1), 2(1), 5(1), 7(1), 13(1), 16(3), 17(1), 21(2), 22(1), 24(1), 25(1) |
| Project 9 | An element that considers project interfaces of collaborative activities within a collaborator portfolio | A major issue is the definition and demarcation of responsibilities and tasks, i.e. who does what when and is responsible for it. It is important that the network is developed and involved as early as possible. During a car development there is a transition from network to project which is important to install and organise [#3:225] | 3(2), 9(1), 14(4), 16(1), 25(1) |
| Organisational 9 | An element that considers organisational interfaces of collaborative activities within a collaborator portfolio | It was necessary to create a R&D department that can communicate with the customer via an interface, such as CAD systems, ZSB-drawing, models, etc. [#17:29] | 3(2), 9(1), 16(1), 17(1), 24(1), 25(1), 27(1), 28(1) |
| Technical 9 | An element that considers technical interfaces of collaborative activities within a collaborator portfolio | You really have to analyse in detail which tasks you need to do yourself and which not, i.e. not only the components and systems as such but also the detailed tasks that come with them... This way we ensure that we do not give away and thereby loose our core competence [#14:77] | 14(4), 16(1), 18(1), 24(1), 25(1), 28(1) |

| Category / Code | Definition / Description | Example [#interview:paragraph] | Coding |
|---|---|---|---|
| Collaboration | Factors that are concerned with the execution and management of collaboration between parties within the collaborator portfolio in the context of inter-firm R&D collaboration in the German automotive industry. Includes: Facilitators, Management Elements, Operative Collaborator Activities, and Outcomes | N/A | Referenced interview (number of passages therein), e.g. 2(3), 15(1) |
| Facilitators | Factors that influence and facilitate collaboration between collaborators in the portfolio | N/A | N/A |
| Positive | Factors that influence collaboration positively | N/A | N/A |
| Competence orientation 104 | Aspects reflecting an emphasis on competence features, e.g. R&D know how, evaluation competence, culture, local presence, ownership, reliability, etc. | Collaborative partnership is only possible through the focus on competencies [#20:73] | 2(3), 3(4), 4(3), 5(1), 6(4), 7(6), 8(5), 9(6), 10(7), 11(5), 12(2), 13(3), 14(10), 15(3), 16(3), 17(3), 18(2), 19(6), 20(6), 22(5), 23(3), 24(3), 25(5), 26(2), 27(2), 28(2) |
| Frontloading 86 | Aspects that consider the early and intense collaboration between collaborators in the portfolio | At the moment we can only estimate what it means for the design and development stage if a supplier is already involved in the concept development. But if the supplier can introduce his ideas in the concept already, this should lead to less effort in the later design and development [#14:99] | 1(2), 2(1), 3(7), 4(2), 7(2), 8(4), 9(5), 10(2), 11(3), 12(1), 13(1), 14(11), 15(11), 17(2), 18(2), 19(3), 20(1), 21(1), 22(7), 23(4), 24(4), 25(3), 27(2), 28(5) |
| Fairness 50 | Aspects that consider a fair and objective mutual treatment of the collaborators in a collaborative relationship, e.g. mutual support, respect, honesty, open communication, etc. | Experience has shown that an open and honest attitude towards working with partner has positive effects on the collaboration as such [#23:57]<br><br>Good collaboration is when you can discuss critical topics openly and professionally [#3:241] | 3(1), 4(2), 5(2), 7(4), 8(3), 14(2), 15(6), 16(1), 17(2), 18(1), 19(4), 20(2), 21(1), 22(3), 23(2), 24(5), 25(3), 27(1), 28(5) |
| Type & degree of relationship 43 | Aspects that consider the intensity of the existing collaborator relationship, e.g. in terms of longevity, degree of involvement, etc. | We try to consider the suppliers more as partners than in the past. We have learnt that a change of suppliers, especially for complex components such as locks, causes big problems. From a strategic perspective we therefore want to involve suppliers longer term [#15:27] | 3(2), 4(2), 7(1), 8(2), 9(5), 12(1), 14(3), 15(5), 17(1), 9(3), 22(4), 23(1), 24(4), 25(1), 27(1), 28(7) |
| Holistic & long-term thinking 31 | Aspects that consider thinking in holistic and longer terms aiming for a win-win situation between the collaborators by avoiding sub-optimisations | As long as everyone sticks to their own supply chain model because they want to gain a competitive advantage, a holistic optimisation will not be possible [#21:47] | 2(3), 3(5), 4(1), 5(3), 6(1), 7(1), 9(1), 14(1), 17(3), 19(1), 20(1), 21(3), 23(1), 27(1), 28(5) |
| Simultaneous engineering 29 | Aspects that consider the integration of different functions within as well as across organisational boundaries through the creation of interface points between the collaborating parties | The most important aspect of this simultaneous engineering approach is not necessarily that all the different businesses within the OEM are working together but they need to work together with the suppliers. Because only very few parts in the cars are made by the OEMs themselves. [#28:59] | 2(3), 3(5), 4(5), 5(3), 6(1), 14(1), 17(1), 19(2), 22(1), 23(1), 24(2), 25(1), 27(2), 28(1) |
| Definition of responsibilities & roles 25 | Aspects that consider a clear definition and demarcation of responsibilities and roles of the collaborators for a collaborative activity | Of course you will have an increased coordination effort through the creation of new interfaces. The challenge and necessity is to define those interfaces very clearly in the first place [#24:54] | 3(1), 4(1), 7(2), 9(1), 14(4), 19(1), 20(3), 23(1), 24(7), 25(2), 26(1), 27(1) |
| Knowledge sharing 25 | Aspects that consider the active exchange and sharing of technical know how and knowledge between the collaborating parties | A good example is the computer and electronics industry were technology and innovation is shared in independent forums. I can imagine that this could be a model for the automotive industry to improve collaboration [#6:101] | 2(3), 5(2), 6(3), 7(1), 8(4), 9(3), 10(1), 12(1), 13(1), 14(1), 18(1), 22(1), 23(2), 24(1) |

| | | | |
|---|---|---|---|
| Top management support 25 | Aspects that consider strategic decision making in favour of collaboration | Partnership needs to be defined by the top management, i.e. social behaviour needs to be passed on in a top down manner. Otherwise it will not work. I know many employees within the OEMs very well who would like to pursue a more social behaviour but are then reprimanded by their superiors [#20:61] | 6(1), 7(1), 8(2), 9(3), 11(2), 14(4), 16(1), 18(1), 20(1), 21(2), 22(1), 23(1), 24(3), 25(1), 28(1) |
| Collaboration infrastructure 23 | Aspects that consider the existence of mechanisms and structures for collaborative activities | Summarising you can say that it is necessary to create and develop an infrastructure that enables the pursuance of common goals [#24:34] | 3(4), 9(4), 14(4), 15(1), 16(1), 20(1), 22(1), 23(1), 24(5), 28(1) |
| Inter-personal relationships 18 | Aspects that consider good relationships on the personal level of the collaborators | If all the inter-personal relationships are working well, then the whole organisation will be considered as partner [#17:73] | 3(1), 5(1), 6(1), 9(2), 11(1), 12(1), 15(1), 16(1), 17(1), 18(1), 19(2), 20(1), 22(1), 23(1), 24(2) |
| Cluster creation 18 | Aspects that consider the creation and development of clusters, e.g. regional cluster or competence cluster, in order to reduce collaboration effort | Our desire is that big suppliers would collaborate with each other. In the chassis area, for example, there are suppliers that focus on axles; others focus on breaks, wheels, etc. Our desire is that those suppliers would collaborate in a kind of cluster or network and offer the whole package to us [#14:129] | 3(2), 4(1), 9(1), 14(1), 15(2), 16(1), 18(3), 20(1), 22(4), 25(2) |
| Leadership 13 | Aspects that consider the existence of a leader for each collaborative activity within the collaborator portfolio that has the competence to manage the activities and transactions between the collaborating parties | We were part of a project in which three equal suppliers collaborated to offer a bigger module to the OEM. I think the project failed because there was no leader that defined clear responsibilities for each partner [#25:57] | 2(1), 3(2), 5(1), 7(2), 9(1), 11(1), 23(1), 24(2), 25(2) |
| Sourcing contingencies 12 | Aspects reflecting influencing factors of the collaborator sourcing, e.g. competence profile, stage of PDP, product attributes, organisational design, collaborative supply management strategy, etc. | The quality of collaboration strongly depends on the stage of the PDP in which you are [#13:73] | 7(1), 13(1), 18(1), 19(1), 24(4), 25(1), 26(2), 28(1) |
| Trust 11 | Aspects that consider a trusting and harmonic atmosphere between collaborators | It is important to create proper conditions for collaboration via a trust culture [#24:24] | 7(2), 8(1), 9(1), 14(1), 18(1), 21(1), 22(1), 24(2), 27(1) |
| Communication 8 | Aspects that consider communication skills of the collaborators leading to a two-way communication within a collaborative activity | It is not good if a supplier cannot communicate properly, i.e. that the information flow does not function properly, as the companies are all located around the world [#15:125] | 3(1), 4(2), 5(1), 7(1), 15(1), 23(1), 24(1) |
| Financial stakeholding 4 | Aspects that consider equal participation of the collaborating parties in revenues as well as financial investments | I think that these strategic or virtual collaborations only work if they are real Joint Ventures whereby various companies invest in a new company [#25:58] | 20(1), 25(1), 26(1), 28(1) |
| Virtuality 1 | Aspects that consider a virtualisation of collaborative activities within a collaborator portfolio | Through a virtual collaboration we were able to reduce the complexity of collaborative activities across company borders [#21:41] | 21(1) |
| Negative | Factors that influence collaboration negatively | N/A | N/A |
| Adversarial strategy 46 | Aspects that consider unfair behaviour, e.g. blackmailing or applying pressure, against collaborators in collaborative activities | Basically an OEM will never forgo on price competition because with this he would destroy his prices. It only can be of advantage to the OEM to include as many suppliers in the bidding process as possible in order to apply price pressure on the good design and development suppliers [#18:78] | 1(1), 3(2), 5(1), 6(2), 7(3), 8(3), 9(2), 11(1), 12(1), 13(3), 14(2), 15(7), 16(1), 18(2), 19(3), 20(3), 22(1), 23(1), 25(3), 27(2), 28(2) |
| Functional thinking & organisation 23 | Aspects that consider thinking and organising in functional sub-units, departments, etc. | An issue that is very important in my opinion is the departmental structure within the OEMs. For example, they have technical departments for locks, hinges, mechatronic components, etc. This means that as a supplier you do not have one central contact person for the boot door for example. These interfaces within the OEMs often lead to competence factionalism [#18:48] | 3(2), 4(2), 8(1), 13(1), 14(3), 15(1), 17(1), 18(1), 20(2), 22(2), 24(2), 25(2), 27(1), 28(2) |

| | | | |
|---|---|---|---|
| Cost focus 21 | Aspects that consider the focus and emphasis on cost and price aspects within a collaborative relationship | I believe that the cost pressure, which will increase over the next years, will prevent partnerships. The Damocles sword, that everything needs to be cheaper, does not allow this kind of collaboration at the moment [#15:135] | 8(1), 9(1), 15(1), 16(1), 17(1), 18(4), 19(1), 22(1), 23(2), 25(3), 27(1), 28(4) |
| Time pressure 18 | Aspects that consider little time for product development often due to long decision processes and short PDPs | The time pressure in the PDP can be dangerous and expensive which is not covered by the customer. In order to minimise the risk we need to invest, e.g. in prototypes or auxiliary tools, in order to be able to manufacture and test components before the SOP [Start of Production]. In most cases the OEM does not cover this anymore [#22:23] | 8(4), 9(2), 11(1), 12(1), 16(2), 17(1), 18(1), 22(4), 23(1), 24(1) |
| Short-term thinking 15 | Aspects that consider short-term and bottom line thinking | I got the feeling that nowadays only the short-term success is crucial which obviously inhibits good medium to long-term strategies and plans as well as collaborative relationships [#8:22] | 6(1), 8(3), 9(1), 18(1), 19(1), 23(2), 24(1), 28(5) |
| Complexity & dynamics 13 | Aspects that consider complexity and dynamics in products, processes, organisational structures, collaboration configurations, etc. | My general observation is that the collaboration was easier in the past because the focus was not so much on the specification catalogues that are getting more and more complex and detailed. In my opinion the OEMs are steering into a dead end because in the design catalogue requirements are getting fixed that will not be reduced anymore. Hence the products are becoming more expensive and complex [#18:52] | 8(1), 17(1), 18(3), 19(1), 21(1), 22(1), 23(1), 24(3), 27(1) |
| Insufficient competence 5 | Aspects that consider unsophisticated or insufficient competencies of the collaborators regarding the requirements of the collaborative activity | With a technology you buy a certain know how. If you then discover that the particular know how does not exist you have a big problem. Unfortunately this is not an exception [#15:129] | 7(1), 10(1), 15(1), 24(1), 28(1) |
| Management Elements | Factors that consider general management dimensions of collaboration between collaborators in the portfolio | N/A | N/A |
| Relationship management 13 | An element that considers the active management of collaborator interactions on the personal as well as organisational level | The most important aspect of this simultaneous engineering approach is not necessarily that all the different businesses within the OEM are working together but they need to work together with the suppliers. Because only very few parts in the cars are made by the OEMs themselves. Most of the OEMs are just assembly lines that take in parts at a very high level. And the performance characteristics of a car are really defined by those parts and systems [#28:59] | 3(3), 4(1), 7(1), 9(1), 12(1), 14(1), 16(1), 17(1), 18(1), 24(1), 28(1) |
| Technology management 12 | An element that considers the active management of IT interfaces between the collaborators in a relationship or activity | DaimlerChrysler has started to oblige certain electronic data processing (EDP) tools. We consider this as the wrong way because the utilisation of modern media such as the internet creates the possibility for the suppliers to work in their own IT systems and realise the data transfer e.g. via an XML interface. Some OEMs work on the development of standardised interfaces, e.g. B2B platforms, in order to realise the data transfer via the internet [#2:125] | 1(1), 2(1), 5(1), 7(1), 16(3), 17(1), 21(2), 22(1), 24(1) |
| Knowledge management 8 | An element that considers the active management of exchanging know how and knowledge between collaborators | Of course there are issues that you keep to yourself as a kind of secret recipe. The notion 'transparent organisation' has a negative touch but detailed information is de facto exchanged between the parties. If we do not do this, there would be no chance for survival [#16:79] | 7(1), 8(1), 10(1), 12(1), 16(1), 18(1), 24(2) |
| Collaborator activities | Factors that consider different operative activities executed by the collaborators during their collaboration | N/A | N/A |
| OEM | Factors that consider the operative tasks executed by the collaborating party that acts as the buyer or decision maker within | N/A | N/A |

| | | | |
|---|---|---|---|
| | the portfolio | | |
| Coordinating & intermediating 51 | A task that considers the coordination of collaborative activities within the portfolio involving the intermediation between the collaborating parties, e.g. 1st and 2nd tier supplier | The coordination is basically always the task of the OEM. However, where possible we try to transfer some responsibilities to the prime contractor [#24:56] | 2(6), 3(2), 5(1), 6(1), 7(5), 8(3), 9(3), 10(2), 11(1), 12(1), 13(1), 14(3), 15(2), 17(1), 18(4), 19(3), 22(1), 23(1), 24(5), 25(1), 26(2), 28(2) |
| Translating & designing 41 | A task that considers the translation of customer requirements and desires into technical specifications for the concept development of a car (product architect) | The supplier does not develop from his point of view but based on our specification that we derive from customer requirements [#13:47] | 1(1), 2(2), 3(1), 4(4), 5(1), 6(2), 8(2), 9(3), 10(1), 13(2), 14(3), 15(6), 16(1), 17(1), 19(2), 22(1), 23(1), 24(4), 27(1), 28(2) |
| Decision making & allocating 39 | A task that considers the decision making about collaborative activities and relationships and the allocation of roles and tasks to the collaborating parties | It is often the case that the OEM allocates the lead for the system to a big supplier but still decides who will deliver the individual components [#18:46] | 1(1), 2(3), 3(3), 4(2), 6(2), 8(3), 10(1), 11(1), 14(2), 15(1), 16(1), 18(2), 19(3), 20(2), 22(1), 23(2), 24(6), 26(1), 27(1), 28(1) |
| Scouting & integrating 26 | A task that considers looking for potential collaborators outside the existing portfolio and integrate them into the collaborator portfolio | It is an important task of any OEM to differentiate between good and bad suppliers [#17:32]<br><br>OEMs have to change their thinking from getting parts at the cheapest price towards finding and developing future partnerships [#28:49] | 1(1), 2(1), 3(5), 4(4), 13(1), 14(3), 15(4), 17(2), 18(1), 19(1), 24(1), 25(1), 28(1) |
| Leading & initiating 15 | A task that considers leading the portfolio and its relationships and initiating collaborative activities with other members | An essential point is that the origin of the idea needs to come from the OEM. If you only wait for the suppliers to bring along innovations it might often be too late as other OEMs were quicker [#13:41] | 3(2), 9(1), 13(3), 14(3), 15(2), 17(1), 19(1), 25(1), 27(1) |
| Facilitating & enabling 15 | A task that considers the active support and management of members of the portfolio (collaborator development), e.g. in developing their competencies | It is possible that a supplier does not possess a certain competence, e.g. a special paint-spraying, but is very attractive otherwise so that we decide to teach him the missing know how [#13:71] | 4(3), 7(1), 8(1), 13(1), 15(1), 17(2), 18(1), 19(1), 24(4) |
| Developing & manufacturing 13 | A task that considers the development and manufacturing for parts, components, modules or systems which are considered as core competence and activity | There are technical packages that we always will do ourselves, e.g. dimensioning of the chassis or the topic of motor and powertrain [#14:43] | 1(1), 4(1), 6(1), 14(2), 15(1), 17(1), 19(1), 25(1), 26(2), 28(2) |
| Marketing & selling 4 | A task that considers selling the product to the market involving responsibilities for marketing, brand management, distribution, after sales service, customer relationship initiatives, etc. | On the other hand the OEM is forced to focus on marketing, distribution, etc. activities [#9:25] | 3(1), 4(2), 9(1) |
| Supplier | Factors that consider the operative tasks executed by the collaborating party that acts as the supplier or member within the portfolio | N/A | N/A |
| Developing & making 51 | A task that considers the development and manufacturing of parts, components, modules or systems for which a specific competence is hold | Often it was the case that parts would be developed within the OEM and produced and delivered by the supplier. This has changed dramatically towards the situation that suppliers are more and more required to provide design and development service or conduct feasibility studies [#19:25] | 1(3), 2(5), 3(4), 4(2), 6(4), 8(3), 9(2), 11(3), 13(2), 14(5), 15(3), 17(3), 18(2), 19(2), 24(3), 25(1), 28(4) |
| Innovating & problem solving 39 | A task that considers innovating and providing solutions to contextual problems of the collaborative activity by delivering a specific competence | As a supplier you are not only the one who develops a product but also a methodical assistant for the customer that has a particular problem for which he wants a solution. Based on these solutions, concepts and ideas, new products will emerge [#17:19] | 1(2), 2(2), 5(1), 6(4), 8(2), 9(1), 10(1), 13(3), 14(5), 15(1), 16(2), 17(2), 18(1), 19(3), 24(3), 25(3), 26(1), 28(2) |
| Integrating systems 26 | A task that considers the integration of smaller parts and components to bigger modules or systems including the responsibility for the involved interactions | A competence that a system partner has to possess beyond the technological competence for the product is the ability of systems integration, i.e. to bring together various companies and take responsibility for the overall system [#19:23] | 2(1), 6(4), 7(3), 8(1), 10(1), 11(1), 12(1), 14(1), 18(1), 19(2), 20(1), 22(1), 23(2), 24(2), 25(2), 27(2) |

| | | | |
|---|---|---|---|
| Managing sub-supplier 26 | A task that considers managing a sub-supply network involving elements of collaborator scouting and development as well as coordination of activities among them | We require of our big suppliers to integrate the smaller suppliers into their processes and systems [#14:125] | 2(3), 3(2), 4(1), 7(2), 8(1), 10(1), 12(1), 13(1), 14(4), 17(1), 18(1), 19(2), 20(2), 21(1), 22(1), 24(1), 27(1) |
| Coordinating 16 | A task that considers the coordination of activities within the collaborator portfolio involving the intermediation between the collaborating parties | In this project the prime contractor was involved in the coordination during the concept phase already, i.e. BMW has not coordinated all the parts and component suppliers itself anymore but transferred this task to the prime contractor [#24:35] | 3(7), 4(1), 6(1), 7(2), 10(1), 14(1), 24(2), 27(1) |
| Creating added value 9 | A task that considers adding value to a collaborative relationship and activity for its competitiveness | It is the duty of the suppliers as little speed boats to create an advantage for the OEM that is very big and slow like a tanker [#10:42] | 6(3), 8(1), 10(1), 14(1), 17(1), 25(1), 26(2) |
| Providing full service 9 | A task that considers providing full service by accompanying a product over the full PDP or even product life cycle | For our product portfolio we have all the necessary competencies within the house in order to be able to fully support the OEM, i.e. management of product development, testing, and implementation in series production [#19:63] | 2(2), 6(1), 7(1), 8(1), 19(2), 20(1), 27(1) |
| Outcomes | Factors that consider outcomes and success of collaboration between collaborators in a portfolio | N/A | N/A |
| Positive | Factors describing positive outcomes and impact on success mainly caused by good collaboration practices | N/A | N/A |
| Short-term | Factors that relate to success in the short-term | N/A | N/A |
| Cost reduction 34 | Aspects that consider a reduction in cost for the collaborative activity and its outcomes in form of products, developments, etc. | Once the partnership is established and agreed only then the price is discussed. But in the short-term this appears inefficient because it looks like the prices they are paying are higher than the competition. But when you take a step back and take a holistic and long-term view of the real overall cost of the part in terms of warranty returns, cost of failure in the market place, cost of customer not being satisfied and not coming back and also cost of not having a coherent and consistent brand identity, this will look differently [#28:31] | 3(2), 4(1), 6(2), 8(1), 9(1), 10(3), 13(1), 14(5), 15(1), 16(1), 17(2), 19(1), 20(2), 21(2), 22(2), 23(2), 25(1), 26(2), 28(2) |
| Speed & flexibility improvement 21 | Aspects that consider an improvement of speed and flexibility through collaboration leading to shorter time to market | The OEM has the advantage of reacting quickly and flexible to the market with new products because the supplier is closer to the OEM and more integrated in the system [#22:23] | 3(1), 5(1), 6(2), 7(2), 8(2), 9(3), 10(2), 11(1), 14(1), 15(1), 17(2), 22(2), 24(1) |
| Risk reduction 8 | Aspects that consider a mitigation and sharing of risk potential between the collaborators, e.g. investments, warranty cost, etc. | Experience shows that the risk does not increase with the reduction of suppliers but with the segmentation and allocation of quantities to various quota suppliers [#21:61] | 18(1), 20(1), 21(1), 22(1), 27(1), 28(2) |
| Interface management improvement 6 | Aspects that consider an improvement of managing the interfaces between the collaborating parties | The value for the OEM is that the R&D engineers do not need to take care of the money issues anymore but can concentrate on the management of the technical interfaces again. In the past this led to the R&D engineers becoming product managers rather than innovative developers [#20:53] | 12(1), 18(1), 20(1), 23(2), 24(1) |
| Less supply chain disruptions 3 | Aspects that consider a decrease in supply chain disruptions through closer links and holistic optimisation | Through close collaboration it is possible to permanently optimise the network and eventually equalise or avoid risks [#21:29] | 16(1), 18(1), 21(1) |
| Long-term | Factors that relate to success in the long-term | N/A | N/A |
| Quality improvement 37 | Aspects that consider quality improvements of products or development solutions through collaboration | Yes, the quality will definitely be improved. You can align your development better to your production system which will have an influence on product quality [#15:35] | 3(1), 4(1), 6(1), 7(4), 8(1), 9(3), 10(1), 11(1), 12(2), 14(2), 15(2), 16(1), 17(2), 18(2), 20(1), 21(1), 22(3), 23(3), 25(1), 26(2), 28(2) |

| | | | |
|---|---|---|---|
| Stability & continuity 19 | Aspects that consider the development of stable and continuous collaborative relationships that enable more strategic and long-term decision making | The advantage for the OEM lies in the consistency and security through the knowledge that the relationship with the supplier has worked in the past, that there were no quality or delivery problems, and that the project could eventually be finished early. This way it is possible to save cost in the long term which is not tangible immediately due to being qualitative aspects [#17:83]<br><br>The supplier gets the opportunity to invest in the future and gets the guarantee to survive in business and not constantly have to drive down cost in the short term to maintain business [#28:25] | 9(2), 11(1), 12(1), 15(3), 17(1), 18(1), 21(3), 22(1), 24(1), 26(1), 28(4) |
| Mutual competence development 18 | Aspects that consider the development of competencies of the collaborating parties through the sharing of know how and learning from each other | Obviously you can learn from someone who is specialised in a certain product or system. His experience will inevitably influence the product, i.e. if you as an OEM develop and manufacture the product yourself then you only will benefit from your own experience [#6:65] | 3(2), 4(1), 5(4), 6(4), 7(3), 13(1), 22(1), 23(2) |
| Motivation & ownership improvement 16 | Aspects that consider an improvement of motivation of the collaborating parties leading to more ownership and identification with the collaborative activity | That means that you identify more with the OEM and that you are willing to take ownership and initiative, which at the end will be beneficial for the OEM [#25:108] | 12(1), 15(3), 17(2), 20(1), 21(1), 23(1), 25(4), 28(3) |
| Innovation & maturity improvement 12 | Aspects that consider an improvement of innovativeness of the collaborators and maturity of collaborative activities | Cost reduction is not the main goal. Of course it is nice if cost reductions could be realised as well, but the main focus is on functional and technological improvements and a higher maturity in the development [#14:103] | 6(1), 7(1), 9(1), 11(1), 14(1), 15(2), 17(1), 21(1), 22(1), 23(1), 26(1) |
| Exclusivity 7 | Aspects that consider the exclusivity of the relationship between collaborators, e.g. in terms of products, innovations, etc. | If we could agree on long-term collaborative relationships then we would be able to guarantee exclusivity [#25:141] | 5(1), 6(3), 24(1), 25(1), 28(1) |
| Product portfolio coverage 1 | Aspects that consider the coverage of a wider product spectrum through capacities of collaborators | Our product portfolio has grown drastically over the last few years and we discovered that we cannot handle it alone anymore. Taking the X3 model as an example, we definitely wanted to enter that segment but did not have enough capacities. Then we looked at the market and finally outsourced it [#14:21] | 14(1) |
| Negative | Factors describing negative outcomes and impact on success mainly caused by bad collaboration practices | N/A | N/A |
| Immature product launch 5 | Aspects that consider the launch of immature products or developments | The risk exists that an immature product goes into production. In order to adhere to the specifications you need time. But when you do not get the necessary time it can eventually happen that not everything works fine [#22:25] | 4(1), 8(1), 11(1), 22(2) |
| Creativity & competence loss 4 | Aspects that consider the loss of creative capability and competences through too close and stable relationships (creative chaos) | It is all a product of non sustainable house keeping. The fear is always that creativity is lost through continuity [#21:55] | 9(1), 10(1), 14(1), 21(1) |
| Reparation claims 3 | Aspects that consider increasing costs and prices through reparation claims of collaborators after a long period of adversarial relationships (path dependency) | Imagine what would happen if an OEM collaborated with his suppliers in a friendly way. I am convinced that 90% of the suppliers would try to recover their deprivations from the past. The price for cars would immediately increase by 20-50%. That means that an immediate implementation of collaborative relationships is not possible and desirable [#20:63] | 15(1), 20(1), 28(1) |
| Lock in | Aspects that consider a certain lock in of the collaborators in the relationship eventually leading to inflexibility | The disadvantage is that it tend to stagnate over a period of time, e.g. if a supplier comes along with a new technology or innovation the OEM's supplier does not have then the OEM would be locked in his partnership with the supplier and would need to break this partnership first before he can access the new technology [#28:23] | 6(1), 9(1), 28(1) |

| | | | |
|---|---|---|---|
| 3 | | | |
| Interface problems 3 | Aspects that consider emerging interface problems between the collaborators during a collaborative activity | We had the problem that difficulties occurred between the design and development of the prime contractor and the supplier so that our purchasing department had to act as intermediator [#24:50] | 16(1), 24(2) |

| Category / Code | Definition / Description | Example [#interview:paragraph] | Coding |
|---|---|---|---|
| Competence | A competence can be considered as a bundle of skills and technologies that must be competitively unique (Hamel and Prahalad, 1994). Includes: Influencers, Features, Attributes, and Developers. | N/A | Referenced interview (number of passages therein), e.g. 2(3), 15(1) |
| Competence Influencers | Factors that influence possession and development of a competence | N/A | N/A |
| Product portfolio 35 | The possession and development of a competence or a core business activity can be influenced by the current and future product portfolio | Within the product portfolio we decide on our core products which are mainly based on volume. High volumes indicate the mass market and hence our 'bread and butter' business [#1:27] | 1(3), 2(1), 3(1), 4(2), 5(3), 6(1), 7(1), 8(3), 9(4), 10(1), 13(1), 14(1), 16(1), 19(3), 20(4), 25(2), 26(3) |
| Value for competitiveness 28 | The possession and development of a competence can be influenced by its value for the development of competitive advantage for the company, e.g. the more value a certain know how adds to the competitiveness of the company the more likely it will be considered as a core business activity or core competence | For our competitiveness the electronics area is getting so important for us that we cannot afford to outsource everything to suppliers but need to have certain competencies in that area on our own [#25:55] | 1(2), 2(2), 4(2), 5(1), 6(1), 14(2), 18(2), 19(1), 20(2), 23(2), 25(6), 26(5) |
| Outsourcing 25 | The possession and development of a competence can be influenced by outsourcing activities which are based on strategic sourcing decisions | Outsourcing always holds the danger of giving away competencies [#6:85] | 2(2), 4(1), 5(2), 6(3), 7(2), 8(1), 9(1), 10(2), 12(1), 13(1), 15(2), 17(1), 18(1), 19(1), 22(1), 23(1), 25(1), 28(1) |
| Company size 16 | The possession and development of a competence can be influenced by company size | Very often the big suppliers are the more competent ones, at least in projects that already gained a certain maturity [#1:43]<br><br>Experience shows that most innovations come from SMEs [#2:85] | 1(2), 2(2), 3(1), 7(2), 8(1), 11(1), 17(1), 18(1), 20(2), 21(1), 22(1), 27(1) |
| Company history 9 | The possession and development of a competence is partly determined by the company's culture, historical structure, business model, etc. | In our company we have technologies that we consider as core technologies. This is based on a 100 year old company history and tradition [#19:23] | 2(2), 9(1), 16(3), 19(1), 24(1), 25(1) |
| Competence Features | Considers the features that a particular competence can consist of. Includes: Technical & Technological, Efficiency, and Collaboration & Social | N/A | N/A |
| Technical & Technological Feature | Considers a competence feature that comprises a specific, hard, and technical knowledge | N/A | N/A |
| Product know how 38 | A feature that considers the technological knowledge for designing and developing a product or problem solution, e.g. design and engineering know how | Competent suppliers also understand the complexity of design and development, i.e. they design and develop products according to our required specifications [#28:81] | 1(1), 3(2), 4(1), 5(1), 6(4), 7(3), 8(2), 9(1), 10(1), 12(1), 13(2), 14(3), 15(3), 16(1), 18(1), 19(3), 20(1), 21(1), 22(1), 23(1), 25(1), 28(3) |
| R&D Evaluation 34 | A feature that considers the ability to evaluate and assess the quality and sophistication of R&D work and solutions | The OEMs certainly have to have the capability to interrogate the design and development processes of the suppliers [#28:71] | 1(1), 2(2), 4(3), 5(2), 8(1), 9(1), 11(1), 12(1), 13(2), 14(2), 15(7), 17(1), 18(1), 19(1), 20(2), 24(1), 25(1), 26(1), 27(1), 28(2) |
| Innovativeness 33 | A feature that considers the intellectual capability of a company in terms of developing new ideas and inventions | Our second foundation is our innovativeness and willingness for innovation. Innovation is de facto a competence of our company which is one of our strategic focuses as well [#6:71] | 1(3), 4(1), 6(6), 7(2), 8(2), 9(2), 10(1), 12(1), 13(3), 17(1), 18(1), 19(1), 20(1), 21(1), 23(1), 24(1), 25(2), 27(2), 28(1) |
| Process know how | A feature that considers the technological knowledge of the production system and processes and their efficient application | That means they need to be intimately knowledgeable about the materials they use, the processes they use, the equipment they use, etc. [#28:75] | 1(1), 2(1), 4(1), 5(2), 6(6), 7(2), 9(2), 13(2), 14(3), 15(2), 16(2), 19(3), 21(1), 25(1), |

| | | | |
|---|---|---|---|
| 32 | | | 28(3) |
| Interface management 28 | A feature that considers the ability to manage and coordinate the technical interfaces between parts / components / modules and their related suppliers | The critical issue is the coordination and integration of the various interfaces in a car. This competence of integrating the various components and modules towards the whole car has to lie within the OEM [#2:151] | 2(7), 3(2), 5(1), 6(1), 7(4), 9(1), 10(1), 11(1), 12(2), 19(3), 20(2), 22(1), 25(1), 28(1) |
| Product & process quality 19 | A feature that considers the ability to provide high quality and mature product or problem solutions | Nowadays, not only the technology but also the quality is an important competence in car manufacturing [#6:39] | 1(1), 2(2), 4(1), 6(7), 7(2), 8(1), 11(2), 13(1), 19(1), 28(1) |
| Delivery quality 9 | A feature that considers the aspects of quality or reliability of delivery | The suppliers should deliver products at a certain performance level in terms of quality and reliability [#28:81] | 2(2), 6(1), 8(1), 13(1), 16(2), 19(1), 28(1) |
| Total Process Partner (TOPP) 7 | A feature that considers the ability and service to cover the whole value stream concerned with ones own product | We are a partner that covers all risks, problems and efforts concerned with our product in the environment of the car from A to Z. This is best circumscribed with the term TOPP, i.e. from the development of the car, via the marketing in the production phase to the support in after sales [#8:37] | 6(1), 8(2), 10(1), 19(2), 20(1) |
| R&D software knowledge 3 | A feature that considers the knowledge about the necessary CAD techniques and software tools for the design and development of products or problem solutions | It is a competence to be able to apply the various required techniques and software tools that are used in R&D, such as complex algorithms, FMEAs, or the CAD software Catia v5 [#7:41] | 5(1), 7(1), 12(1) |
| Efficiency Feature | Considers a competence feature that relates to efficiency criteria | N/A | N/A |
| Speed 26 | A feature that considers the ability to develop and deliver R&D and production work and solutions quickly | It is a competence to discover problems early and solve them quickly. In the light of the dynamics of the markets speed is inevitable [#6:43] | 1(2), 2(1), 3(4), 4(1), 6(3), 7(1), 10(1), 11(1), 13(1), 16(3), 17(1), 18(1), 22(1), 24(1), 27(3), 28(1) |
| Cost alignment 23 | A feature that considers the ability to provide R&D and production work and solutions at low costs and prices | Basically you can only realise a 'unique sales point' (USP) via a certain competence. This refers to the solution itself but also to the ability to deliver the solution cheaper than a competitor [#18:58] | 1(1), 3(2), 4(1), 5(2), 6(2), 7(1), 8(2), 9(1), 12(2), 13(1), 16(1), 18(2), 19(2), 22(1), 24(1), 28(1) |
| Flexibility & adaptability 20 | A feature that considers the ability to be flexible and adaptive to changes in the environment, e.g. customer requirements | For us a further positive indicator for competence is the ability of the supplier to adapt to our requirements and specifications [#15:123] | 3(1), 4(1), 5(2), 6(3), 8(1), 9(1), 10(1), 11(1), 14(1), 15(1), 16(2), 17(2), 23(1), 24(1), 25(1) |
| Project management 18 | A feature that considers comprehensive project management skills when executing given tasks, e.g. efficient resource allocation, good communication and know how transfer, meeting commitments, time management skills, etc. | The project management competence is an important issue to ensure a certain efficiency in the development process. You need a clear and lean project structure and personnel who are not only competent in product development but are communicative as well [#22:37] | 1(1), 3(2), 5(2), 7(1), 9(1), 11(1), 13(1), 14(1), 15(1), 16(1), 19(3), 20(1), 22(1), 28(1) |
| Knowledge accessibility 10 | A feature that considers the ability to access the necessary knowledge easily with little effort | What qualifies our company is the ability to refer to and access expert know how within the whole group very easily through a central database [#7:41] | 7(2), 16(1), 21(1), 22(2), 24(2), 25(1), 27(1) |
| Social Feature | Considers a competence feature that comprises a basic, soft, and social know how and ability | N/A | N/A |
| Organisational structure, culture & business model 37 | A feature that considers the ability to align the organisational structure, culture and business model in accordance to customer requirements | The organisational structure indicates competence. The OEM expects our organisational structure to be aligned with his requirements. Therefore we restructured our company into customer individual key accounts [#22:23] | 3(1), 5(6), 7(1), 8(1), 9(2), 11(1), 16(2), 17(2), 18(1), 19(2), 20(2), 21(1), 22(7), 23(1), 24(2), 25(3), 27(1), 28(1) |
| Customer focus 25 | A feature that considers a focus on customer requirements | I would consider our strong customer focus as one of our competencies. We want and need to understand what the OEM expects from us [#8:53] | 6(4), 7(1), 8(4), 11(1), 12(1), 13(1), 15(1), 16(2), 17(1), 19(1), 20(1), 22(1), 23(1), 24(1), 25(3), 28(1) |

| | | | |
|---|---|---|---|
| Ownership 15 | A feature that considers the commitment towards playing an active role and taking on responsibility in a collaboration | But the most important aspect for competent suppliers is to take ownership of their systems [#28:81] | 5(1), 6(1), 7(2), 8(1), 14(5), 19(1), 21(1), 23(1), 27(1), 28(1) |
| Local presence 14 | A feature that considers the ability and willingness to provide local service | We provide the service to be locally available. Especially in the R&D area a certain local proximity is crucial [#23:78] | 3(1), 5(3), 6(1), 16(1), 17(1), 19(1), 22(3), 23(1), 25(1), 27(1) |
| Plug & Play ability 14 | A feature that considers the ability and willingness to integrate your own system (including your sub-supply network) into a wider collaborative environment and cooperate with partners by providing and sharing your know how | We do not only assess the suppliers' technical competence but also their competence and willingness of working with partners and how they manage their own sub-networks, i.e. we assess their social skills in terms of an ability to integrate and cooperate as we want the interfaces within our network to be as smooth as possible [#14:155] | 2(1), 3(3), 6(3), 14(3), 15(1), 18(1), 19(1), 21(1) |
| Stability & reliability 12 | A feature that considers the willingness and capability of maintaining a required performance level | A constant contact between the supplier and us is crucial, i.e. that high fluctuations in their personnel and organisational re-structuring is a negative competence [#15:125] | 1(2), 6(2), 12(1), 14(1), 15(2), 17(1), 20(1), 28(2) |
| Pressure resistance 1 | A feature that considers the ability to cope with pressure and handle problems in a friendly and partnership orientated way | For me a competence is not only the cost efficiency itself but also the question of how you cope with the cost pressure, i.e. in a friendly or adversarial way [#3:213] | 3(1) |
| Competence Attributes | Factors that determine the ability to use the competence in transactions with other collaborators in the portfolio | N/A | N/A |
| Transferability & embeddedness 6 | Determines the degree to which a competence is integrated into a company's value system and hence is transferable to a cross-boundary collaboration | For the design we have established processes that are not easy to transfer. There are people with a certain know how and competence behind it [#24:38] | 12(1), 24(4), 27(1) |
| Attractiveness & deployment 9 | Determines the attractiveness of a competence due to the degree to which it can be applied to a variety of purposes | Parallel to the traditional R&D issues, such as car body or interior, we developed areas, such as prototyping, testing, simulation. Based on this we try to cover the whole automotive product development process from the concept phase and the definition of the car until the start of production [#5:27] | 5(3), 6(2), 8(2), 10(1), 11(1) |
| Maturity & sustainability 4 | Determines the degree to which a competence is capable of producing long-term solutions based on its maturity and sophistication | It is a measure for being competent if you are able to eliminate a problem permanently. In other words this means to develop sustainable solutions from the beginning which requires a lot of experience [#18:70] | 6(1), 12(1), 13(1), 18(1) |
| Competence Developers | Factors that facilitate the creation and development of a competence of a collaborator | N/A | N/A |
| In-house specialism 20 | A competence can be developed internally by extending and refining the company's knowledge base and value system | We strengthen our competence through internal departments, e.g. we started to develop electronic components due to their increasing complexity which makes it necessary to develop them internally [#8:34] | 2(2), 4(2), 5(2), 6(2), 7(4), 8(2), 10(1), 11(1), 16(1), 23(1), 25(1), 27(1) |
| Acquisition 17 | A competence can be developed by acquiring or creating financial linkages with a company that possesses the required know how | Magna for example has extended its competencies through the acquisition of many smaller and specialised firms [#2:95] | 2(2), 3(3), 4(1), 5(3), 6(2), 10(1), 18(1), 20(1), 23(1), 25(1), 27(1) |
| Collaborative activities 12 | A competence can be developed through efficient collaboration in the sense that the collaborators are sharing their know how and thereby learn from each other | Then we searched for the required know how and competencies amongst our suppliers and established R&D partnerships with them [#23:79] | 4(1), 5(1), 6(3), 7(2), 21(1), 22(2), 23(1), 25(1) |
| Human Resource Management (HRM) 10 | A competence can be developed through hiring new qualified staff or developing and educating the existing staff | DaimlerChrysler, for example, tries to improve its quality drastically through the allocation of more qualified and skilled workforce [#11:21] | 5(1), 6(1), 7(1), 8(1), 10(1), 11(1), 16(1), 18(1), 22(1), 23(1) |

| Category / Code | Definition / Description | Example [#interview:paragraph] | Coding |
|---|---|---|---|
| Holistic Competitive Advantage | Factors that consider the development of competitive advantage and business success for the overall collaborator portfolio in the context of inter-firm R&D collaboration in the German automotive industry | N/A | Referenced interview (number of passages therein), e.g. 2(3), 15(1) |
| Collaboration 37 | Aspects that consider collaboration issues for the development of holistic competitive advantage, e.g. mutual competence development (Relates to *Collaboration Outcomes*) | In my opinion the collaboration between OEM and supplier is an extremely important component of business success. The possession of abilities and competencies is on issue, but how to integrate everything in the car is another issue. Thereby, the differentiating factor is the quality of collaboration [#6:33] | 2(1), 3(2), 4(1), 5(1), 6(4), 7(2), 8(1), 9(1), 10(1), 14(5), 17(1), 19(2), 22(1), 23(1), 25(3), 26(1), 27(1), 28(8) |
| Competence 24 | Aspects that consider the possession of sophisticated as well as unique competencies within the collaborator portfolio (Relates to *Competence Features*) | Basically I can only realise my 'unique sales point' via relevant competencies [#18:58] | 1(1), 2(1), 3(2), 4(3), 5(1), 7(1), 9(4), 13(3), 15(2), 16(1), 18(2), 20(1), 22(1), 25(1) |
| Collaborator sourcing 11 | Aspects that consider the selection of appropriate collaborators, e.g. with supplementing competencies (Relates to *Collaborator Sourcing*) | A key part of any new product that is designed, developed or launched is the selection of suppliers for the components of this new product. This is particularly true for complex and innovative topics [#28:23] | 1(1), 2(1), 6(1), 8(1), 9(1), 14(1), 24(1), 28(4) |

**Table J.1: Coding Master Table**