Collaborative Alliances and Organisational Innovation: A Study of the Innovation Process

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Doctor of Philosophy

Aston University

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SUMMARY

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Despite the voluminous studies written about organisational innovation over the last 30-40 years our understanding of this phenomenon continues to be inconsistent and inconclusive (Wolfe, 1994). An assessment of the theoretical and methodological issues influencing the explanatory utility of many studies has led scholars (e.g., Slappendel, 1996) to re-evaluate the assumptions used to ground studies. Building on these criticisms the current study contributes to the development of an interactive perspective of organisational innovation.

This work contributes empirically and theoretically to an improved understanding of the innovation process and the interaction between the realm of action and the mediating effects of pre-existing contingencies i.e., social control, economic exchange and the communicability of knowledge (Scarbrough, 1996). Building on recent advances in institutional theory (see Barley, 1986; 1990; Barley and Tolbert, 1997) and critical theory (Morrow, 1994, Sayer, 1992) the study aims to demonstrate, via longitudinal intensive research, the process through which ideas are translated into reality. This is significant because, despite a growing recognition of the implicit link between the strategic conduct of actors and the institutional realm in organisational analysis, there are few examples that theorise *and* empirically test these connections. By assessing an under researched example of technology transfer; the government's Teaching Company Scheme (TCS) this project provides a critique of the innovation process that contributes to theory and our appreciation of change in the UK government's premier technology transfer scheme (QR, 1996).

Critical moments during the translation of ideas illustrate how elements that are linked to social control, economic exchange and communicability mediate the innovation process. Using analytical categories i.e., contradiction, slippage and dysfunctionality these are assessed in relation to the actions (coping strategies) of programme members over a two-year period. Drawing on Giddens' (1995) notion of the *duality of structure* this study explores the nature of the relationship between the task environment and institutional environment demonstrating how and why knowledge is both an enabler and barrier to organisational innovation.

Key words: Structuration, knowledge, organisational innovation, interactive process perspective, and critical-realism, Teaching Company Scheme.

DEDICATION

Nico, Yvonne and Ron, Marie and Les
Nuala and Sam

Embarking on Doctoral research should not be taken lightly and although I have generally enjoyed the whole experience it is necessary to recognise that this journey would not have been possible without the support of those who have had the misfortune of living it with me.

In the first instance, Nico, who began this journey as my long-term partner and now wife, must take much of the credit for ensuring that this thesis has been submitted. At the start of this journey it is true to say Nico was not overjoyed. On telling her that I had decided to begin the thesis she burst into tears. Not for joy, but in desperation for what this would mean. Nico comes from a successful academic family and was better informed about the trials of completing such a journey. Luckily the tears did not last long and as the best of companions has given everything that has been asked and much more. All I want to really say is that we now have the rest of our lives together.

Alongside Nico there have been others who have been incredibly supportive. To this end, I also dedicate this thesis to my parents Yvonne and Ron who have supported me and softened the emotional *and* financial bumps when times were tough. Similarly, Nico's parents Nuala and Sam have given to the same cause and so many thanks to them for their generosity and hospitality. Finally, but no means least my grandparents, Marie and Les have been a constant source of inspiration. They have never questioned the wisdom of my decision instead they have been unfailingly supportive and should be given the recognition this deserves.

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Chapter One

Collaborative Alliances and Organisational Innovation: A Study of the Innovation Process

1.1 Introduction

In this chapter I consider the aims, contributions and content of the thesis. Of particular interest is the status of the innovation studies literature and the directions taken to improve our understanding of organisational innovation. Building on recent bids to explain the relationship between the behavioural and institutional characteristics of the innovation process (*e.g.,* Clark and Staunton, 1989) this study considers the theoretical and methodological advantages of adopting interactive process perspectives. Using "sensitising devices" taken from social theory to connect interactivity with the idea of duality (Giddens, 1995) the study assesses the establishment and running of the UK government's premier technology transfer programme the Teaching Company Scheme (TCS).

In recent years a number of scholars and studies have attempted to explain the relationship between strategic conduct (agency) and institutional elements (structure) in the innovation process (*e.g.,* Amabile, 1988; Van de Ven *et al*, 1989; Barley, 1986; 1990; Saren, 1990; Thomas, 1994; Edwards, 2000a; Jones *et al*, 2000). Therefore, the key contribution of the thesis is not in the uniqueness of an interactive perspective rather it is in the development of the theoretical and methodological logic supporting such an approach within the context of collaborative alliances. Drawing on empirical data obtained from two years

intensive longitudinal research in four TCS Programmes it is possible to expose and explain the mediatory properties of the innovation process. TCS offers a framework within which to increase our understanding of organisational innovation.

1.2 Background to the Research

The TCS is claimed to be the most successful UK publicly funded programme aiding collaborative links between industry and academia (QR, 1996). Its longevity (established 1975) attests to the assumed links between economic growth and competitiveness with better skills in the work place, innovation and technology transfer (DoE, 1987; 1991; DTI, 1983, 1994, 1995a; 1995b; 1998; CIHE, 1987; 1988; 1992). As we begin the twenty first Century this remains dominant, as the European Union Objective 1 regional assistance document affirms (European Commission, 2001). A key aim of objective 1 is to develop a "culture of innovation" in locations where mature industries (e.g., coal and steel) have disappeared (e.g., West Wales and the Valleys, West Midlands and Yorkshire) thereby re-generating economically deprived locales.

Although innovation is linked to prosperity there is evidence from writers commenting on the commodification of academic work (Miller, 1991; Willmott, 1995) and the privatisation of the public services such as the health service (Scarbrough, 1996) that such assumptions are problematic. For example, Scarbrough (1996) has shown that the management of expertise is mediated by a complex simultaneous equation of interdependencies (i.e., economic exchange, social control and communicability). Knowledge is as much a source of resistance as an enabler of organisational change. This is because the control and application of knowledge is contextually contingent so change activities are neither neutral nor easily achieved. Making sense of such contingencies is a key concern of the thesis.

Presently, the innovation studies literature is subject to various conceptual and methodological divisions. The emergence of process analyses reflects attempts by some authors to attend to the inconclusive and fragmented level

of explication and understanding provided by normative-variance approaches (Wolfe, 1994). Implicit in such revisions has been an attempt to reformulate representations of social reality. It is because a theory of innovation has not emerged despite 'the accumulation of more and more data' (Downs and Mohr, 1979:380) that other approaches have been proposed (Slappendel, 1996). The interactive model of innovation (Rothwell and Zegveld, 1985) has gone some way to demonstrate that the innovation process consists of many complex patterns of intra- and inter- organisational links. Here such patterns are considered in terms that accommodate the behavioural and institutional aspects of organisational reproduction and innovation. By treating action and structure as two sides of the same coin the research study contributes to the philosophical and methodological debate. The practice of objectification is rejected in favour of exploring the processes through which innovations are constructed, mediated, appropriated or abandoned.

It is perhaps because TCS is acknowledged as a successful mechanism for technology transfer (QR, 1996) that the number of academic papers on the subject has grown over the last decade (Tiler and Gibbons, 1991; Peattie, 1993; Baker, 1995; Senker and Senker, 1994; 1995). Given this, it is timely that an attempt is made to conceptualise the social processes leading to programme success or failure. There is plenty of evidence to suggest that success and failure are linked to strategic as well as institutional elements yet the nature of such junctures remains unexplained. Peattie (1993) for example refers to process issues including the (i) Associates' status and power; (ii) organisational friction; (iii) academic involvement; (iv) internal ownership and support; and (v) project control. Context issues including the (vi) company size; (vii) financial health; (viii) changes to senior management, corporate strategy and culture; (ix) roving reporting relationships; (x) internal company politics; and (xi) bargain-hunting and finally content issues. However, links between these factors are not developed. The relationship between content or the knowledge creation process, context and process issues and the level of success or failure is underdeveloped. Here it is proposed that to achieve this necessitates an assessment of the mechanisms through which TCS programmes are mediated. In other words, a better level of understanding

depends on demonstrating the chronology, complexity and interactivity between content, context and process. This aids not only the theoretical and methodological debate surrounding organisational innovation it also contributes to our understanding of TCS which as Peattie (1993:71) notes "surely deserves closer academic scrutiny".

1.3 Theoretical and Methodological Aims and Contributions

The theoretical and methodological aims of the thesis involve the appraisal and development of an interactive process perspective. This project includes a number of integrated steps involving a critical review of the meta-theoretical and methodological assumptions of the orthodox innovation studies literature. In doing so, several areas of contention are identified. First, the move away from normative-variance toward process methods indicates the difficulty of trying to predict innovation. This reorientation coincides with the wholesale reassessment of the conceptual notions underpinning our understanding of innovation and social reality. This is significant as the shift in method cannot be appreciated without reference to the revision of theoretical assumptions.

- Methodological Approach (Variance, Process)
- Theoretical Assumptions (Individualistic, Structuralist, Interactive Process)

Moving from normative-variance methods (surveys) toward linear process models of innovation and more recently interactive process perspectives has occurred against increasing criticisms of the explanatory utility of scientific methods in the innovation studies literature (Downs and Mohr, 1976; 1979) as well as the social sciences (Goddard, 1993). Here the aim is to contribute to the development of an interactive process perspective through the critical evaluation of those meta-theoretical assumptions grounding our knowledge and representation of social reality thereby providing advances in our appreciation of innovation *and* TCS.

It has been necessary to draw upon theoretical schemes from sociology, organisational studies and the knowledge management literature. The thesis adds to our understanding of organisational innovation by considering the socio-technical processes associated with translating ideas into reality. An analytical framework is developed that takes into consideration the interactive relationship between practices, norms, relations and mechanisms embedded and embodied within existing organisational routines and the configurations and relations defined through the TCS programme.

The innovation process is considered to represent a dynamic yet contingent set of activities that are mediated by various complex interdependencies that include (Scarbrough, 1996; Robertson *et al*, 1996; 1997; 2000):

- Communicability (knowledge creation)
- Economic Exchange (operational and business)
- Social Relations (programme participation within and across the firm)

As socially constructed contingencies these interdependencies can constrain as well as enable organisational innovation. They are both the medium and outcome of innovative activities executed within a pre-existing institutional realm. The thesis is based on the proposition that social phenomena are mediated by quasi-causal structural mechanisms at the core of social reproduction. Of particular interest is how a firm's representatives and academics define the business problem and find appropriate solutions. To account for these elements it has been necessary to consider several research questions:

1. How are TCS Programme aims and objectives translated into reality; consider the social shaping of innovation?

The knowledge creation process is examined to illustrate its negotiated and generative characteristics. By assessing the interdependencies mediating the actions of programme members using intensive research methods (Morrow,

1994, Sayer, 1992) it has been possible to examine how the socio-technical elements of programmes are negotiated and instantiated in the operational domain of the participating firms. To this end, the thesis contributes to our conceptualisation of organisational innovation and in particular the innovation process by demonstrating the connections between innovative activity (i.e., invention, diffusion, implementation) and changes to, or the entrenchment of, existing organisational configurations.

2. What is the relationship between the complex interdependencies characterising the innovation process and the success or failure of the four TCS Programmes?

3. How and to what extent does an interactive process perspective contribute to our understanding of TCS as a model of organisational innovation?

In the past researchers tried to identify the predictive rules which explain organisational change. My aim is to add to the qualitative evidence of critical perspectives by capturing the essence and unpredictability of the dynamic processes mediating knowledge creation. Drawing on observations from the case studies differing configurations have been identified to demonstrate the various contingencies and dynamics affecting the translation of ideas into reality. These include:

- Contradiction
- Slippage
- Dysfunctionality

Contradiction, slippage and dysfunctionality refer to those moments when the substantive and organisational foundation of each programme is brought into tension or problematised. These categories loosely define the outcomes of disjunctures in the organisation of each programme. Events surrounding the moments demonstrate the interactive relationship between the strategic

conduct of programme members and the complex interdependencies that mediate such disjunctures (i.e., institutional realm). A link is inferred between these moments and the interdependencies (communicability, social relations and economic exchange) that are the medium and outcome of each TCS programme.

By developing these ontological assumptions the thesis attempts to advance the notion of interactivity. Previously, the logic that connects these levels of analysis has been underdeveloped (Amabile, 1988; Van de Ven et al, 1989). However, with recent developments in neo-institutional theory (DiMaggio and Powell, 1983), which attempt to reconcile the duality of structure (e.g., Barley, 1986) it is seemingly possible to contribute to alternative avenues. This thesis continues along the line of neo-institutionalism with the provision of empirical evidence demonstrating the mediating influences of the institutional realm. This affirms recent prescriptions as to future directions of innovation studies (Slappendel, 1996) and coincides with those studies that acknowledge the importance of reflecting on the link between the behavioural and institutional realms or the social and technical realms of organisational reproduction (Thomas, 1994).

Similarly, the thesis contributes to our understanding of TCS by offering a qualitative account and explication of those "factors" (process, context and content) that are often cited as enabling or constraining TCS programmes (Peattie, 1993; Senker and Senker, 1994; 1995; Tiler and Gibbons, 1991). In existing accounts no effort has been made to demonstrate the connections or essence of the many elements affecting programmes. Put simply, writers on the subject have restricted their comments to the problems of knowledge transfer and organisational learning (Tiler and Gibbons, 1991; Senker and Senker, 1994; 1995; Peattie, 1993). Such observations are then linked to the need for changes in organisational culture and by implication the significance of facilitating the sharing of tacit knowledge. Little attention has been given to exploring the intersection of elements or to conceptualise the "TCS" innovation process in a way that accounts for the interactivity of members actions and the mediating affects of the institutional realm. In contrast, the

thesis conceptualises the processes associated with establishing and running TCS programmes and illustrates the difficulty of "engineering" success through the deployment of management procedures.

1.4 The Thesis Structure

A critical appraisal of the organisational innovation and knowledge creation literature is undertaken while the methodological implications of using a critical realist perspective based on the philosophical notion of the duality of structure are considered. Developments in theory are combined with the empirical analysis of collaborative alliances between academic institutions and small and medium sized enterprises involved in the UK government's premier technology transfer scheme – TCS.

Although the thesis is presented in such a way as to locate the literature before the empirical analysis it would be wrong to assume these represent discrete activities. The research process is an iterative process that has relied on both a review of the literature as well as noting patterns and themes from the case studies. This has helped in making sure the abstract discussion of theoretical issues makes intuitive sense. This has set off a new inductive cycle where further inferences were generated and deemed valid in the sense they seemed "probable, reasonable or likely to be true" (Miles and Huberman, 1994:431). Considering organisational innovation in this way meant that patterns and themes from the literature and case studies were considered as a way of making initial, intuitive sense of the innovation process. Maintaining this inductive cycle relied on the adoption of appropriate research methods: intensive longitudinal case studies.

Chapter two reviews the organisational innovation literature. As a theoretical analysis the chapter critiques the main conceptual perspectives. These are divided into two methodological camps (variance and process) and three theoretical schools (individualist, structuralist and interactive). Attention is given to the differing assumptions and methods found in the literature with the core observations being explored in subsequent chapters. The thesis is

discussed in the context of the existing innovation studies literature and draws heavily on the advances made by authors adhering to the interactive process perspective.

Chapter three develops ideas around the knowledge creation during the innovation process. This is a theoretical analysis of the various innovation episodes including invention, diffusion and implementation. Drawing on studies from a variety of schools of thought (Social Construction of Technology, Sociology of innovation and Actor-Network Theory) it has been possible to consider the diversity of the social processes associated with change activities in organisations and collaborative alliances. This provides a broad grounding for assessing the substantive (socio-technical and organisational) elements of the innovation process.

Chapter four considers the conceptual and philosophical implications of an interactive process perspective based on the duality of structure. Structuration theory (Giddens, 1995) is adopted and located more broadly within the Critical Realist School of thought. This offers a broad appreciation of the methodological and conceptual implications of attempting to consider action and structure simultaneously. The advantages and disadvantages of such an approach is considered.

Chapter five explains the methodology adopted in the thesis, the research questions and the research venue. A brief discussion of prior research on TCS is offered, as is an examination of the distinctive character of TCS as a subject of inquiry. A thumbnail description of each case study is given as well as a table of interviews and meetings held during the research.

Chapter six explores how programmes are first established. This examines the variety of ways participants create an obligatory passage point through which the innovation process is located and organised. The remainder of the chapter is dedicated to considering the key themes emerging from each case study and outlining ways of developing an interactive process perspective of organisational innovation.

Chapter seven assesses the complexities of organisational innovation in two of the four case studies. The advantage of adopting intensive research logics is established as the mediational properties of both the "innovation" and each firm's organisational repertoire (Clark and Staunton, 1989) are considered. The key theme is to assess how knowledge is produced, distributed and valued across different social contexts.

Chapter eight provides a discussion of the empirical data in relation to the research questions posed in earlier chapters. It establishes the key empirical and theoretical advances of the thesis and advances some preliminary conclusions regarding the four TCS programmes.

Chapter nine concludes the thesis. An evaluation of the academic value of the work is presented and the implications of the work are outlined. The main contributions are to provide a critical view of organisational innovation through the reappraisal of the orthodox conceptualisations of process and innovation. The thesis offers a unique contribution to the study of innovation drawing as it does on insights from the sociology of innovation and critical theory.

I begin with a discussion of the innovation studies literature. This lays the foundations of the thesis as questions of theory and methodology are addressed and proposals for the development of this field of study are advanced.

Chapter Two

Perspectives on Organisational Innovation

2.1 Introduction

In this chapter, I explore the different assumptions and methods characterising recent studies and commentaries on organisational innovation. My aim is to identify their strengths and weaknesses suggesting likely future directions. Like many authors before, I locate studies in their respective schools of thought (King 1990; Van de Ven and Rogers, 1988; Slappendel, 1996; Wolfe, 1994). While this may oversimplify commonalities or differences (Hassard, 1993) it has the advantage of providing the means to link these studies according to conceptual themes.

I begin by defining organisational innovation and then briefly chart the study of innovation in the economy and the firm. From this review it is apparent that there is little explanatory utility in much of the literature. Appraising the shortcomings of the orthodox literature serves to highlight the hiatus afflicting attempts to improve our understanding of the phenomenon. Future developments seem to depend on the resolution of a debate that has occupied the minds of academic

researchers in this field of study since the 1970s and 1980s. This debate, which is one of many relates to the relative importance authors place on agency and structure in social analysis. Mapping the conceptual and explanatory implications of the agency-structure dialectic in the study of organisational innovation is the core subject of this chapter.

2.2 Innovation and Technical Change: an overview

2.2.1 Defining the field of inquiry

Definitions vary from the Schumpeterian (1943:83) view that innovation encompasses 'the new markets, the new forms of industrial organisation that capitalist enterprise creates' to the narrower view in which innovation is objectified to describe a piece of 'high-technology' equipment like a personal computer (Swan, 1996). Here innovation in organisations is understood to represent 'the development and implementation of new ideas by people who over time engage in transactions with others within an institutional order' (Van de Ven *et al*, 1989:590). Instead of taking what amounts to an economic perspective of innovation and concentrate on the outcomes of this process I am more concerned with the process itself. Understanding organisational innovation requires an investigation of the processes through which 'new ideas, objects, and practices are created and developed or reinvented' (Slappendel, 1996:108). Here I develop the idea that organisational innovation encompasses various 'phases or episodic activities, recursively rather than sequentially related' through which different bodies of knowledge are constructed communicated and exchanged (Robertson *et al*, 1997:1-2). The foundations of this perspective are the subject of chapters 2, 3 and 4. In chapter 5 the methodological implications of this approach are considered.

2.2.2 Innovation and the Economy

Economists have generally recognised the importance of technological change for economic progress (Marx, 1858; Smith, 1776; Schumpeter, 1912). However, it is only since the 1980s and 1990s that knowledge, inventions and innovations

have become a *focus* of economic analysis (Rothwell, *et al* 1974; Dosi, 1988; Freeman, 1994). Prior to this a number of factors seem to have obscured the inclusion of 'intangible' investments (i.e., the production and distribution of knowledge), from accounts of economic growth. For the most part, 'ignorance of natural science and technology on the part of economists; their preoccupation with trade cycle and employment problems; and the lack of usable statistics' (Jewkes *et al*, 1958 cited in Freeman and Soete, 1997:2), ensured that economists tended to only include inputs like labour and capital in their economic models. The tendency to omit technical change or innovation reflected the long-held view by economists that such factors were 'exogenous' to economic analysis (Coombs *et al*, 1987). Fluctuations in the supply and demand of goods and services were thought to depend on changes to a number of core factors (labour and capital) while technology, remained, it was assumed, equal and unchanged. A view has now formed around development theory (World Bank, 1991) that economic growth is as dependent on intangible investments as tangible investments in premises and equipment (Freeman and Soete, 1997). This change of emphasis has been matched by a similar re-orientation in organisational studies. In this, 'theory building and policy analysis has shifted from an implicit focus upon efficiency, with innovation as the deviant case, to innovation as the crucial focus, with efficiency as a necessary adjunct' (Clark and Staunton, 1989:4). Increasing interest in innovation reflects the pressing problem of adaptation and confirms the view currently held by scholars, policy makers and industrialists that a firm's competitive edge has less to do with static price competition and more with creating knowledge a little faster than their competitors (Maskell and Malmberg, 1995).

Although economists have until relatively recently seemingly relegated innovation and technical change to the 'edges' of economic analysis there have been some important exceptions. Schumpeter (1912) was one of the first economists to evaluate the innovation process. According to Schumpeter, the entrepreneur was central to the process of technological change: it was the entrepreneur who recognised a market opportunity and accessed the necessary knowledge to develop the new products or services. In time, this view ('Mark' 1) was revised by Schumpeter (1943), as it became apparent that

the bureaucratic management of innovation was replacing entrepreneurial flair and the large company (as opposed to small) was becoming the main focus of technological innovation in the economy ('Mark' 2). Perhaps the most striking change linked with Schumpeter's second thesis was the growth in and professionalisation of industrial research and development; most notably in the steel, electrical, oil, chemical, synthetic material, computer and electronics industries (Freeman and Soete, 1997). As we begin a new century and as technology becomes ever more complex and information and communication technology more pervasive firms seem less likely to go it alone. Instead, they are tending to *collaborate* with academic research institutions (Coombs *et al*, 1996), and other firms through innovation networks in and between sectors, regions and nation-states (Hakansson, 1989; Hagedoorn and Schakenraad, 1992; Soeters, 1993). To this end, both governmental (DoE, 1987; 1991; DTI, 1983; 1994; 1995a; 1995b; 1998) and non-governmental policy makers (CIHE, 1987; 1988; 1992) have been instrumental in encouraging industry to form new partnerships with the knowledge base. The rhetoric is explicit in drawing a link between, innovation, collaboration and economic growth and prosperity. It remains for researchers, academics and managers to consider and explain the complexities of turning these prescriptions into reality.

2.2.3 Innovation and the Firm

Although scholars have tried to test a range of hypotheses and proposed a variety of antecedent factors as predictive of innovative behaviour in the firm little in the way of conclusive evidence has been forthcoming. Many have taken their lead from Schumpeter's (1942) hypotheses that a firm's proclivity to innovate depends on the link between two key factors: market structure (perfect versus monopolistic competition) and firm size (large versus small). Studies include Anglemar (1985), Kamien and Schwartz (1982), Kaplinsky (1983), Rothwell and Zegveld (1981), and Scherer (1980). By way of review Saren (1987; 1990) suggests no clear conclusions have been offered linking market structure and firm size with innovation. Likewise, it has been argued innovation could be explained by both technology-push (Schumpeter, 1912; 1943) and market-pull stimuli (Schmookler, 1966). Studies considering both

technology-push and demand-pull stimuli have not offered clear explanations although market-pull explanations have generally been favoured (see Walsh, 1984). Perhaps the only firm observation coming from these investigations is the idea that industrial innovation will necessarily involve the coupling of a new *technology* with a *market* (Freeman and Soete, 1997:200).

Successful innovations depend to some extent on the links between marketing and R&D i.e., technology strategy (Rothwell *et al*, 1974; Calantone and Cooper, 1981; Bonnett, 1986). To this end, technology strategy is inextricably linked to corporate strategy (Dussage *et al*, 1992); what Mintzberg (1988), describes as the 'mediating force' linking the firm with its environment. Interest in technology strategy at the level of the firm did not become the subject of academic enquiry until the 1980s (Kantrow, 1980). At which time a number of taxonomies ordered a firms strategic options: (i) leader or follower; (ii) entrepreneurial or positional; (iii) internal-led or external-led and; (iv) proactive or reactive (Urban and Hauser, 1980; Foxall, 1984; Twiss, 1980):

> "there is a relationship between a firm's innovation strategy and the *source* of both opportunity and entrepreneurship. This ranges from extremely reactive firms who take their product development 'cues' from competitors to the most proactive firms who search through the multitude of sources for innovative ideas - internal and external - in an entrepreneurial manner. In the former case the initiative and entrepreneurial locus is external and in the latter it is entirely within the firm" (Saren, 1990: 213).

Although these typologies are a useful heuristic for categorising firm behaviour they say very little of the innovation process. Greater explanatory insight is available from studies that consider one or more of the following themes (Saren, 1987; 1990):

(i) Economic factors (size of firm);
(ii) Social and behavioural factors (values, education, attitudes);
(iii) Information and communication factors (contacts with scientists and technologists);
(iv) Organisational and managerial factors (delegation of responsibility).

As it is, consideration of these factors has done little to aid attempts to develop theories of innovation. At the centre of this problem is the issue of complexity and how it is explored. Explanations based on firm size generally give a partial view and tend to anthropomorphise the firm obscuring the underlying processes precipitating such trends. It is now recognised that "innovatory advantage is unequivocally associated with neither large or small firms" (Rothwell, 1989:62). However, this is not to deny that such studies have provided useful insights into innovative activities. For instance, it has been found that small and medium sized enterprises (SMEs) can enjoy *behavioural* advantages over large firms in the innovation process. This includes an ability to respond rapidly to 'external threats and opportunities', having both 'efficient internal communication' and an 'interactive management style' (Rothwell, 1989, 1991; Rothwell and Dodgson, 1991). This is useful as it indicates that certain organisational arrangements in SMEs enable rather than hinder change, which may support findings that found large firms bureaucratic structures antagonistic to innovation (Pugh *et al*, 1969; Blau *et al*, 1976). Conversely, SMEs are thought to lack the *material* and *technological* resources that enable large firms to 'spread risk over a portfolio of new products' and fund 'longer-term R&D' (Rothwell and Dodgson, 1991; Rothwell 1992; 1994). Limited access to in-house expertise has been found to be a major obstacle to SMEs embarking on such collaborative arrangements (Senker and Senker, 1994). On those occasions when in-house engineers and scientists are available, Rothwell (1992; 1994) and Rothwell and Dodgson (1991) argue success depends on the managerial competence and planning and control procedures used to organise innovation. In contrast, Freeman and Soete (1997:222), argue that such recommendations have been given in the absence of any 'strong evidence of the effectiveness of such procedures'. Instead, they suggest that firms of any size have been unable to make accurate estimations of the costs and time taken for development of radical innovations especially.

Given that innovation is problematic, managers do not have perfect knowledge about the technology or market (March and Simon, 1958), it is remarkable that accounts of technology strategy (e.g., Zahra *et al*, 1994, Dussage *et al*, 1992) continue to ignore unpredictability (Jones and Tang, 1996). Citing Tsoukas

(1994:774), Jones and Tang argue that authors such as Zahra *et al*, 1994 and Dussage *et al*, 1992 wrongly assume that 'regularities in the past can be extrapolated into the future' thereby failing to acknowledge that 'for radical innovation to be possible, the future ought to remain not only unknown but unknowable'. The implication is innovation relies as much on serendipity and unintended consequences as rational choice. This view coincides with criticisms of the strategy literature, which has been criticised for failing to interrogate how strategic decisions are articulated and translated (Clark and Staunton, 1989).

As technology becomes more *complex* a firm's ability to innovate (large or small) increasingly hinges on its *collaborative prospects* (Saren, 1990; Coombs *et al*, 1997; Robertson *et al*, 1997; Tidd, 1997). This has led to the proposition of new models of innovation (Rothwell and Zegweld, 1985; Saren, 1990) with an interactive model of innovation replacing linear "science-push" or "market-pull" accounts:

> "The interactive model highlights the ability of innovative organisations to manage relationships internally within the firm (between project groups, functional departments and divisions), and externally (including industrial sectors, geographical regions and nations)" (Jones *et al*, 1998: 123).

The *innovative potential* of enterprises is increasingly believed to depend on the close integration of internal and external relations and processes. This is most apparent in recent commentaries on the benefits of adopting lean manufacturing practices (Womack, *et al,* 1990). This Japanese model of manufacturing views the factory floor as a place where knowledge can be created as well as applied, where production workers think as well as do. This model has five dimensions (Delbridge and Lowe, 1998:227):

(i) Transition from physical skill and manual labour to intellectual capabilities or 'mental labour'

(ii) Increasing importance of social or collective intelligence as opposed to individual knowledge or skill

(iii) Acceleration of the pace of technological innovation

(iv) Increasing importance of continuous process improvement on the factory floor

(v) Blurring the lines between the R&D laboratory and the plant

These dimensions have been adapted to provide a learning factory framework constituting the following attributes:

(i) Innovation is the central motif of the learning factory. The learning factory generates, codifies and applies knowledge to improve its various products, structures and processes

(ii) Learning factories are host to continuous improvement activities that are driven by internal sources of information such as tacit knowledge of shop-floor workers, the contextual knowledge of technicians, and the formal knowledge of professionals and craft workers

(iii) The learning factory also benefits from improvement derived from external sources of information, such as problem-solving suppliers and the supplier development programmes of customers

(iv) The learning factory is embedded in an innovation network of collaborators with whom there is information exchange and shared learning (Delbridge and Lowe, 1998:227).

The significance of inter and intra organisation co-operation is not new. Studies such as *Project SAPPHO* (Rothwell *et al*, 1974) have indicated that the innovation process is likely to involve multiple organisations (Languish *et al*, 1972; Johanson and Mattson, 1987; Clarke *et al*, 1988; Malsot, 1980; Tonnies, 1957; Contractor and Lorange, 1988; CEST, 1990; Dodgson, 1989; Freeman, 1994; Freeman and Soete 1997; Robertson *et al*, 1996; Rothwell and Dodgson, 1991; Forest and Martin, 1992). This view is supported in findings of UK small and medium-sized manufacturing firms:

> "Innovative SMEs have dense external networks involving other firms (mainly SMEs) in a variety of...relationships and involving infra-structural institutions such as universities and private research institutes" (Rothwell, 1991:93).

Interest in collaborative links has until recently focused on collaborations with large firms. This is changing as it is recognised that SMEs can benefit from such alliances (Jones, 1997). Perhaps the best known is the research driven biotechnology and new technology-based firms on university science parks (Oakey, 1994). Although, it should be noted the success of science parks has been contested (Massey *et al*, 1992). In turn, Laredo and Mustar (1996) argue new collaborative forms are evolving with state sponsored links between academic and commercial groups in pre-competitive cooperative R&D facilitating organisational arrangements not solely limited to inter-firm networks. These now include activities among 'institutionally heterogeneous actors'.

If we are to explain the complexities of collaborations it is perhaps necessary to explore their historical and social contexts (Clark, 1995; 1997; Clark and Staunton, 1989; Pettigrew, 1985). Exploring the innovation process is likely to prove more useful for theory building and policy analysis than prescribing 'grand technological strategies' (Jones and Tang, 1996; Jones *et al*, 1994). Given the limits to existing studies of innovation in the firm it surely remains the responsibility of economists and sociologists to provide deeper understanding of how and why organisations change shape thus putting 'flesh and blood' on Schumpeter's notion of entrepreneurship and innovation (Freeman, 1991:499).

2.3 Researching Innovation: challenging the orthodoxy

Perhaps the most significant development in the study of innovation has been the challenges to the assumptions grounding the mainstream or normative-variance type approaches. This has significant implications in the way writers have come to theorise and research innovation which can be summarised as follows:

(a) Pro-innovation bias;
(b) Innovation is a linear process;
(c) Innovation involves the imitation of ideas, products or processes;
(d) Innovation is easily managed.

Many scholars now consider innovation in different ways (Clark, 1985, 1987, 1995, 1996; Clark and Staunton, 1989; Robertson *et al*, 1997; Van de Ven *et al*, 1986). It is now seen as inherently uncertain, dynamic and specificity contingent. Such activities may be politically or socially motivated (DiMaggio and Powell, 1983) and are likely to be 'messy' not linear with feedback loops (Schroeder *et al*, 1989). In short, appropriating new ideas, products and processes is uncertain and can be problematic (Clark, 1987; King and Anderson, 1995).

The tendency to objectify innovation has also been rejected. This is significant as objectification led to the pervasion of 'four guiding principles in theory building and empirical research':

(i) Use of the 'before change' and 'after change' format as a standard research design to examine objectified innovations;
(ii) The search for a single scale of technology
(iii) The split between administrative and technological innovations;
(iv) An attempt to identify the variables that correlate with the adoption of objectified innovations (Clark and Staunton, 1989:52).

In an attempt to identify the *antecedents* influencing innovation many studies concentrated on single events purchase or adoption. In doing so, the long-term dynamics of the innovation process were unwittingly perhaps, ignored. Viewing 'innovation' as an object also tended to ensure the 'knowledge aspect of technology' was neglected thus perpetuating (wrongly) a deterministic notion of technology (Grint and Woolgar, 1997). Little attention was also given to the innovation process with the 'heritage of the configuration of knowledge within which the new equipment is located' generally being ignored (Clark and Staunton, 1989:54). Studies failed to consider the configuration of technology with other dimensions or how technology influenced organisational structure and process (Barley, 1986; 1990). Objectification also led to distinctions being made between 'types' of innovation (Damanpour and Evan, 1984; Damanpour, 1990). Separations such as those proposed by Damanpour (1990) between *technical innovations*, *administrative innovations* and *ancillary innovations* could be

misleading because technologies cross technical-administrative boundaries (Clark and Staunton, 1989).

The analytical lens has slowly turned to the long-term dynamic of the innovation process with a focus on knowledge construction, communication and exchange. This shift in emphasis and reorientation of basic assumptions link to a broader debate concerning issues of theory and method.

In reviewing the literature, King (1990) and Van de Ven and Rogers (1988) have noted that much of the innovation literature is split between those studies using *variance* research methods and those studies using *process* research methods. Wolfe (1994), suggests the literature can be framed chronologically showing how different methods have in time become conceptually and methodologically suspect; gradually being replaced by alternative approaches:

(i) *Diffusion* of innovation;
(ii) *Determinants* of organisational innovation;
(iii) Innovation *process*.

Process methods appear to have reversed the tradition of using analogies taken from the natural and biological sciences (Clark, 1996). Slappendel (1996:108) argues that although such reviews provide insights into the literature they fail to 'expose the underlying theoretical assumptions about the role of individual action or structures'. She frames the literature according to the importance studies place on the role of individual action or structure. Three perspectives are discussed in order of historical development and influence:

(i) Individualistic;
(ii) Structuralist;
(iii) Interactive process.

Taken together these reviews seem to suggest an important trend. On the one hand, there has been a general move towards the use of process research methods in place of variance research methods, while on the other scholars

have begun to attend to the important theoretical issue concerning the link between action and structure. Agreement has now formed around the view that normative-variance approaches, typically of the late 1960s and 1970s, failed to provide satisfactory explanations of organisational innovation. Wolfe (1994:405), argues that they have been 'inconclusive, inconsistent and characterised by low levels of explanation', thus undermining the positivist assumption that a theory of innovation would 'gradually emerge from the accumulation of more and more data' (Downs and Mohr, 1979:380). In place of past certainties about scientific method scholars have adopted process methods. These have developed from simple linear stage models (Saren, 1984; Wolfe, 1994), through to those that include recursivity, feedback loops (Schroeder *et al*, 1989; Robertson *et al*, 1997) and more recently interactivity between individual action and structure (Clark and Staunton, 1989; Van de Ven *et al*, 1989).

2.3.1 A Variance Perspective

Variance theory building is concerned with identifying causal links between variables that conform to the view that 'the precursor (X) is a necessary and sufficient condition for the outcome (Y)' (Mohr, 1982:37). Key variables (e.g., earliness of innovation, extent of innovation, presence/absence of innovation), are tested against contributory conditions (e.g., motivation and resources) that have their own variance: 'the level of innovation is a function of the levels of motivation and resources' (Mohr, 1982:40). Scientific explanations based on variances have proven very difficult to achieve in the social realm. Prediction has seemingly been impossible to realise while the conceptualisation of innovation and the contributory conditions informing variance studies have been open to extensive criticism. Complexity relates to the numerous and random *interactions* between variables and the conditions contingent upon each individual study. The main problem has been to provide a variance theory of innovation that can account for this complexity:

> "The ability to make the kinds of generalizations and predictions that are typically associated with science and models is consistently being undermined by the phenomenon of complexity" (Downs and Mohr, 1979:379).

Such a theory has been elusive because 'virtually every determinant employed has proved to be a highly and inexplicably erratic predictor of innovativeness with an impact that varies dramatically across studies' (Downs and Mohr, 1979:380). The determinants or antecedent factors most commonly tested to determine 'high and low innovative organisations' include (King, 1990; King and Anderson, 1995):

(i) People;
(ii) Structure;
(iii) Climate and culture;
(iv) Environment

The origin of this view is found in the sociological and social anthropological work on the diffusion of innovations (Rogers, 1962, 1983). Linking *people* with organisational innovation reveals interest in correlating individual characteristics (e.g., leadership) with innovative behaviour. Hage and Dewar (1973) argue that the 'elite' values of organisational leaders are predictive of high levels of innovation. Such observations are not consistent across studies. Kimberly and Evansiko (1981) found for example that innovativeness was more closely linked to organisational structure than the characteristics of leaders. Interest in leaders has subsequently shifted so that questions about personality traits, values, beliefs, experience and knowledge have been replaced by questions about leadership style. Work on leadership style has been highly prescriptive and normative (Peters and Waterman, 1982) with authors advocating *one* leadership style. In contrast, contingency approaches assume that leadership style will *change* according to the innovation and the positioning of individuals in the innovation process (Dunphy and Stace, 1988; Van de Ven *et al,* 1989). Interest in 'change agents' has also been the subject of research. Rogers (1983) identifies eight core attributes of changes agents that are likely to influence successful innovation. Similarly 'ideas champions' have been seen as important contributors to ensuring the adoption of innovative ideas. The main criticisms of trying to predict innovation based on the attributes of individuals or their leadership styles concerns the degree to which individuals actually contribute to

or control the innovation process (King and Anderson, 1995). Concentrating on individuals alone is unlikely to provide a complete picture.

Organisational *structure* has also been linked to innovation. Defined as: 'The formal allocation of work roles and the administrative mechanisms to control and integrate work activities including those which cross organisational boundaries' (Child, 1977, cited in King and Anderson, 1995:99), its origins derive from the seminal work of Burns and Stalker (1961). In brief, according to these authors, the structure of the organisation should complement its environment. Hence, if the environment is stable and predictable then a mechanistic structure is most appropriate. Likewise, if the environment is unpredictable then an organic structure is necessary as a mechanistic configuration will be too inflexible. The findings suggest that an organic organisational structure is best suited to facilitating organisational innovation. Burns and Stalker's work is of course more insightful than the very brief synopsis suggests. For example, in the latest edition of their work (1994), they remark that the distinction between organic and mechanistic structures may rely as much on 'internal politics' as changes in the external environment. Recognition of this aspect of their work has been rare. An exception is the study by Jones and Stevens (1999) on 'micro-politics' in the innovation process. Instead, Burns and Stalker's work continues to be closely associated (rightly or wrongly) with their structural analysis whereby innovation is explained in terms of structural influences (Kimberly and Evanisko, 1981; Zaltman *et al,* 1973). Zaltman *et al,* (1973) suggest structure can have varying influences during the innovation process. The main criticisms of this approach relates to the narrowness of the analysis. For instance, Wilson (1992) suggests that market position and national political and economic circumstances may be as important in influencing organisational innovation.

Organisational *climate* and *culture* (Handy, 1985; Nystrom, 1990) have also been seen as important predictors of successful innovation with several studies considering the relationship between national cultures and the propensity to innovate (Archibugi and Michie, 1997; Bergen *et al*, 1988; Albach, 1994; Kedia *et al,* 1992). There are two perspectives concerning climate and culture: structural and interpretative (Wilson, 1992). The former focuses on the 'link

between culture and organisational structure' while the later views 'culture in terms of the symbols, rituals and myths pervading the organisation' (King and Anderson, 1995:105). Perhaps the main problem with focusing on climate and culture as predictors of innovation is the extent to which they can be 'managed'. This links back to *people* where the successful manipulation of organisational culture is likely to be problematic due to the *multiple sub-cultures* embedded in the experiences and practices of organisational members. It is important to recognise that organisations are heterogeneous not homogenous collections of norms, values and cultures (see Whittington, 1992).

Finally, many scholars have formulated typologies to identify the positioning of organisations in relation to their *environment*. The assumption is that successful innovation will depend on the firm's positioning. This view has been criticised for its normative assumptions ('this is the best approach to follow') and for the way the organisation is seen as separate from its environment. In particular, little attention is given to exploring how firms and their 'environment' are inextricably intertwined (King and Anderson, 1995).

The failure of variance studies to conclusively explain and predict successful innovation has much to do with the methods of variance research. In particular, studies tend to rely on cross-sectional surveys which has hindered attempts to establish causality:

> "The finding that organisations with organic structures are more innovative is generally held to show that organic structure facilitates innovation. But it could equally be the case that engaging in high levels of innovation causes the organisation to adopt a more organic structure" (King and Anderson, 1995:112).

In addition and related to this first point has been the tendency to rely on an invariant notion of innovation thus neglecting to see if changes occur during the innovation process (Rice and Rogers, 1980; Wolfe, 1994). The preponderance of cross-sectional surveys in variance studies has also meant that little attention has been given to individuals in communicating meaning or knowledge about the innovation (see Swan, 1996; Weick, 1990). Swan (1996:3) argues that when

diffusion and determinant studies using variance methods are used to investigate the implementation of 'best practice' knowledge they wrongly assume that (i) individual cognitions only play a small role in technological innovation and (ii) individuals are relatively passive when receiving new ideas. In doing so, these studies fail to account for the way individuals are 'actively involved in the construction of the knowledge base'. Variance studies also tend to offer recipes (e.g., the adoption of organic structures when the environment is turbulent) to be followed by practitioners. This is a weakness as organisational change is usually characterised by unanticipated events (Schroeder *et al*, 1989). Attempts at rectifying these basic issues and problems have resulted in scholars adopting process perspectives.

2.3.2 A Process Perspective

According to Slappendel (1996), interest in *process perspectives* has increased since the publication of critical essays by Downs and Mohr (1976:1979). Wolfe (1994) suggests that there have been two generations of process theory research. An earlier generation termed *stage model research* (Pelz, 1983; Ettlie, 1983) which characterises innovation as a series of stages unfolding over time, and a later generation, known simply as *process research* (Dean, 1987; Dyer and Page, 1988; Schroeder *et al*, 1989):

> "Process theory research of organisational innovation investigates the nature of the innovation process; how and why innovations emerge, develop, grow, and (perhaps) terminate...the unit of analysis of process theory research is the innovation process itself" (Wolfe, 1994: 409).

This version holds particular favour at present because it coincides with current views that innovation is usually a complex iterative process, which is not linear or easily managed and not best represented by sequential stages (Schroeder *et al*, 1989). Saren (1984) provides a useful review of the types of stage/process models present in the literature. Five distinct models of the innovation process have been found defined in terms of those models that (a) focus on the activities involved in the innovation process, (b) those that discuss these activities in

relation to specific departments, and (c) those that emphasise the decisions taken in the process:

(i) Departmental-stage models (Robertson, 1974);
(ii) Activity-stage models (Utterback, 1974);
(iii) Decision-stage models (Robertson and Fox, 1977);
(iv) Conversion process model (Twiss, 1980) and;
(v) Response models (Becker and Whisler, 1967).

According to Saren (1984:21), the first three models attempt to 'break down the innovation process into its component parts'. As a normative-rationalistic approach it presents 'innovation as an orderly, logical process' yet tends to give insufficient attention to the unexpected. By neglecting the unexpected it is difficult to accept the innovation process follows an orderly path. They also fail to recognise that interpretations of the innovation process may vary across an organisation. Aydin and Rice (1991), observe that the introduction of a computer system in a hospital was appropriated differently across the organisation thus reflecting the existence of many 'social worlds' (occupational and departmental). In contrast, the firm in conversion process models is understood to be the user of various types of inputs, raw materials, scientific knowledge and individuals which are converted, in no specified order, into outputs like products and services (Becker and Whistler, 1967). Conversion models offer insight into the process by focusing on the variety of inputs constituting the innovation process, the activities, information and departments of the company. This approach has, ironically perhaps, been criticised for not *ordering* the events constituting the innovation process. Finally, response models represent innovation in terms of the 'firms 'response' to some external or internal stimulus'. These have been criticised for offering only limited insight because they fail to take account of the various inputs constituting the innovation process (Saren, 1984:23).

Saren's typology represents a substantial body of work that has attempted to 'organise' and explain the *process* of innovation in organisations. Yet, as Saren (1984:24) has suggested 'despite the number of models and perspectives more work does need to be concentrated on the *nature* of the innovation process in

the firm itself' (*my italics*). This remains as true today as when Saren (1984) made these comments over 15 years ago. In an attempt to consider the nature of the innovation process some have proposed the significance of temporal differentiation and recursivity (Clark, 1985, 1987; Clark and Staunton, 1989). The application of these ideas, especially in organisational sociology, reflects dissatisfaction with those analyses of organisational behaviour that have a 'strong orientation towards the construction of analytical schemas and law-like statements which are "time free"' (Clark, 1985:35). There has been a tendency to focus on synchronic rather than diachronic investigations of organisational change with many studies of organisational innovation focusing on the enduring features of 'structure' like the Aston studies (Pugh and Hickson, 1976), rather than 'flux, transformations, histories, dynamics, disaster, or the "mechanisms" of organisational continuity/ discontinuity' (Clark 1985:35). On the occasions where time is considered (stage and process methods) it is restricted to 'clock-time'. This is problematic as *singular-chronological* time is separated from events and as a result obscures the temporal embeddedness of organisational action. Clark (1985, 1995) suggests organisational behaviour reflects multiple 'organisational times' through which differing 'operational units are organised to cope with contingently recurring periodicities' (Clark, 1985:38). Organisational action is differentiated according to multiple 'chronological codes' of which clock-time is but one while event-based time reckoning is another.

Perhaps the most common illustration is Gearing's (1958) study of the Cherokee Indians. In this study, frequently cited by Clark, the behaviour of the Indian village is described as a 'structural repertoire' differentiated into a number of distinct 'structural poses' (the hunting party, the household, the clan segment, the tribe as a whole). Individuals activate the various poses depending on the recurring periodicities (events) in the year. Three classes of events are identified which activate poses: (i) events which occur at fixed points in the year; (ii) events which are variable within fixed seasons (e.g., hunting); and (iii) events which could be anticipated, but occurred at irregular intervals (e.g. clan wars) (Clark and Staunton, 1989). When used to explain organisational behaviour the notion of event-based time-reckoning systems (poses) helps to illustrate how innovative activities (illustrative of a pose) involves individuals from various

operating units embarked on multiple activities in the organisational repertoire. In this way, innovation is considered across a much broader historical dimension where organisations can find themselves on 'one of several possible event trajectories' (multiple poses) which may provide continuity to or may transform the repertoire (Clark, 1985) (see Chapter Three).

Recursivity is complementary to the notion of temporal differentiation in so far as it indicates individuals in the innovation process are likely to be engaged in reworking their position, commitments and involvement. Innovation is not a neutral activity, nor is it believed to be smooth or frictionless. Reproduction of the organisational repertoire is subject to chronic recursiveness (rhythmic persistence) so that any attempt to transform the repertoire (through innovation) is likely to be met by resistance from within. This marks a significant departure from considering the innovation process as linear and calls into question its manageability.

According to King and Anderson (1995), the 'illusion of manageability' is composed of three sets of second-order beliefs: the *illusion of linearity*, the *illusion of predictability* and the *illusion of control*. In the first instance, it is assumed that the innovation process or organisational change will always follow key stages (e.g., Lewin's (1951) unfreeze-change-refreeze model of change). Given the notion of linearity it is assumed that innovation or change processes are predictable. Predictability provides a 'template for action' such that managers can proceed through a sequence of activities to achieve change. This feeds the illusion of control and manageability. Attention to recursivity and temporal differentiation ensures that innovation is seen as multidimensional, contingent and potentially conflict ridden. It offers a radically different approach to orthodox normative-variance and simple process studies.

Process theories of innovation offer a significant departure from variance approaches because they are primarily concerned with the complex inter-relationship between the necessary conditions, probabilistic processes and external discretional forces that influence innovation (Mohr, 1982). Instead of explaining innovation in terms of 'efficient causes' and 'co-variances' the

objective is to account for the probabilistic rearrangement of discrete states or events over time. Implicit in this endeavour is the need to consider and relate various levels analysis:

> "Some events and states may relate directly to the purposive actions of individuals, while others may emanate from external structural influences. However, in attempting to generate theories that will specify the conditions under which these multi-level events will join or separate, there is an implicit need to address the complex, and paradoxical relationship between action and structure" (Slappendel, 1996:119).

This is not an easy task, as attention has to be given to making adequate sense of the action-structure interface. Van de Ven and Rogers (1988:646) suggest four ways of reconciling agency and structure:

(i) To acknowledge the deterministic and voluntaristic aspects of social systems;
(ii) To clarify the connections between the various levels of analysis;
(iii) To link action and structure with different temporal stages;
(iv) To develop new theories of the action-structure relationship.

Attempting to make sense of the relationship between action and structure has resulted in a range of interpretations that can be assembled under the rubric of *interactive process* perspectives. It should be noted that the term 'interactive process' might be confused because it is used to describe intra and inter firm innovative activities (Rothwell and Zegveld, 1985; Saren, 1990). In this instance, and for the purposes of the thesis the term 'interactive process' refers to those practices that will usually include intra and inter firm activities, but essentially, it denotes the interactivity of action-structure.

2.3.3 An Interactive Process Perspective

Over twenty years ago, Pierce and Delbecq (1977), identified three perspectives on the relative importance of action and structure in studies of innovation in organisations:

> "The deterministic structural model has captured the most attention; structure and context cause innovation. Alternatively, member values and attributes can be cast as the primary rival causal force in determining organisational innovation; i.e., elite values favourable to change best predict organisational innovation. Finally, the relationship between organisation and innovation may be interactively influenced by both structure and action" (Pierce and Delbecq, 1977:34).

These approaches reflect differing theoretical foundations and research methods (figure 2.1).

Figure 2.1 Approaches to Organisational Innovation

	Individualistic	**Structuralist**	**Interactive process**
Basic assumptions	Individuals cause innovation	Innovation determined by structural characteristics	Innovation produced by the interaction of structural influences and the actions of individuals.
Conceptual-ization of an innovation	Static and objectively defined objects or practice	Static and objectively defined objects or practice	Innovations are subject to reinvention and reconfiguration. Innovations are perceived.
Conceptual-ization of the innovation process	Simple linear, with focus on the adoption stage	Simple, linear with focus on the adoption stage	Complex process
Core concepts	Champion Leaders Entrepreneur	Environment Size Complexity Differentiation Formalization Centralization Strategic type	Shocks Proliferation Innovative capability Context
Research methodology	Cross-sectional survey	Cross-sectional survey	Case studies Case histories

Source: Slappendel (1996:109)

An *individualist perspective* is concerned with the action of individuals. These actions are not believed to be constrained by external factors rather they are the outcome of self-directing agents who are capable of introducing change. For Slappendel (1996), this represents a 'trait approach' to innovative behaviour (using variance methods) that is broadly concerned with the innovator's

characteristics such as age, sex, education, values, personality, goals, creativity and cognitive style (Schumpeter, 1912; March and Simon, 1958; Rogers, 1962).

A *structuralist perspective* (also using variance methods) assumes innovation is influenced by organisational characteristics including: centralisation, complexity, formalisation, size, strategy and goals (Kanter, 1985; Drazin, 1990). Central to this perspective is the idea that organisational behaviour is somehow shaped by a 'series of impersonal mechanisms that act as external constraints on actors' (Slappendel, 1996:113). Both approaches have been criticised. The individualist perspective is thought to be wrong in assuming that innovative decisions only involve single individuals or that individual characteristics are not affected by organisational role. The structuralist is criticised for treating organisational features as objective realities and for failing to account for the way they are created and maintained (Slappendel, 1996).

Studies that have considered the interaction between action and structural influences on innovation have adopted various strategies to accommodate the theoretical and analytical split. In particular, they usually adopt case study methods and assume that there are both deterministic and voluntaristic aspects of social systems. Amabile's (1988) study drawn from social psychology seems to reflect this view while Van de Ven *et al's*, (1989) study makes reference to the connections between various levels of analysis using a meta-theory to link action-structure across temporal and spatial stages.

Amabile's (1988:122) study is concerned with examining the 'factors influencing creativity and innovation in organisations'. This research integrates a model of individual creativity with a preliminary model of organisational innovation. The model includes the following elements:

(a) The entire process of individual creativity;
(b) All aspects of organisations that influence innovation;
(c) The major phases in the organisational innovation process;
(d) The influence of organisational factors on individual creativity.

Individual creativity is defined in terms of three major components, the first two: domain-relevant skills and creativity-relevant skills reflect broadly cognitive, personal and working styles of individuals. The third, intrinsic task motivation or organisational factors, determine 'the extent to which domain-relevant skills and creativity-relevant skills will be fully and appropriately engaged in the service of creative performance' (p132):

> "What happens in the organisation is significantly influenced by individual creators, but individual creators are significantly influenced by what happens in the organisation" (p150).

The organisational elements thought to impact success are three-fold:

(i) Motivation to innovate;
(ii) Resources in the task domain;
(iii) Skills in innovation management.

Motivation to innovate can have both a positive or negative impact on individual creativity. Resources in the task domain are those elements that aid work targeted for innovation and include material resources or individuals with relevant stocks of knowledge in the task domain. Finally, skills in innovation management relate to management skills and styles at the organisation and project level that are conducive to individual creativity. These elements overlap at the individual and organisational level and reflect *interactivity*:

> "Motivation is the most important of the three components, both for the individual and for the organisation...for the individual, domain-relevant skills and creativity-relevant skills determine what he or she is capable of doing, but the presence or absence of intrinsic task motivation will determine what that individual actually does. The same is true of the organisation. Resources in the task domain and skills in innovation management make innovation possible, but the necessary catalyst is the motivation to innovate, the forward-looking, risk-orientated vision that comes from the highest level of organisation" (Amabile, 1988:155).

Thus, the innovation process is seen to reflect continual 'flows' of influence between the organisation and the components of individual creativity and vice-

versa. Amabile insists that there is interdependence between individual and organisational elements in *enabling* individual creativity. For Amabile, motivation is essential to this process while the maintenance of this motivational variable is dependent upon organisational factors. As a result, although agents are able to conduct innovative activities by virtue of their being domain-relevant skills and creativity-relevant skills, such activities are ultimately enabled because of the intrinsic-task motivation, which reflect organisational factors. Increasing attention is being given to understand the social conditions that facilitate or hinder creativity. Csikszentmihalyi (1988) argues that creativity is not wholly located in individuals. A social psychological view of creativity argues that 'what constitutes creativity depends on the subjective judgements within a relevant field of activity or social setting' (King and Anderson, 1995:64).

The Minesota Innovation Research Program (1989) considered a variety of innovations. Attention was given to the innovation process because the authors felt that 'relatively little attention has been given by scholars to describing the processes by which organisational and technological innovations actually develop and are implemented over time' (Schroeder *et al,* 1989:502). The research program portrayed the innovation process as complicated and multi-faceted. Six core factors (not stages) were identified as influencing the process:

(i) Shocks
(ii) Proliferation
(iii) Setbacks and surprises
(iv) The degree of linking old and new
(v) Restructuring
(vi) Hands-on top management.

Shocks stimulate innovation and can be internal or external to the organisation. They may include new leadership, product failure, a budget crisis, or an impending loss of market share. An innovative idea tends to *proliferate* into a number of ideas during the innovation process. This can include people and transactions thus introducing complexity and interdependence. *Setbacks and surprises* are seen to be an inevitable aspect of the innovation process that can

constitute instances of organisational learning. As the innovation develops *new* activities will eventually be linked with the existing or *old* activities of the organisation. *Restructuring* of the organisation can happen taking a number of forms including joint ventures, changes in organisational responsibilities, use of teams and so on. Finally, *hands-on top management* involvement is seen to be important throughout the innovation period. These factors are seen to be complex and 'messy' which cannot be placed in discrete stages. Hence, an explanation of the various findings reported in the study is beyond a single theory. Instead, the authors develop a meta-theory to explain the experiences of the researchers (Van de Ven *et al*, 1989).

The development of a meta-theory reflects the various development models; historical, functional and emergent adopted by the researchers in reporting their findings. The adoption of the most appropriate model is influenced by 'the existence of rules and programs in the innovation's institutional context, and by how the innovation process is structured by key actors' (Van de Ven *et al,* 1989: 650). The innovation process reflects two key factors (local/global) an actor's schemata that organises those innovative activities and the institutional context that plays a crucial role in the creation and alignment of the schemata. The meta-theory is used to specify the appropriate explanatory models (historical, functional or emergent) to be used according to specific situations (local/global). Each model may be changed according to three switching rules (type, temporal and spatial) therefore identifying the points at which differing levels of analysis might be most appropriate (Van de Ven *et al,* 1989). A meta-theory of innovation is determined by the circumstances relative to a specific change in context: from local to global and visa-versa. Complexity in innovation is resolved by switching the focus of analysis depending on the situation.

The common theme of these two studies is in treating action and structure as a dualism (Giddens, 1995). Each analysis is clear in stating a connection between the two levels of analysis yet the analytical lens is only ever focused on one or other level at any one time. Although the connection is assumed to be significant these studies provide a rather crude logic (rhetorical rather than substantive) to link each level (see Reed, 1997). There is no sense of the *mechanisms* of social

reproduction, a key consideration in interactivity, even though it is implicit in their analysis.

Philosophically and analytically a way of escaping the determinism-voluntarism schism is to apply a new theory of the action-structure relationship. In doing so, it is necessary to reject two assumptions: (i) that social structures have an objective reality separate from day-to-day patterns of social interaction, and (ii) that social interaction is totally voluntary. Bridging these perspectives requires a re-conceptualisation of entities. To this end, social structures are assumed to be both the medium and outcome of social practice with the analytical focus being placed on the reproduction of social systems. Agency is believed to depend on the 'underlying generative mechanisms that produce manifest phenomena as observable contingent tendencies or patterns' (Reed, 1997:25). Developing an interactive process perspective reflects a concern to show how actions and institutions are recursively related:

> "Institutions set bounds on rationality by restricting the opportunities and alternatives we perceive and, thereby, increase the probability of certain types of behaviour. However, just as perfect rationality is rare, so too is completely bounded rationality. Through choice and action, individuals and organisations can deliberately modify, and even eliminate, institutions" (Barley and Tolbert, 1997:94).

This interpretation of social reproduction is apparent in a range of studies considering innovation and technological change. Thomas (1994) argues for technical determinist and social determinist perspectives to be reformulated to provide a better understanding of technical change:

> "On the one hand, we encounter the idea that technological development goes forward virtually of its own inertia, resists any limitations and has the character of a self-propelling, self-sustaining, ineluctable flow. On the other hand, there are arguments that human beings have full and conscious choice in the matter and that they are responsible for choices made at each step in the sequence of change" (Thomas, 1994:1).

Instead of adopting one or other approach the key objective for Thomas (1994) is to show how they *structure* one another. Consequently, technological change is perceived as an ongoing process of structuring characterised by interaction between the physical requisites of technology and its' embedding in social practices and relationships. Thomas adopting a 'power-process perspective' extends the temporal context of studies beyond capturing a single moment in time or discrete episode of change to take account of the:

> "full range of activities associated with the introduction of new technology, including the identification of problems to be solved and solutions to be attached to problems; the selection among alternative technologies and, within a given technology, among alternative configurations; and finally, the implementation of a chosen technology" (Thomas, 1994:13).

Pettigrew (1987:650) in offering a contextual account of strategic choice deploys a similar method when he links content, context and process. This approach takes technological change as a continuous process which is context driven. Pettigrew (1987) defines context as 'the antecedent conditions of change, the internal structure, cultural and political context within which leadership occurs, as well as broad features of the outer context of the firm from which much of legitimacy for change is derived'. Content and process are understood to be areas of transformation such as technology, and the actions, reactions and interactions of the actors involved (Pettigrew, 1987). Hence, by looking at the content, context and process of change it is possible to illustrate its historical and socially constructed nature. Thomas (1994) takes a similar view arguing that the historical and temporal context influences the structuring of organisation and technology. History or prior choices made by individuals can reflect the dominant ideologies, rules, routines, procedures, norm's and precedents characteristic of an organisation. The social system that binds individuals together and is embedded in the organisational structure not only reflects the goals or interests of specific groups but also indicates levels of dominance in a technical system. The stratification of organisations suggests that individuals from top middle and lower management as well as shop floor workers can have differential influences on the organisational operations in which they participate. The structuring of organisations including technology reflects the 'worldviews' or

the 'ensemble of norms, beliefs, expectations that individuals use to explain the world around them' including the organisational rules, rewards, socialisation activities, performance measures social and occupational backgrounds that characterise the work place. The communication of worldviews among agents is political and may reflect tensions in the organisation's social order. According to Orlikowski (1992:399), such an analysis shows 'how different assumptions, knowledge and techniques are embedded in different kinds of artefacts or practices' which may have differential consequences for human action and cognition.

The adoption of perspectives that deal with action and structure marks a significant shift from previous normative-variance approaches because this perspective, what I have termed *interactive,* enables us to show how social orders in organisations are sustained or changed. In this way, notions of conflict, subordination, inequality and domination are favoured to those of linearality and manageability.

2.4 Conclusions

In this chapter I have set out to provide an overview of the organisational innovation literature. This is a partial account of the voluminous studies that have been published since the late 1950s and early 1960s. Within these limits it has been possible to map many of the developments. The decline of normative-variance methods and the rise of process and interactive process perspectives mark a shift in the conceptualisation and research of organisational innovation.

The sociological aspects of innovation have become a focus of attention that has had consequences for its definition and analysis. Complexity remains both conceptually and analytically problematic. In an attempt to make sense of complexity in organisational innovation it has been proposed that process perspectives be developed that are sensitive to the interaction of action and structure.

The key advantage of developing an interactive process perspective sensitive to the idiosyncrasies of organisational innovation is to provide explanations that make sense of rather than simplify complexity. By considering the temporal embeddedness of organisational action in terms of the mediating properties of social structures it is possible to comment on the dynamics of organisational reproduction. To do so means developing a conceptual frame that provides the foundations to explain social reproduction. Instead of giving lip service to interactivity it is necessary to propose concepts that explain and illustrate reproduction.

In chapter three the substantive aspects of innovation and knowledge creation are explored while in chapter four the philosophical and analytical implications of applying interactive process perspectives based around Giddens (1995) structurational theory are discussed.

Chapter Three

The Innovation Process and Knowledge Creation

3.1 Introduction

In the previous chapter I discussed a number of themes around organisational innovation. I concluded by suggesting that a synthesis of approaches would help to improve the explanatory utility of future studies. This was encapsulated in a discussion of the *interactive process perspective*. In this chapter, I consider the constituent characteristics of the *innovation process*.

Building on the insights provided in chapter two it is assumed that innovations are socially made processes (not objective entities) that have to be "unpacked" by agents in organisational settings. To understand organisational innovation it is necessary to consider the antecedents of innovative activities or the agents 'zones of manoeuvre' that enable and constrain the introduction of new ideas, products or processes. In this chapter I outline the social and political dimension of organisational innovation the processes through which change is negotiated and closed (perhaps only temporally) around a particular solution.

3.2 The Innovation Process

As discussed in the previous chapter scholarly interest in innovation has in recent years focused on the innovation process. The assumptions grounding this approach have now begun to shift as linear-stage models are replaced by analyses that try to make sense of complexity rather than simplify it. Robertson *et al*, (1997) provide a recent example illustrating the variety of roles played by networks in the innovation process (also see Robertson *et al*, 2000). They state 'networks' comprise process dimensions defined as the *social activities* undertaken by groups and individuals within and across the firm:

> "Networking involves a search for knowledge and information through the creation and articulation of informal relationships within a context of formal intra/inter organisational relationships" (Robertson, *et al* 1997:1).

They assume that the innovation process involves various phases or episodic activities (invention, diffusion and implementation), recursively not sequentially related through which knowledge is constructed, communicated and exchanged (figure 3.2.1). In this way, innovative activities involve organisational learning the acquisition, sharing and utilisation of knowledge (Hube, 1991).

The *invention* episode is a personalised process through which social interaction is focused on the construction of knowledge (Bijker *et al*, 1987). The main objective of this process is to identify potential network participants who posses the appropriate skills, information and expertise. Having tapped the 'tacit and contextual knowledge of different individuals and groups' formal and informal teams are assembled (on the basis of uncertain reciprocity and trust) to test and validate the knowledge (Robertson *et al*, 1997:8). Parallel to the invention episode is the *diffusion* episode. This involves formal and informal exchanges of information among members of the network (Rogers, 1962; 1983). Boundary spanning individuals play a significant role in translating ideas into locally relevant solutions (Tushman and Scanlan, 1981). Similarly, the *implementation* episode is characterised by the appropriation of knowledge by social groups (Clark, 1987). The 'appropriation' of knowledge involves individuals and social

groups engaged in activities to 'fit' the knowledge with the organisation (Nonaka and Takeuchi, 1995).

Figure 3.2.1 - The Innovation Process

Source: Robertson et al, 1996

This framework is used to structure the following discussion of the innovation process. But before embarking on this synthesis of ideas it is important to note the perspectives discussed in this chapter are introduced for reasons other than for resolving the agency-structure dialectic (although actor-network theory has been interpreted as one way of rejecting the agency-structure divide). Of interest here is the sensitive way the Social Construction of Technical Systems (SCOTS) (Bijker *et al,* 1987) and Actor Network Theory (ANT) literature (Callon, 1991; 1992) deal with how technologies are constructed and negotiated. It may be argued that by couching the present argument in the agency-structure debate the 'complexity' alluded to in this review may be lost by remaining tied to these parameters. However, in order to consider the innovation process it is

necessary to clarify what is meant by process, and to ensure that, the numerous elements that constitute such activities have to be adequately conceptualised (also see chapter four). It maybe by adopting the discourse of agency-structure some doors are closed but it is equally valid to assume that many more may be opened.

3.2.1 The Network Perspective

The network perspective has proven to be a useful tool for expressing relational data amongst objects such as people, groups and organisations joined by a variety of relationships (Tichy *et al*, 1979). Fombrun (1982:280-281) describes it as 'a powerful means of describing and analysing sets of units by focusing explicitly on their inter-relationships', which are 'embedded in a context that both constrains and liberates'. It is based on the sociological tradition that has attempted to investigate and identify the causes and consequences of the structure and patterning of relationships in social systems (Marsden and Lin, 1982; Scott, 1991; Tichy *et al*, 1979).

The different research fields adopting this approach include, the public sector (Kickert *et al*, 1997), the diffusion of innovation (Rogers and Shoemaker, 1971; Robertson *et al*, 1996), the innovation process (Robertson *et al*, 1997; 2000), and knowledge work (Knights *et al*, 1993). Policy networks are defined in terms of the interactions between public and private bodies. This builds on the notion of interdependencies in public policy processes based on the interplay between the distribution of power and dependencies, organisational features and inter-organizational relations. Public management is re-interpreted as 'network management' (Kickert *et al*, 1997). In the case of innovation networks, studies have looked at the role of 'boundary spanners' in transferring information across project, functional and organisational boundaries (Tushman and Scanlan, 1981).

With all sociological traditions the network perspective is characterised by different assumptions about the social world resulting in a pluralism of theories, raising the question of mutual incompatibility or complementarity (Van Poucke, 1980). Differences in approach reflect the various ways authors have attempted

to conceptualise networks. A distinction can be made between those studies drawing on a metaphorical orientation and those that use a mathematical orientation (Conway, 1994). Using a metaphorical orientation provides ways of *picturing* the structure of social reality: an organism in relation to its environment. A mathematical orientation classifies 'the sorts of bonds between individuals and the patterns formed by them, to discover what causal connections there may be between the various patterns and the behaviour of the individuals belonging to the networks' (Van Poucke, 1980:181).

Network studies also reflect two different research traditions: relational and structural (Conway, 1994). A relational network analysis concentrates 'on the pathways in networks and entails identifying the cliques of individuals among the members of a network' (Conway, 1994:73). This actor perspective 'attempts to gather insights into how actors manipulate networks to reach certain aims' (Van Poucke, 1980:182), while the structural perspective, traces the role of structural properties of networks on the behaviour of individuals and organisations (Bott, 1971; Laumann, 1973).

The adoption of a mathematical or metaphorical orientation using structural and relational perspectives respectively reflects a tendency to favour determinist or voluntarist approaches in network analysis. Robertson *et al's* (1997) work finds resonance with the social construction of technical systems literature and Actor-network theory where networks are defined as practical constructions between social and technical aspects of the innovation process. This is termed the enrolment of both human and non-human entities in the configuration of the innovation network. This approach resists the determinists' main premise that component elements of networks have inherent characteristics, by denying the essentialist or *a priori* analytical distinction between the social and technical (Grint and Woolgar, 1997).

Callon's (1991) Actor Network perspective infers that innovation processes constitute *techno-economic networks* (TENs) the intermediaries that circulate and give material content to the links uniting actors. Attention is drawn to the way human agents struggle with one another to 'first determine their existence

and then if that is secured define their characteristics...the outcomes of these struggles depend upon the particular combination of elements in play' (Law, 1986:15-16). Power, from this perspective is the overall effect of a set of strategies rather than being possessed by any one agent or group. This is significant as the innovation process represents the interplay of new and pre-existing or dominant institutional forms and interpretations: agent's actions are never totally voluntary. This is consistent with constructionist work (Bijker, 1987) that highlights the processes through which social structures are embedded in artefacts. In particular, it points to the way actors are differentially enabled or constrained thus alluding to the stratification of social systems (see Reed, 1997).

3.2.2 Social Construction of Technical Systems: A Theory of Invention

A social constructionist perspective uncovers "invisible' criteria and processes inherent in design processes and therefore embedded in particular technology choices' (Clark, 1995:6). Knowledge construction involves heterogeneous actor networks, embracing both human and non-human actors, translating and closing (perhaps only partially) knowledge around dominant interpretations (Law and Hassard, 1999; Law, 1986, 1991; Callon *et al,* 1986).

According to Bijker (1987:182), a theory of *invention* should provide some order to the 'chaos of artefacts, relevant social groups, technological frames, and variation, selection and stabilisation processes' that accompanies the design process of technical artefacts (e.g., Bakelite). Bijker (1987) suggests that there are three types of *developmental situation* that an artefact can be at any one time. The notion of situation is defined in terms of the social group, technological frame and levels of inclusion that orientate the activities of actors. The first situation relates to those occasions where no one social group dominates the design process. Here, the technological frame's of various social groups; the 'techniques employed by a community in its problem solving' (Bijker, 1987:168) remains open to negotiation and persuasion. In this situation it may be that the relevant social groups have yet to establish a coherent technological frame. When they are eventually established such frames represent the 'current theories, goals, problem-solving strategies, and practices of use' of particular

social group's which orientate strategies for resolving problems. In the second situation one social group will dominate drawing as it does on the corresponding technological frame. Bijker (1987:172), argues that 'the concept of technological frame is intended to apply to the *interaction* of various actors. Thus, it is not an individual's characteristic or the characteristic of systems or institutions; frames are located *between* actors, not *in* actors or *above* actors' [italics in original]. In this way, frames represent the *meanings* attributed to new processes. For Bijker (1987:173), 'the inter-actional nature of this concept is needed to account for the emergence and disappearance of technological frames'. Thus, the dominance of any frame illustrates the ascendancy of certain interpretations of a problem that in turn structures the interaction of members of a social group. However, actors will vary to the degree they are included in any one frame while actors will, in principle, be affiliated to more than one frame. The notion of inclusion (partial) reflects the dynamic character of innovation and technological development: *interpretative flexibility* is chronic as actors may draw on goals, problem-solving strategies etc, from multiple frames. Hence, the third situation refers to those occasions where two or more frames orientating social groups vie for dominance. Transition depends on what Bijker (1987:183) terms *stabilization processes* where social groups will try to *enrol* others around its frame. This will include identifying potential network participants (human and non-human) to test and validate knowledge. C*losure mechanisms* (rhetorical) maybe used to substantiate one interpretation at the expense of another.

Bijker provides insight into the way social structures are embedded in technical systems. This indicates how and why innovations take the form they do. By assessing the usually taken-for-granted knowledge about innovations it is possible to appreciate the historical and cultural specificity of technical and social systems. Artefacts are constructed in the course of social life and this 'fabrication' suggests that our interpretations are ongoing, a product of the social processes and interactions that individuals engage. Antecedents represent the structures of legitimacy and power that mediate innovative activities a view echoed in the discussion of techno-economic networks.

3.2.3 Innovation and Actor-Network Theory (ANT)

Techno-economic networks are defined as 'a coordinated set of heterogeneous actors which can include public laboratories, research centres, companies, financial institutions, government, and users' (Callon, 1992:73). Actors participate collectively in the conception, development, production, distribution and diffusion of procedures for producing goods and services.

TENs are organised around three poles: the *scientific pole* which produces empirical knowledge and consists of universities and other independent research centres; the *technical pole* which comprises technical laboratories, pilot plants, development engineers and scientists, which utilise the empirical knowledge for prototypes, models, tests and trials; and the *market pole* which contains users who generate specific demands or needs, and attempt to fulfil them (Callon, 1991). The poles organise actors around particular activities and motives. In addition to these three *supporting pillars* there are two *mediating poles*. The *commercialisation pole* which 'consists of production and distribution activities that mobilise technology to create/satisfy needs' and the *transfer pole* which 'specialises in connecting science and technology' (Laredo and Mustar, 1996:159). The establishment and evolvement of TENs is the product of interaction between the social and the scientific/technological realms involving a number of diverse actors:

> "The processes of production and exchange that we can observe taking place in TENs involve a whole series of intermediation between these poles...The different poles have memberships, goals and procedures which may apparently be mutually exclusive...however, arrangements and links are made between the members of different poles, so that the outputs of various activities are exchanged with the members of other poles" (Callon, 1992:74).

Interaction is dependent on the intermediaries that pass between actors '*which defines the relationship between them*'. Consequently, the relationship between actors and the intermediaries mobilised during interaction is irrevocably tied, such that, '*actors define one another in interaction - in the intermediaries they*

put into circulation' (Callon, 1991:135, italics in original). Callon (1991, 1992) refers to four categories of intermediary when defining the relationship between actors: *Texts* or literary inscriptions include anything that is written, such as advertisements, reports or software. *Technical artefacts* are non-human entities that facilitate functions and tasks such as hardware, prototypes, machines etc. *Skills* of human beings and the knowledge they generate and reproduce. And *money,* in whatever form including subsidies and loans etc. TENs will usually consist of varying combinations or hybrids of intermediaries' human and non-human, individual and collective entities.

In considering TENs Callon distinguishes between *actor* and *intermediary*. This distinction gives notice that all interactions reflect some form of authorship i.e., '*an actor is an intermediary that puts other intermediaries into circulation*' (Callon, 1991:141, italics in original). Actors are set apart from intermediaries by the fact that actors, as authors, impute intermediaries in relationships:

> "an actor is an entity that takes the last generation of intermediaries and transforms (combines, mixes, concatenates, degrades, computes, anticipates) these to create the next generation. Scientists transform texts, experimental apparatus and grants into new texts. Companies combine machines and embodied skills into goods and consumers. In general then, actors are those who conceive, elaborate, circulate, emit, or pension off intermediaries" (Callon, 1991:141).

Although the process through which actors attempt to define their relationship and identities with other intermediaries is uncertain, open to doubt and controversy it does represent the evolvement of a set of equivalences and alliances around a particular scenario which carries the *signature of its author.* In this way, an actor is also a network (hence the term actor-network) that is actively seeking other entities to embark upon a set of clearly defined relationships (Callon, 1991). The emergence of a TEN around a clear set of equivalences and definitions is a complex endeavour. This process termed translation involves several overlapping, reciprocal and continuous dimensions: *problematisation, interessement, enrolment* and *mobilisation. Problematisation* is the dimension during which one or more actors (institutions) work together to

define and explore a problem. *Interessement*, is the dimension during which actors who believe they have a relevant solution to a problem are able to persuade others to agree with their definition and gain agreement to collaborate in pursuing that favoured solution. *Enrolment* is the dimension during which various co-ordinating mechanisms and procedures are established to build and maintain the running of the network. *Mobilisation* is the dimension during which rules and methods are employed to sustain the network (Callon, 1986; 1991). In this way, 'a concern with translation focuses on the process of mutual definition and inscription' (Callon, 1991:143); it takes the multiplicity of entities and equivalences and maps the interplay of definitions inscribed in the various intermediaries that constitute an actor-network. However, this process is not simple, as many problematisations may exist at any one time:

> "It...means to interfere with a message, to distort information. Interference can go on forever criticisms and reactions to them form a branching chain, which is never broken - unless the parasite devours its host. And this occurs when one problematisation succeeds in destroying that which it was criticising" (Callon, 1981:217).

As with Bijker's (1987) analysis this approach assesses the way networking activities translate ideas into reality (Knights *et al,* 1993; Hennert, 1993). The intention is not to treat technical systems as different from social systems (Grint and Woolgar, 1997), rather, it is to make sense of the *form* of social interaction that constitutes simultaneous moments of negotiation, problem defining and construction. Although, the work of Bijker concentrates on the design process (invention), both are useful in the way they suggest that the constitution of innovations may only ever be partially closed; translation is a recursive process that 'spills-over' into diffusion and implementation. Construction, communication and exchange of knowledge can 'breakdown' at any point during translation. At such times, translation turns into 'treason' (Callon, 1986). This is likely to happen at any point during the innovation process.

3.2.4 Innovation: Diffusion and Implementation

If innovations are never totally 'closed' in their use (Grint and Woolgar, 1997) then it is necessary to understand how innovations are unpacked during the diffusion and implementation (appropriation) phases. Work on the diffusion of innovation is most commonly associated with Rogers (1962, 1983). In both pieces of work Rogers suggests that diffusion involves formal and informal exchanges of information and knowledge among members of a network. Making sense of such links has and continues to interest academics for example, Granovetter's (1973) study of strong and weak ties in promoting the exchange of new ideas and Conway's (1994,1995) mapping of informal links in successful technological innovations (Steward and Conway, 1996). Although, scholarly interest in diffusion usually takes its cue from the work of Rogers (1962; 1983), this has been criticised (Clark, 1987) and such criticisms provide an important juncture in the promotion of ideas around an interactive process perspective. In Rogers' first work on *'The Diffusion of Innovations'* (1962) attention was given to the supply side of the diffusion of innovations. The diffusion model of Rogers (model 1) provides a causal map for arranging the efforts of change agents to ensure the successful diffusion of different types of innovation. The original audience of the model was the American agricultural extension agency. Its main aim was to promote best practice among American farmers. Rogers' model was based on the following assumptions (implicit) (Clark, 1987:70):

(i) Innovation is an object
(ii) Innovation is best policy
(iii) The user is a passive agent in the whole process
(iv) The supplier designs the innovation and provides objective, neutral data about it
(v) The innovation remains largely static
(vi) Diffusion occurs through contagion

This model relies on a fairly narrow view of innovation taken as it is from a *supplier perspective*. In particular, treating innovations as objects ignores the view that artefacts are socially made durables. In doing so, Rogers' (model 1)

fails to consider how innovations are unpacked during diffusion and ignores to question whether innovations are appropriate in all cases. Adoption is seen as a simplistic task characterised by imitation (Clark, 1987). In his second work (model 2) Rogers (1983) maintains a preference for assessing the supply side of the diffusion process. However, a number of revisions are proposed (Clark, 1987:70):

(i) A limited analysis of the generation of innovations is offered
(ii) The organisation context which leads to a re-conceptualisation of the collective processes of decision making is considered
(iii) It is recognised that innovations are sometimes modified by the user in a process called re-invention
(iv) The consequences, positive and negative, of adoption are examined

Perhaps the most significant shift is the acknowledgement that diffusion involves the 'active' participation of users. Rogers effectively distances himself from the imitation paradigm and begins to attend to the dynamics of the supplier-user junction. Hence, users reconfigure innovations to better match their own organisational context. Even with these revisions other less satisfactory assumptions are carried-over from the first model. In particular, the rationale for innovative activities continued to be thought of simply as meeting needs and solving problems. The possibility that such activities might be associated with other social pressures is not considered (DiMaggio and Powell, 1983).

Problems with implementation are given greater attention by Clark (1987) in his discussion of appropriation. Appropriation is at one end of the *implementation* continuum illustrating how users differentially ingest and develop innovations. According to Clark (1987:155), there are three degrees of appropriation:

(i) Failure to adopt
(ii) Partial imitation
(iii) Appropriation

In the first instance, 'failure to adopt' represents those occasions when users are unable to make the innovation operable. In the second case, 'partial imitation' is where the innovation is adopted in its most basic guise. In the final situation, 'appropriation' involves a complex process where the user is able to bridge the gap between the innovation and the firm's ability to develop it to meet its specific needs. This is rare:

> "The objective of the user should be to appropriate those innovations which are essential to its core skills and from which it can derive benefits. However, appropriation implies the continual, cumulative and incremental modification of an original innovation in all its details" (Clark, 1987:157).

In developing a model of the innovation process it is necessary to appreciate those features of the firm that enable and constrain knowledge construction, communication and exchange. As previously suggested such processes are historically and culturally contingent. Innovative activity depends on the 'antecedents, starting points and existing capabilities' of the firm (Clark, 1995). A firm's ability to *appropriate* new knowledge will depend on the 'finite' capabilities of the organisation.

3.2.5 Innovation: Institutional forms and finite capabilities

Clark (1985) proposes a theory of structural activation to make sense of innovation and organisational change. Organisational capabilities represent firm specific knowledge. This knowledge constitutes an organisational repertoire and co-ordinates (Clark and Staunton, 1993:184-185):

(i) Everyday activities
(ii) Activities associated with change
(iii) Activities undertaken in response to special situations

These actions come into play at different times and places and may vary to the degree they are embodied in the companies operational units. An organisational repertoire is made up of a combination of *poses*. For example, when an

organisation is handling the 'introduction of different forms of operating...which orient the adaptive capability [of the organisation] towards future problems' (Clark and Staunton, 1989:185), it is likely to adopt an *innovation pose* in conjunction with its everyday activities (i.e., basic operating pose). As shown in figure (3.2.2) the introduction of an innovative product or process may effectively transform the existing basic operating pose of the repertoire. Moving from the top left corner to the bottom right corner the diagram illustrates the multiple activities associated with innovation in an organisation - the transformational *and* ongoing activities associated with transformation and the provision of services and products.

Figure 3.2.2. Transformational Change of Organisational Repertoire

Source: Clark (1987:11)

Change in the repertoire (partial or total) is not guaranteed because it represents an attempt to alter the organisation-specific practices previously embedded in its operating procedures. New practices may be compromised because of resistance or because of an absence of knowledge to make sense of and mobilise the new procedures and equipment. Therefore, an investigation of

transformational change is dependent on showing how the *existing* features of the repertoire, expressed through a particular operating pose embedded in the organisations social and economic context provides the means to undertake these activities. According to Clark (1987:51), this is achieved by making sense of uncertainty:

> "the degree of uncertainty embodied and embedded within an innovation, and the extent to which users already possess levels of knowledge and skill which enable them to systematically encode the uncertainty and to devise means for handling its level".

An organisation's ability to deal with this uncertainty depends in part on those skills, resources, rules, normative frameworks and knowledge that define the organisation and allow it to undertake some actions and not others. Thus, It depends in part on the extent to which the innovation can be unpacked and the extent to which individuals have the necessary skills and knowledge to do so. Introducing innovations in an organisation will depend on the 'configuration of forces and the relations of tension between pre-existing social groups and individuals' (Clark, 1996). The context of these activities are key because the actions of individuals will be 'ring-fenced' so that pre-existing organisational arrangements constrain innovative activities; institutional forms represent the *zones of manoeuvre* within which agents can move. The effect of such features can be illustrated with reference to the notion of a 'template'. This encapsulates a special case of situated practice and habitus such as those found in weddings and sports:

> "Each of these consists of a replicable sequence of actions derived from a known generative pattern which is sufficiently articulated, embodied and portable to be utilised by competent bearers of the template when they and their constituency require. Templates are generalised cognitive frameworks used to impose an orientation on action and to give those actions legitimacy and meaning in some particular domain. Templates cue and are cued by affect and behaviour" (Clark, 1995:11).

The templates exhibited at weddings and sports are usually tight. However, templates can change depending on the particular context within which they are introduced. Exporting rugby union from Britain into America being an example.

Appropriating such practices may result in a change to those practices (i.e., template) reflecting the zones of manoeuvre accorded to agents in particular contexts:

> "when American middle classes sought to play these sports they brought the British templates into a context with distinctive power balances, tensions, conflicts, constrains and dependencies. The outcome was more like American football" (Clark, 1996:9).

Further appreciation of how structures influence the innovation process can be gleamed from institutional theory. Much of this work has suggested that even when innovations are undertaken successfully they may not be effective and may only have been 'sought and imposed because of the fit with the logics of legitimacy and existing meaning systems' (Clark, 1995:3). Such an analysis calls into question the explanatory utility of studies based on notions of rational organisational decision-making that link innovation and efficiency.

3.2.6 Institutionalisation and the Innovation Process

Scholars of institutional theory (e.g., Meyer and Rowan, 1977; Zucker, 1977; DiMaggio and Powell, 1983; Powell and DiMaggio, 1991) have shown how cultural influences or social structures impact the decision-making and formal structures of institutions. Institutional theory 'holds that organisations, and the individuals who populate them, are suspended in a web of values, norms, rules, beliefs, and taken-for-granted assumptions, that are at least partially of their own making' (Barley and Tolbert, 1997: 93). In this way, institutions constrain the activities of agents and groups although such constraints maybe modified in time. Institutions are therefore defined as '*shared rules and typifications that identify categories of social actors and their appropriate activities or relationships*' (Barley and Tolbert, 1997:96, italics in original). Social order is brought about by the application of rules and routines, although 'the creation and implementation of institutional arrangements [is] rife with conflict, contradiction, and ambiguity' (Powell and DiMaggio, 1991:28). Institutionalism draws attention to the role of powerful actors, the state, professions, or dominant agents in influencing the activities of individuals, groups and organisations. It rejects positivist/functionalist views of organisational structure that assume structures to

'reflect organisational decision-makers rational efforts to maximise efficiency by securing coordination and control of work activities' (Tolbert and Zucker, 1997:177).

Criticism of this orthodox approach is associated with the work of March and Simon (1958) who suggests the rationality of organisational decision-makers' is limited. Advocates of institutional theory have begun to question the limits of autonomous decision-making. This stands in stark contrast to rational-actor or functional approaches that have stressed the importance of 'social influence processes, such as imitation or normatively based conformity' (Tolbert and Zucker, 1997, DiMaggio and Powell, 1991). In considering the limits of autonomous decision-making institutional theorists suggest that decisions to adopt formal structures may have little to do with deficiencies in the organisation (Meyer and Rowan, 1977). In fact, an organization's structures may be changed in response to external social influences and not because of problems with production or efficiency. Consequently, the survival of an organisation may have more to do with other sources of influence that shape organisational reality:

> "Independent of their productive efficiency, organizations which exist in highly elaborated institutional environments and succeed in becoming isomorphic with these environments gain the legitimacy and resources to survive" (Meyer and Rowan, 1977:352, cited in Tolbert and Zucker, 1997).

In criticising the positivist/functionalist view of formal structure institutional theorists have begun to question what it is to be 'institutionalised'. Although there are ambiguities in the institutional literature about this (Tolbert and Zucker, 1997:179) it is reasonable to assume that to be institutional, structure must generate action. Implicit in this interpretation of organisational behaviour is the intersection of social structures and agency. Institutional theorists acknowledge that although 'institutions set bounds on rationality...through choice and action, individuals... can deliberately modify and even eliminate institutions (Barley and Tolbert, 1997:94). Institutional theorists drawing on Berger and Luckmann (1967) emphasise that antecedent interpretations of organizational behaviour mediate future interactions and negotiations. To this end, DiMaggio and Powell (1983) posit the notion of institutional duality: institutions are the medium and

outcome of social action (see Barley and Tolbert, 1997). The notion of duality is preferred to dualism and shares assumptions with social theorists (Bhaskar, 1984 and Giddens, 1995) and institutional theorists alike (Clark, 1987, 1995, 1996):

> "So far orthodox processual approaches in organisational studies have been very static, over-simplistic and have failed to deal with human agency. Yet an alternative approach to process is beginning to emerge. The alternative builds on the theory that structure and agency are a duality. That is, individuals as active human agents are both influenced by pre-existing forms of structuring, yet at the same degree empowered to interpret what should be done in the future. The theory of structure and agency presumes that individuals learn a collective repertoire of cognitions normative frameworks and behavioural patterns. The repertoire consists of dormant aspects and active components rather in the same way an American football team possess a repertoire" (Clark, 1987:9).

It is proposed that innovation is uncertain, dynamic and specificity contingent: (i) from the point of view of the user the shape and uses of an innovation of any kind are normally problematic; (ii) innovations are sets of ideas with both technological and organisational dimensions which are embedded in distinct socio-cultural settings; (iii) innovations are typically combinations and consolidations of many diverse elements; (iv) innovations are best conceptualised as bundles of elements with varying degrees of tightness and looseness. The generators of an innovation may consider the bundle to be tight, whilst the users may well prise it open and make a quite distinctive series of uses; (v) the users make significant and extensive contributions to the eventual shape and uses of an innovation; (vi) innovations are shaped by the unintended configuration of contending groups who surround their construction and adoption; (vii) innovations vary in the degree to which their initial, founding conditions affect their subsequent stretching and evolvement; (viii) innovations are often temporary solutions to an array of inter-connected pressures; (ix) the organisational context of innovations is often highly differentiated so that the struggles between contending groups and strata operate on the innovation long after its apparent introduction into any setting; and (x) innovations are influenced by contextual factors (Clark, 1987:168-169).

The various phases of the innovation process represent an ensemble of activities that overlap and transform. The expected outcomes of these activities are not guaranteed and may well be impossible given the finite capabilities or antecedents of the firm. When change does occur this may be temporary. Hence, to appreciate the innovation process it is necessary to account for its dynamic contingent specificity. The actions of change agents can only be appreciated in relation to the socio-setting that mediates the systems of meaning, legitimises and sanctions such actions.

3.3 'Knowledge' and knowledge creation

In the discussion so far innovation has been located around three recursive phases or episodes. The invention phase is when knowledge is *constructed* and *communicated*; the diffusion phase is when knowledge is *exchanged*; and the implementation phase is when knowledge is again subject to *construction* and *communication*. The coupling of innovation and knowledge is central to an understanding of the innovation process. Thus, to analyse innovation is to understand the 'dynamic unfolding of the relationship between disembodied and embodied knowledge' (Clark and Staunton, 1989:59). Nonaka and Takeuchi (1995) provide a similar viewpoint in their evaluation of innovation in organisations. They state that the knowledge creation process involves the mobilisation and conversion of tacit knowledge into explicit knowledge and then back into tacit knowledge. Core to this process is the cognitive content of innovation its meaning, commitment and action. Instead of treating knowledge as 'absolute, static and non-human' knowledge is seen as a 'dynamic human process of justifying personal belief toward the "truth"' (Nonaka and Takeuchi, 1995:58). The emergence and evolvement of innovation involves individuals and groups enlisted in activities to ensure interpretative closure around certain constructions of problems and solutions, which are eventually embodied (perhaps only temporally) in some form of technological or social system.

Knowledge or expertise is not only a source of competitiveness it is also the source of resistance. Scarbrough (1996:4) says the management of expertise 'has emerged as a crucial modality of organisational life; that is, both the

driver of change, but equally the biggest barrier to it'. Doctors' resistance to change in the NHS is an example. For Scarbrough (1996) perspectives on expertise have seen a shift of emphasis away from a professional model. With the effective marketisation of expertise and its codification the dominance of professional groups' access to and control of knowledge has been undermined. Knowledge production has also changed so that 'the distance between the locus of invention and the locus of use' has been significantly reduced, while disciplinary knowledge has been replaced by transdisciplinary knowledge. Experts are expected to externalise their knowledge into the context of marketing and use' (Scarbrough, 1996:26). Accordingly, expertise has increasingly come to be seen in economic terms. The multidimensional character of expertise advocated by Scarbrough (1996) is represented in figure (3.3.1). Expertise or knowledge is not only a political contingent phenomena that has increasing economic value it is also the media through which knowledge, economic value and social relations are reproduced:

> "although I have noted the politicality of organisational change in the NHS, the politics of expertise here are not simply a clash of different vested interests. They are being driven by an explicit economic agenda to do with market disciplines and are being worked through by subtle changes in the knowledge base of doctors" (Scarbrough, 1996:27).

The accumulated affect of such shifts is the way knowledge work has become increasingly contingent on local circumstances and less with the wider institutional influences associated with the professional model of expertise. To this end, the organisation of expertise reflects the interdependence of control and exchange relations and its 'communicability' (Scarbrough, 1996:225):

> "The distinctive importance of communication applies with particular effect to innovation projects. The latter involve a complex simultaneous equation in which social actors develop effective means of communicating their respective knowledges, define and order their different interests and relationships, and do so, moreover, in such a way as to incentivise both through the prospect of shared economic gains. Thus the expert groups involved in these projects gradually delimit the rules, relationships and rewards of the innovation process at the same time as communicating and sharing the relevant knowledges".

Figure 3.3.1 - A Perspective on Expertise

Source: Scarbrough (1996:27)

The methods of communicating knowledge can take on many different forms depending on the 'strategies of social closure' adopted by the individuals and groups involved. Scarbrough (1996:224) proposes three methods:

(i) *Professionalism*: the communication of knowledge through its embodiment in the learning and experience of individuals and groups

(ii) *Objectification:* the pursuit of portability and universal applicability through standardisation

(iii) *Organisational sedimentation:* the communication of knowledge via rules, standards, routines and structures.

Strategies of social closure reflect different contingencies associated with economic exchange and social control (figure 3.3.2). The taxonomy ('black boxing', 'hostage' and 'prisoner') produced by Scarbrough (1996) indicates the relationship between social closure, transactions and communicability. In the case of black boxing, knowledge is codified in artefacts so that there is minimal reliance on social relations. In contrast, the hostage strategy reflects an attempt

to ensure greater reciprocation between supplier and user of knowledge while the prisoner strategy reflects those instances when social control is greatest in the host organisation.

Figure 3.3.2 - Continuum of transactions and strategies of social closure in organising technical knowledge

Source: Scarbrough (1996:227)

The articulation of technical knowledge or innovation ultimately reflects the interplay of tacit (disembodied, intangible assets and working practices) and explicit knowledges (embodied technologies) (David, 1992; Howells, 1995). For Nonaka and Takeuchi (1995:62), the innovation process consists of 'interaction between tacit and explicit knowledge' while Leonard and Sensiper (1998) note the significance of tacit knowledge in organisational learning a view supported by Bessant and Buckingham (1993) in a study of the implementation of advanced manufacturing technology.

Tacit knowledge is understood to be 'non-codified, disembodied know-how that is acquired via the informal take-up of learned behaviour and procedures' (Howells, 1995:2) (see Polyani, 1962,1966). Acquisition of tacit knowledge is

generally acknowledged to be difficult requiring as it does changes in the behaviour of the acquirer. Those elements considered critical to the acquisition of tacit knowledge are reflected in the directions of the many studies in this field: 'learning by doing' (Arrow, 1962), 'learning by using' (Rosenberg, 1982) and 'learning to learn' (Stiglitz, 1987). Thus, tacit knowledge is acquired through the membership of multidisciplinary teams and collaborative networks usually forming part of a general process of organisational learning routines (Nelson and Winter, 1982) that help create and diffuse firm-specific competencies and knowledge (Howells, 1995).

Given the significance of tacit and explicit knowledge it is perhaps appropriate to treat innovations as configurations or as a 'bundle of elements' (Clark and Staunton, 1989:55). Bundles consist of disembodied knowledge that varies to the degree it is embodied or codified. Hence, knowledge in the 'innovation configuration' consists of four features:

(i) Its plurality and diversity
(ii) Its enormous growth
(iii) Its codification
(iv) Its embodiment

In the first instance, the *plurality* and *diversity* of knowledge is associated with the notion of 'logics of action' (Karpik, 1978). For Clark and Staunton (1989) the work of Karpik (1978) illustrates the way enterprises consist of 'firm specific knowledge' or a 'cognitive dimension' (e.g., tacit knowledge) that provides them with a competitive edge. However, as they go onto suggest an organisation may have difficult in revising and updating this knowledge. In the second instance, the *growth* of knowledge in the twentieth century is reflected in the coming together of science and technology through R&D (Freeman and Soete, 1997). In the third instance, the *codification* of knowledge or its conversion from tacit to explicit (Nonaka and Takeuchi, 1995) is a continual process of accomplishment. In the fourth case, the *embodiment* of knowledge represents its incorporation in a number of forms:

(i) Equipment
(ii) Raw materials
(iii) The built environment
(iv) Standardized operating procedures (Clark and Staunton, 1989).

The innovation configuration is a 'significant investment in *systems of classification* which is the precise equivalent of the investment in equipment' [italics in original] (Clark, 1995:12-13). What is more, the nature and outcome of such investments can be remarkably varied not just radical as is sometimes assumed (Rogers, 1986). Here, it is suggested that innovations are to be found at different points on the 'radical/incremental continuum' (Clark and Staunton, 1989):

- Radical-altering innovations reshape existing organisational configurations. The introduction of markedly different equipment, raw materials, forms of knowledge, and physical contexts result in existing competencies becoming redundant and established directions being reversed.
- Incremental-entrenching innovations build on existing directions. Equipment is modified rather than replaced while knowledge is extended and reinforced (Clark and Staunton, 1989:80).

The outcome will depend on the purpose for which the innovation is intended and the context into which it is applied (Abernathy and Clark, 1985). To this end, innovations will have an affect on two other dimensions: (i) production systems and their operation and (ii) linkages between the firm and its consumers and markets and is depicted as an *innovation matrix* in figure 3.3.3. There maybe instances when innovation entrenches the market linkages while altering production linkages (Clark and Staunton, 1989). The difference between entrenching and altering innovations is in the way they transform the organisational repertoire. This is understood by contrasting the extent knowledge is introduced or existing configurations are reconfigured.

Figure 3.3.3 - The Innovation Matrix

Source: Clark, K.B. (1985) cited in Clark and Staunton, 1989.

Whether radical or incremental, innovation involves constructing knowledge. For an appreciation of the mechanics of this process Nonaka and Takeuchi's (1995) account of organisational knowledge creation in Japanese firms is useful. Here knowledge is converted from tacit into explicit and back into tacit knowledge and represents a 'spiral' with four specific modes:

(i) Socialisation
(ii) Externalisation
(iii) Combination
(iv) Internalisation (figure 3.3.4).

Figure 3.3.4 - The Knowledge Spiral

Source: Nonaka and Takeuchi (1995:71)

These modes rely on five core conditions to allow for individual knowledge to be articulated and "amplified" into and throughout the organisation.

(i) Intention
(ii) Autonomy
(iii) Fluctuation and creative chaos
(iv) Redundancy
(v) Requisite variety.

These modes of conversion and facilitating conditions act in combination during the five phases of the knowledge creation process (figure 3.3.5):

(i) Sharing tacit knowledge
(ii) Creating concepts
(iii) Justifying concepts
(iv) Building an archetype
(v) Cross-levelling knowledge

Figure 3.3.5 - The Organisational Knowledge-Creation Process

Source: Nonaka and Takeuchi (1995:84)

Amplification represents a conversion process whereby knowledge spreads through the organisation as a direct result of social interaction involving the sharing of tacit knowledge and creation of explicit knowledge. The shift from tacit toward explicit and then back to tacit (figure 3.3.4) involves a complex process of generating *fields of interaction,* formalising these *mental modes,* creating new *explicit concepts* and then finally combining or *codifying* these concepts into the knowledge system. This process is significant because 'when experiences through socialization, externalisation and combination are internalised into individuals tacit knowledge bases in the form of shared mental modes or technical know-how, they become valuable assets' (Nonaka and Takeuchi, 1995:69).

These activities are represented as a five-phase model (figure 3.3.5) and are dependent on 'enabling conditions' brought to bear in differing combinations. For illustration it is useful to consider the first two phases. *Sharing tacit knowledge*

usually involves a multidisciplinary team ('requisite variety') through which a wide range of mental modes and information ('redundancy') is shared and used to make sense of an organisation's goals ('intention'). Socialization is facilitated by the goals set ('creative chaos') and teams are given the freedom ('autonomy') to develop interpretations and concepts. During the second phase *creating concepts*, is facilitated through dialogue. Once again, the 'autonomy' of the group is thought to be an important contributing factor to the team's ability to consider multiple options. In doing so, 'requisite variety' provides a broad scope of perspectives that can be used to reframe existing notions and mental modes. 'Fluctuation and chaos' may offer junctures necessitating re-evaluations of perspectives, while 'redundancy' provides the flexibility associated with multiple mental modes to be able to crystallize core interpretations. The framework provided by Nonaka and Takeuchi (1995) provides useful insight into the design process and indicates changes in *knowledge* during innovation processes. However, although they begin to develop ideas around the flow of activities (i.e., the product development process emerging from the constant interaction of the multidisciplinary team) they are locked into 'limited perspectives of knowledge' (Scarbrough 1996:27). By overemphasising both the cognitive (i.e., espoused beliefs) and formistic (i.e., tacit and explicit) ideas of knowledge they lose sight of its dynamic and cultural nature (i.e., actual practice) (Moss, 2000). In contrast, and coinciding with the insights drawn from the SCOTS and ANT literatures it is perhaps more useful to consider knowledge as 'multifaceted and complex, being both situated and abstract, implicit and explicit, distributed and individual, physical and mental, developing and static, verbal and encoded' (Blackler, 1995:1030). Nonaka and Takeuchi's (1995) tell us little of the politics of 'closure' which is problematic because attention is seemingly not given to the likelihood that knowledge is as much a source of resistance as the enabler of change (see Scarbrough, 1996).

3.4 Conclusions

Conceptualising the innovation process in terms of the networking activities incumbent of the three-recursive phases (invention, diffusion, implementation) is deliberate. It offers scope to develop a critical interpretation of innovation:

(1) An analysis of the innovation process should consider the ensembles of un-embodied and embodied knowledge (social and technical ware) constituting the TCS programme;

(2) Likewise it is necessary to identify the finite capabilities and zones of manoeuvre representative of the host firm (*organisational repertoire*) in order to take into consideration the scope for appropriation;

Developing these ideas facilitates the view that organisational innovation is a negotiated activity that is dynamic and specificity contingent.

(3) Explaining the innovation process means making sense of the way agents unpack the TCS project (tasks). The organisational repertoire may enable or constrain the appropriation of the innovation.

(4) Innovations may be radically altering, incremental-entrenching or some mix of change and embedding. These may have differing implications for the existing configuration. Transformation may be more problematic if it is seen to be a threat to existing social relations and hierarchies.

Such activities may not be undertaken for reasons of efficiency or productivity although they may be presented in such terms. Instead, innovative activities might be a response to broader social influences of which academics, managers and employees are unaware. Innovative activities are mediated by social structures. In turn, these structures can be transformed during such activities. To do so means changing the 'shared rules and typifications that identify categories of social actors and their appropriate activities or relationships' (Barley and Tolbert, 1997:95). Change in this sense refers to those ongoing processes that ensure the reproduction of social systems.

(5) An analysis of the innovation process is based on the assumption that the organizational repertoire is the medium and outcome of social practice. Any changes to the repertoire will only be enduring if the

structures mediating the innovation are successful transposed into the repertoire. If not, innovation will be partial and temporary.

(6) Agents may adopt a range of strategies to ensure interpretative closure around preferred technical and social frames. Although this process of closure may be temporary it is illustrative of the dynamic negotiated nature of innovation where the positioning of agents in social networks illustrates asymmetries of power in the innovation process.

The present literature review provides a range of conceptual tools to help sensitise the research process. In combination with the discussions in chapter two this review provides the necessary interpretative mechanisms to represent and interrogate the substantive parts of the innovation process. Without an appreciation of the dynamic and social elements to knowledge creation and the institutional characteristics and processes of transforming social structures it would not be possible to develop a balanced yet critical interpretation of organisational innovation. The relationship between action, structure and system reproduction is the subject of the following chapter.

Chapter Four

New Directions in the analysis of Organisational Innovation: Issues in Meta-theory and Methodology

4.1 Introduction

In the previous chapters I argued that an interactive process perspective offers a suitable direction for improving our understanding of organisational innovation. To develop an interactive perspective it is necessary 'to confront a set of issues that irrevocably defines the constitution of [the] subject matter and the analytical and methodological terms on which it is to be researched and explained' (Reed, 1997:21). Presupposing interactivity is only sustainable if the meta-theoretical methodological discourses grounding the majority of organisation studies are reconsidered. Here, I offer an alternative view to the usual commentaries found on meta-theory in the organisational literature (Burrell and Morgan, 1979) by exploring critical theory (Bhaskar, 1984; 1986; Giddens, 1995).

The conventional literature on the philosophy of the social sciences has for too long confined philosophical discourse about the nature of social reality to

the 'subjectivist-objectivist' polarisation. Polarisation has tended to feed the view that there is only one scientific method (statistical modeling). This has resulted in qualitative research being thought of as heuristic tool. In contrast, critical realism as a post-empiricist philosophy of science offers a mediating position that incorporates both analytical and interpretative elements of social analysis. For instance, the usual distinction made between quantitative and qualitative methods is criticised for wrongly focusing on the 'techniques through which social life is represented in the course of research' rather than 'the process of representing social reality' (Morrow, 1994:208). It follows that what is important is the origin of the research logics that informs our portrayal of social reality and the research techniques used. Critical realism combines emancipatory and critical disciplinary interests found in sociological theorising with a methodological pluralism. A critical-dialectic perspective based on the interactivity between action and structure is the result.

Critical realism has a distinct methodological strategy and unique research programme that is based on a revision of the philosophical, empirical and normative dimensions found in the social sciences. The issue of *methodology* is the subject of the following sections.

4.2 The Conventional Approach to Methodology

Methodology in the philosophical sense constitutes the interplay of three theoretical languages: *Meta-theory*, which relates to the pre-suppositions or theoretical strategy supporting a particular view of the nature of social science; *Empirical theory*, which relates to particular notions of explication and analysis or methods and *Normative theory*, which relates to a distinctive research logic for constructing specific types of knowledge (Morrow, 1994). These theoretical languages constitute the discursive terrain on which critical, positivist and humanist theory is understood and legitimised.

The seminal contribution of Burrell and Morgan's (1979) *'Sociological Paradigms and Organisational Analysis'* provides perhaps the most familiar benchmark to

organise the subjectivist-objectivist assumptions and analytical strategies in organisational analysis. This thesis explicates the interplay between a number of meta-theoretical domains and theories of society and is used here to locate critical realism in respect of other approaches. Such constructs are by their very nature simplifications of diverse perspectives. This can be problematical as the lines of difference maybe simplified. However, if used in a cautionary way these methods can offer a useful tool for discussion and explication. It is with this in mind that I use Burrell and Morgan's (1979) framework.

Figure 4.2.1: Meta-Theoretical Positions in Contemporary Social Research

Subjectivist Approach		Objectivist Approach
Nominalism	**ONTOLOGY**	'Naive' Realism
Anti-positivist	**EPISTEMOLOGY**	Positivist
Voluntarism	**THEORY OF ACTION**	Determinism
Ideographic	**THEORY OF EXPLANATION**	Nomothetic

Adapted from table in Burrell and Morgan (1979:3)

Typical meta-theoretical positions in contemporary social research concerns the subjectivist-objectivist split in four domains:

(i) Ontology
(ii) Epistemology
(iii) Human nature (theory of action)
(iv) Methodology (nature of explanation) (figure 4.2.1).

Ontological assumptions are those that 'concern the very essence of the phenomena under investigation' (Burrell and Morgan 1979:1). There are two opposing positions in the conventional literature on ontology in meta-theory: nominalism and realism. The term 'naive' realism is used here (the term naive was not used in the original thesis) to draw attention to the fact that there is more than one interpretation of realism. The 'nominalist' (subjectivist) position is based on the assumption that:

> "the social world external to individual cognition is made up of nothing more than names, concepts and labels which are used to structure reality. The nominalist does not admit to there being any 'real' structure to the world, which these concepts are used to describe. The 'names' used are regarded as artificial creations whose utility is based upon their convenience as tools for describing, making sense of and negotiating the external world" (Burrell and Morgan, 1979:4).

In contrast, 'naive' realism (objectivist) takes the opposing ontological stance. From this perspective it is assumed 'the social world has an existence which is as hard and concrete as the natural world' (Burrell and Morgan, 1979:4). Empirical facts exist independently of an individual's appreciation or consciousness of them. This underpins scientific representations of social phenomena because concepts in science attempt to emulate these *hard* realities thereby providing a scientific picture of them.

Closely associated with the notion of ontology is *epistemology*. This is because 'it is necessary to have a conception of the nature of social reality before one proposes to justify a scientific analysis of it' (Morrow, 1994:54). Epistemological assumptions are 'assumptions about the grounds of knowledge - about how one might begin to understand the world and communicate this as knowledge to fellow human beings' (Burrell and Morgan, 1979:1). This debate is set between anti-positivist and positivist approaches. Positivist epistemologies are concerned with identifying the invariant laws that dictate the relationship among objective structures or observable empirical facts existing outside consciousness. This approach is usually linked to logical empiricism and is most commonly known as the 'covering law model' or 'hypothetic-deductive model'. Explanation is based on necessary causes and essential determinants found in variable analysis (Morrow, 1994; Sayer, 1992).

Anti-positivist epistemologies in contrast base social scientific knowledge on the interpretation of the meanings and consciousness of social actors. They are not concerned with the search for 'laws or underlying regularities in the world of social affairs'. They 'reject the standpoint of the 'observer', which characterises positivist epistemology, as a valid vantage point for understanding human

activities', instead, '[t]hey maintain that one can only 'understand' by occupying the frame of reference of the participant in action' (Burrell and Morgan, 1979:5). This humanistic perspective takes social life to be fundamentally different to phenomena studied by natural sciences and draws inspiration from the *interpretative turn* of human sciences. This philosophy supports a very different empirical approach that is concerned with interpreting actions, *Verstehen*, and of *hermeneutics* which are theories of textual interpretation. In this way, 'rather than attempting to make statistical generalisations concerning a limited set of variables, the concern...is with comprehending the rich complex of factors that define the case at hand - be it individual, organisational, or societal' (Morrow, 1994:206).

Associated with these domains of meta-theory is another set of assumptions that relate to *human nature.* Interpreted as a particular image or theory of social action. Any form of organisational analysis will be built upon certain assumptions about the relationship between individuals and the environment. This debate is usually framed within the voluntarism-determinist model of the individual. Burrell and Morgan (1979:6) state a 'determinist view...regards man and his activities as being completely determined by the situation or 'environment' in which he is located' while the voluntarism regards man as 'completely autonomous and free-willed'. It is usually argued that determinism excludes a number of properties from the field of investigation:

> "The widely received version of the scientific method, in its determined search for methodological certainty, excludes large parts of human nature and experience even though these very elements enter into the constitution of social life itself" (Dickie-Clark, 1990:146).

In contrast, voluntarism assumes the actions of individuals cannot be explained by simple reference to the environment or other determinations. Finally, these notions of human nature rely on opposing views about the character of *social scientific explanation.* The methodological debate is conventionally split between ideographic and nomothetic approaches. In the case of nomothetic explanations found in classical positivism emphasis is placed 'on the importance of basing research upon systematic protocol and technique' (Burrell and Morgan, 1979:6).

The goal of positivism is to determine the invariant laws (covering laws) that account for the patterns found in large populations of individual cases. Such explanations are linked to experimental methods and the quantitative analysis of statistically defined variables (Morrow, 1994). In contrast, '[t]he ideographic method stresses the importance of letting one's subject unfold its nature and characteristics during the process of investigation' (Burrell and Morgan, 1979:6). Ideographic explanations are not based on accounts of patterns in large populations of individual cases rather they are 'interpretations' of individual cases which 'focus down' on their context and uniqueness. This type of explanation is usually based on qualitative methods.

Figure 4.2.2: The Sociology of Organisation Studies

The second aspect of Burrell and Morgan's (1979) thesis *a theory of society* suggests that authors either provide explanations of society stressing conformity and cohesion: the 'sociology of regulation', or they explain social phenomena in terms of the need for radical change due to asymmetries of power, domination

and contradiction: the *sociology of radical change*. For reasons of simplification the various schools of thought found in the social sciences are located within a matrix (see figure 4.2.2).

Burrell and Morgan's (1979) thesis constitutes the conventional discourse in organisational philosophy and offers a heuristic to locate the notions underpinning this field of study. It provides a means to 'label' the key distinctions between researchers and the assumptions informing their explanatory endeavours. However, this matrix is not without its' problems. By this I refer to the location of Critical Theory in the subjective dimension. In doing so, it understates the dialectical element of the perspective. The subjective and objective split unwittingly perpetuates an overly simplistic view of social science. As Willmott (1990:49) states, although Burrell and Morgan are well intentioned in their advice, they have constrained 'analysis within one of the four paradigms, and thus exclude[d] the possibility of forms of analysis that deviate from, or transcend the limitations of the paradigmatic guidelines'.

4.3 Critical Theory/Realism - Revisiting issues of Meta-theory

Burrell and Morgan (1979) offer two methodological paradigms in sociology but fail to account, at the level of meta-theory, for critical theory. This is an important oversight because *critical realism* provides a philosophical bridge to mediate the limitations associated with paradigmatic closure (Willmott, 1990). In regard of explication it offers a theoretical framework to reconnect studies concerned with the local milieu and structural or global accounts of organisational analysis (see Reed, 1997). However, the mediation of positions means clarifying our perspective of ontology and explanation including (i) 'social determination', (ii) 'causality' and (iii) 'interpretation', which constitute the logic of social inquiry.

The basis of critical realism, what Bhaskar (1984) terms 'critical naturalism' is most readily associated with the work of Habermas and Giddens in the social sciences. Critical realism moves beyond the objectivism of positivist epistemologies and the relativism of anti-positivist epistemologies. Advocates

propound a philosophy of science that includes analytical and interpretative methodologies:

> "Whereas the natural and cultural or hermeneutic sciences are capable of living in mutually indifferent, albeit more hostile than peaceful, co-existence, the social sciences must bear the tension of divergent approaches under one roof, for in them the very practice of research compels reflection on the relationship between analytical and hermeneutic methodologies" (Habermas, 1988:3, in Morrow, 1994).

Critical realism 'sits' between the conventional philosophical paradigms. As a pragmatist theory of science it houses both analytical and interpretative methodologies, which is exemplified in the double hermeneutic of social life. For Giddens (1995), although an ontological distinction exists between nature and society (the structures of the social world unlike the natural world were originally constructed by individuals) it is still possible to conceptualise reality, even if fallibly, through discourse.

There is a 'reality' which can be identified but not in the way naive realism suggests, rather, it exists only through the concepts we give it, and as such, these concepts are contingent and subject to varying interpretations across time and space.

> "the double hermeneutic in the social sciences clearly recognises the existence and nature of a body of traditional knowledge made up of beliefs, presuppositions and prejudices that are passed onto people in their historical situation and which enable them to sustain the ideas and practices of the social order they live in" (Dickie-Clark, 1990:150).

Critical realism, starts not from the conventional basis of modern western philosophy or what Habermas terms the philosophy of consciousness or Giddens calls the subject-object dualism. Rather, it draws on the philosophy of language. All knowledge is dependent on the linguistic and interpretative dimensions the means through which we have to represent reality. Although knowledge is represented via second-order concepts it is still ground in the temporal pre-existing conditions of language that reflect 'deep causal mechanisms' that are enabling and constraining. At the ontological level, a

transcendental realist account of science reformulates the conventional notion of ontology and the link with epistemology. Bhaskar (1984:81, italics in original) offers the following reasons for this reflective moment:

> "It struck me as a postgraduate student in the late 1960's that the chief methodological problem with the social sciences was that received philosophy of science was at once ontologically *too restrictive*, inhibiting creative theory, and epistemologically *too permissive*, in that, in the absence of relevant criteria of theory assessment, it was all too easy for any general approach (and even easier for a conceptually confused one), once it had become institutionally entrenched, to effectively immunise itself from any critical controls. A little later I became aware that their main conceptual bottleneck was the lack of any coherent way of relating, articulating, constellating embodied human agency, the sole possible mode of spatio-temporal existence of social forms, with their evident causal power and reality, as in no sense a human construction".

The main problem alluded to above concerns, in the first place, an adequate conception of reality which does not reduce explanation to a form of extreme voluntarism, and secondly a means to develop scientific analysis including the representation of reality which accounts for deeper causal mechanisms.

At the level of ontology, critical realism breaks the empiricist-subjectivist polarisation by making a distinction between thought and objects of thought, what Bhaskar (1984) describes as the 'transitive' and 'intransitive' objects of scientific knowledge. This interpretation distinguishes the concepts, models, and cognitive objects (*transitive objects*) which are constructed in science through practice from the relatively unchanging real entities, relations and so on (*intransitive objects*) which make up the natural and social world and which are external or hidden from the scientific process (Bhaskar, 1984, 1986). As a consequence, Bhaskar proposes an enduring intransitive dimension of social reality while acknowledging that the concepts used to represent this 'reality' cannot be reduced in anyway to the external objects they are intending to represent. The concepts of science exist 'in more or less historically specific, symbolically mediated and expressed, praxis-dependent, ineradicably social forms' (Bhaskar, 1986:60). The concepts used to represent and explain reality need not correspond to reality precisely because these concepts can never be

reduced to reality: rejecting the naive realism of the objectivist approach. In turn, an intransitive dimension of social reality undermines the relativism of nominalism:

> "The decisive step is the ontological claim that although we can never represent objective reality literally and absolutely, we can assume confidently that it has a consistently identifiable nature, and hence is *imbued with inherent causal powers that can be represented indirectly by concepts*. In the case of society, for example, we necessarily assume that basic structures operate behind the backs of agents and mediate their constructions of reality" (Morrow, 1994:137, *my italics*).

According to Outhwaite (1987:45-46, *my italics*) causal tendencies are 'grounded in the interactions of *generative mechanisms*' that 'may or may not produce events which in turn may or may not be observed'. These ontological assumptions provide the basis for a 'post-empiricist' epistemology that rejects the positivist assumption of there being only one true method of scientific explanation.

Rejecting the covering law model of explanation reflects a revision of the discourse on scientific explication in the social sciences. The characterisation between advocates of quantitative or qualitative methods is dismissed in favour of the distinction between intensive and extensive research logics. This opposition is based on a pragmatic interpretation of methodology. Scientific discourse no longer reflects the either/or position of the quantitative-qualitative representation. Instead, based on a 'theory of argumentation' the research methods are chosen on the basis of 'the logics-in-use of specific research strategies' (Morrow, 1994:157). Critical realism connects disciplinary interests in social analysis with specific research logics. For instance, social theorising is associated with intensive research logics. This is because an interest in 'society' usually reflects an interest in explaining the characteristics of social and cultural reproduction. The outcome of this re-working of meta-theory at the levels of ontology and epistemology reflects the logic of critical realist approaches: the 'attempt to represent the *generative mechanisms* which bring about the explanandum' (Outhwaite, 1987:58, *my italics*).

At the level of the theory of action, the voluntarism-determinism dualism is rejected in favour of the notion of the *duality of structure* (Giddens, 1995). This notion of social action is, according to Bhaskar (1984:83-84), transcendental: 'if society is the condition of our agency, it exists and persists only through it, so that human agency is equally an existentially necessary condition for society, as it continually reproduces or transforms the latter'. In other words, following the linguistic turn structures are produced by action and yet are at the same time the medium of action. This interpretation is significantly different to voluntarism because in proposing structure to be the medium and outcome of social practice it follows that social analysis needs to identify those depth processes or quasi-causal generative mechanisms that enable or constrain social practice. Weberian approaches that *centre* the agent are rejected (Clark, 1990) as are functional approaches that views social structure as a constraining force.

A transcendental characterisation of social practice and reproduction is beyond ideographic and nomothetic forms of explanation.

> "Ideographic approaches fail to grasp the embeddedness of particular events in broader systems of structural relations. Nomothetic explanations misconstrue the problem by focusing on the surface of causal processes" (Morrow, 1994:137).

The answer comes in the form of 'interpretative structural explanations', which provide concepts suitable to accommodate the agency-structure dialectic. As a theory of explanation, *interpretative structuralism* enables us to identify generative properties (at the level of action), 'which regulate practice without presupposing a conscious or collective orchestration of action' thereby providing the 'general principles for the creative production of particular acts'. Interpretative structural explanations relate to institutional reproduction as instances of social structuration. Analysis of this kind 'may facilitate the depth interpretation of action by situating agents within a context of conditions of which they are ignorant' (Thompson, 1981:174,177). The mediatory character of the critical realist philosophy of social science is summarised in figure 4.3.1.

Figure 4.3.1: The Critical-Realist Philosophy of Social Science

Subjectivist Approach		**Critical-Realist Approach**		**Objectivist Approach**
Nominalism	**ONTOLOGY**	*Transcendental Realism*	**ONTOLOGY**	Naïve Realism
Anti-positivist	**EPISTEMOLOGY**	*Post-Empiricist*	**EPISTEMOLOGY**	Positivist
Voluntarism	**THEORY OF ACTION**	*Duality of Structure*	**THEORY OF ACTION**	Determinism
Ideographic	**THEORY OF EXPLANATION**	*Interpretative Structuralism*	**THEORY OF EXPLANATION**	Nomothetic

The formulation of a critical realist research strategy is based on a revision of conventional philosophical paradigms. It should also include a reworking of the methods discourse. Consistent with this is the reconstruction of the notions of *quantification* in social science and *empirical analysis* in theory construction (Morrow, 1994). In terms of *quantification*, critical realism rejects strategies of theoretical inquiry that depend on statistical modelling or variable analysis. These are believed to be incompatible with the deep analysis required to help identify the causal tendencies of generative mechanisms. However, this does not mean that all quantitative methods are unsuitable for critical realist purposes. Instead, a different discourse is proposed to redefine the usual distinction made between quantitative and qualitative methods. The usual distinction focuses incorrectly on the 'techniques through which social life is represented in the course of research' rather than 'the process of representing social reality' (Morrow, 1994:208). Processes can be 'accessed' via *intensive* or *extensive* research logics. These logics construct different types of social phenomena that are not arbitrary but reflect the theoretical and ideological status of *empirical analysis* understood as social theorising or social engineering.

4.4 Revisiting the Conventional Discourse on Methods

Researchers usually locate themselves on one or other side of the quantative-qualitative divide dismissing the "opposite" as inadequate. In those instances, when researchers do adopt methods from both sides of the divide - known as triangulation - there is a tendency to see qualitative methods as a heuristic tool to be used *before* the real research begins.

The discourse reflects a dichotomy between formal or numerical methods adopted in quantitative research and the natural modes or interpretative methods adopted in qualitative research. Critical realism is formulated on a different way of constructing social phenomena. The quantitative approach, which is dominant, is most commonly based on the aggregate analysis of individuals and social properties. Investigations are concerned with searching for non-spurious relationships between variables. Individuals and social relationships are left out of the analysis while explanation is dependent on the notion of causation (borrowed from the natural sciences) linking antecedent conditions with particular outcomes. The task of the researcher is to identify non-spurious relationships between variables (see chapter two). Qualitative methods depend on deep descriptions of social activity. Their concern is the opposite of quantitative research, individuals and social relationships. The focus is the local interpretation provided by human agents. Central to notions of interpretation and explanation is the social context of action and language. This ethnographic concern highlights the interpretative nature of social phenomena and the plausible existence of varying layers of social reality. Explanation is based on the analysis of the systemic and social relations that constitute the object of inquiry (Sayer, 1992).

According to Morrow (1994), the conventional dichotomy between these research methods is false as qualitative research can use quantitative representations while quantitative methods, whether in the construction of a questionnaire or survey, will be based on the interplay of constructed meanings between the analyst and the subjects of the research. In this way, research is necessarily based on some form of interpretation and

communication between analyst and subject. Using the language of research as a means to distinguish the forms of research is rejected. Instead, these research languages tend to be associated with one of two specific analytical strategies in empirical social science commonly referred to as 'social theorising' and 'social engineering'. These are different in respect of their normative foundations and the method used to construct social phenomena. Critical realism is a form of social theorising which attempts to account for social integration and system integration. It aims to make sense of the quasi-causal structural mechanisms in social practice and societal reproduction 'the underlying principle of change at work in the emergence and disappearance of the numerous forms of human life and the countless welter of human activities and relationships' (Fay, 1987:69).

To this end, critical research 'can for heuristic purposes be broken down in terms of three analytical moments' (Morrow, 1994:221) which reflect questions about social action - social integration; questions about the reproduction of institutions - system integration; or questions about the dialectic between action and structure and the idea of mediatory analysis. Critical realism can be used to highlight how action and structure 'are implicitly dependent on theoretical and empirical work focused on mediations, or what Giddens would call social practices' (Morrow, 1994:222).

To account for these three analytical moments it is necessary to adopt two distinct yet interdependent intensive research logics: *Intensive explication* and *comparative generalization*. *Intensive explication* is most readily associated with a case study approach in order to bring into view the 'hidden' semantic, socio-cultural, and structural relations which characterise the respective actors, mediations and systems under investigation (Sayer, 1992). In this way, interpretative explication refers to three types of explanatory focus at three different analytical moments of social reproduction: (i) the social cognitions of individual actors, (ii) the structural properties of societal systems, and (iii) the socio-cultural properties of mediations or social practices. *Comparative generalisation* complements intensive explication by allowing some form of

limited comparison between comparable cases at a single point in time or changes in the pattern of a single case over some duration (Morrow, 1994).

This discussion has proposed revisions to the philosophical assumptions that underpin organisational studies and the methods discourse. Having outlined a critical realist perspective the task remains to apply these insights to the study and explication of organisational innovation. It is proposed that structuration theory offer a number of *sensitising devices* to locate and explicate the deeper causal mechanisms or 'structural properties' (using Giddens language) that mediate social practices in organisational innovation. In the next sections I begin by summarising the main tenants of the theory and then review the studies deploying these insights in the study of innovation, technology and management. Following this a discussion of the weaknesses and criticisms of the theory are presented.

4.5 The Theory of Structuration

I have claimed that critical realism bridges the subjective-objective divide in social science while redefining the methods discourse. The aim is to facilitate an analysis of the enduring and transformational character of social activity (e.g., innovative activity). Having reformulated the logic of social inquiry it still remains to consider the tools and resources that make analysis possible. The utility of structuration theory relates to the way the relationship between day-to-day social action and the patterning of social systems is framed. In particular, the *concepts* forming structuration theory have the 'status of an ontology of potentials':

> "They are ontological because they do not refer to empirical events, but rather to generic human capacities and conditions through which social life is constituted, patterned, reproduced and changed. They comprise an ontology of potentials because they admit manifold variations in the way social life is constituted in disparate historical settings and on different occasions" (Cohen, 1990:34).

The ontological status of structuration theory is central to appreciating its utility in explicating and examining social phenomena. It provides a framework to consider the 'quasi-causal mechanisms' that mediate interaction. Giddens is not concerned with testing whether his theory can be verified or falsified as a set of empirically tested explanatory propositions of a generalised kind as with the epistemological orientation of objectivist approaches. *Rather, he offers a conception of the nature of human social activity and of the human agent.*

This is based on the notion that 'all basic concepts in social theory should acknowledge that social action and collectives ultimately consist in, and are generated by, ongoing forms of social praxis' (Cohen, 1990:34). For Giddens (1995) social analysis is tasked with accounting for the interplay of agent's actions and social structures in the production, reproduction, and regulation of any social order. The implication of these ontological assumptions is the recognition that social praxis cannot take place unless agents make use of skills and resources. Social practices do not occur randomly rather actors draw upon the 'structural properties' of society that mediate and bind social practices into social systems. Giddens *duality of structure* corresponds with Bhaskar's (1986) *transformational model* of social activity.

> "Analysing the *structuration* of social systems means studying the modes in which such systems, grounded in the knowledgeable activities of situated actors who draw upon rules and resources in the diversity of action contexts, are produced and reproduced in interaction...The constitution of agents and structures are not two independently given sets of phenomenon, a dualism, but represent a *duality*" (Giddens, 1995:25 *my italics*).

It is claimed that fundamental differences exist between the ontological characteristics of social structures and natural structures. Both claim although human agency is primary to the reproduction of a social order 'social forms are [still] a precondition of most human intentional acts' (Outhwaite, 1990:69). Bhaskar like Giddens claim 'society is at once the ever-present *condition* and the continually reproduced *outcome* of human agency' (Bhaskar, 1986:123). Hence, social structures although transcendental and therefore significantly

different from natural structures are considered 'real'. The ontological and epistemological implications of this approach to 'structure' are outlined by Outhwaite (1990:69-70):

> "Though they can be observed, like magnetic fields, only in their effects, and moreover do not exist except in their actual or potential effects on human activity, their reality is a condition of social activity. Their concept- and activity-dependence, far from being an idealist weakness, is an epistemic resource, a means by which we can come to know them...the recognition that the identification of social practices (activities and acts) depends upon the mediation of meanings requires an extended notion of the empirical. In other words, if there must be social structures, we must be able to know them to some degree in order to function as agents".

The utility of these claims is ultimately dependent upon their translation into social analysis. Consistent with 'critical realism' Giddens is concerned with empirical analysis in the form of social theorising. His approach addresses the ontology of social order and as such represents a theory of action. Although Giddens does not offer any specific 'methods' intensive research logic seems to complement the key theoretical and guiding principles of this theory (see chapter five).

In advocating this form of social analysis it is necessary to clarify the main terms or concepts used in the approach. In this theory these include *agency*, *structure* and *social system* coupled with key ontological tenets (which link these elements) known as the *duality of structure* and *structuration*.

4.5.1 The Duality of Structure in Structuration Theory

For Giddens, 'structure' in social analysis refers to the rules and resources drawn upon and enacted by agents in the reproduction of social systems. It provides the binding of social practices into social systems. Hence, structural properties of social systems are 'both constraining and enabling, in respect of human action' (Giddens, 1982:30). Unlike structural-functionalism 'structural properties of social systems do not act, or "act on", anyone like forces of nature to "compel" him or her to behave in any particular way' (Giddens,

1984:181). Structural properties constitute an agent's 'capability of doing these things in the first place' (Outhwaite, 1990:64). Structures have no reality except in the way they are instantiated in activity or retained mentally as remembered codes of conduct or rights to resources (Giddens, 1995).

> "The description and analysis of structure necessarily are second-order procedures through which social scientists may study aspects of social systems of which social agents engaged in system reproduction may be unaware" (Cohen, 1990:43).

All institutionalised practices of social interaction, according to Giddens (1995) involve four structural properties:

(i) Rules pertaining to the constitution of meaning
(ii) Rules pertaining to normative rights, obligations and sanctions
(iii) Allocative (material) resources
(iv) Authoritative resources.

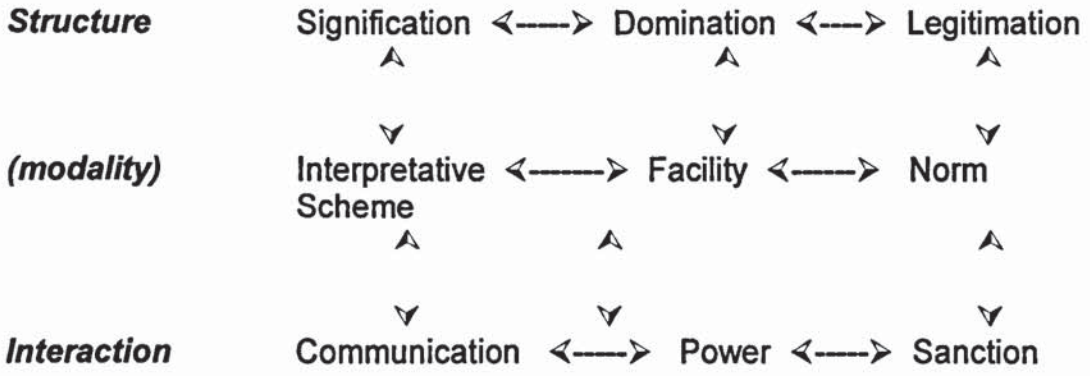
Rules are at the core of the 'knowledgeability' of agents they are the techniques' and procedures applied in the enactment and reproduction of social practices. Resources are the facilities drawn on by agents organised as properties of social systems. The analysis of properties in any given social system will yield three analytical configurations (figure 4.5.1):

(i) Structure of signification (semantic rules);
(ii) Structure of domination (authoritative and allocative resources);
(iii) Structure of legitimation (normative rules and resources).

The signification structure provides actors with a number of *interpretative schemes* or standardised stocks of knowledge to communicate the reality of their actions in the production of interaction. According to Giddens' (1990b:83) they 'form the core of the mutual knowledge whereby an accountable universe of meaning is sustained through and in processes of interaction'. Signification underpins how agents make sense of and organise actions; made possible by interaction with others across time-space either directly or through media such

as information technology. The signification structure is supported by the legitimation structure: 'the differentiation between the two is an analytical, not a substantive one: the conventions whereby the communication of meaning in interaction is achieved have normative aspects, as do all structural elements of interaction' (Giddens, 1990b:85). The legitimation structures bind agent's actions according to the *norms* regulating and sanctioning interaction. These systems of moral rules stress the interplay of norms and sectional interests illustrating how power is implicated in social action. Giddens conceptualises power as 'transformative capacity' chronically implicated in human agency. This 'notion of power has no inherent connection with intention or will', rather, Giddens employs the term to reflect the way power '*is harnessed to actors' attempts to get others to comply with their wants*'. The 'use of power in interaction thus can be understood in terms of the *facilities* that participants bring to and mobilise as elements of the production of that interaction, thereby influencing its course' (Giddens, 1990b: 92-93 italics in original). However, through the 'dialectic of control' he recognises actors with apparently less 'power' can implement change.

Figure 4.5.1: The Dimensions of the Duality of Structure



According to Giddens (1995:373), *facilities* relate to two types of resource drawn upon and reproduced as power relations in interaction. *Allocative resources* are 'material resources involved in the generation of power, including the natural environment and physical artefacts. Allocative resources derive from human dominion over nature', while *authoritative resources* are 'non-material resources involved in the generation of power, deriving from the capability of harnessing the activities of human beings; authoritative resources

result from the dominion of some actors over others'. The utilisation of facilities in interaction constitutes the political process by which values, interests and goals are communicated and instantiated in organisations or other social artefacts and processes like technology.

4.5.2 Agency and Social Systems in Structuration Theory

Giddens contends that all human beings are 'knowledgeable agents' - agents know a lot about the nature and consequences of what they do in their daily lives. Knowledgeable agents reflexively monitor and provide rationales for the character of social life. At a *discursive* level of consciousness they describe what they do and their reason for doing it. At *practical* levels of consciousness social actors rely on implicit stocks of knowledge about how to act and how to interpret events and actions of others although they would not know how to formulate these laws discursively (Giddens, 1995). Discursive and practical levels of consciousness are subject to the motivations located in the agent's unconscious. As Macintosh and Scapens (1990:459) observe '[t]he primary need for ontological security is the foundation of the unconscious and is a key building block in Giddens' construction of the agent'.

The concept of 'ontological security' is important because Giddens claims that agents only feel secure about their own reality when situations are predictable and stable over time. The 'routines of daily life' account for the character and fixity of social organisation such that institutional forms exist in the 'situated contexts of interaction' and the 'physical co-presence' of agents. This fixity reflects agents concern with maintaining the social continuity of organisations. However, although routine in daily social activity illustrates the regularity of the flow of human action; human actors as knowledgeable agents are capable of intervening and affecting social practices in social systems. This is because they reflexively monitor the flow of day-to-day life.

> "The routinsed character of the paths along which individuals move in the reversible time of daily life does not just 'happen'. It is 'made to happen' by the modes of reflexive monitoring of

> action which individuals sustain in circumstances of co-presence" (Giddens, 1995: 64).

Social actors use their knowledge of the conditions of system reproduction to influence, shape or modify that system reproduction. Agents have the 'potential to choose actions deliberately, and to carry them through effectively, even in defiance of established rules and prevailing powers' (Whittington, 1992:696). This interplay reflects the dynamic interaction between differing structural properties drawn upon by agents and stresses the 'structured modes of conduct' as opposed to 'historically specific acts'. Giddens resists an individualist reduction of order when proposing 'structured modes of conduct' while also avoiding reducing order to the enduring properties of social structure; achieved by stressing that 'social systems only exist insofar as they are continually remade' (Cohen, 1990:36).

In proposing 'structured modes of conduct' Giddens is careful not to succumb to other forms of reductionism, methodological situationalism. This is achieved by distinguishing between social and system integration. Social integration refers to face-to-face encounters, system integration relates to reciprocities between *absent* agents. Stressing reciprocity and interdependence between social and system integration confirms 'the systemness of social integration *is fundamental to the systemness of society as a whole*' (Giddens, 1990b:76-77, italics in original):

> "*All* patterns of order involve institutionalised modes of social integration, and small scale systems may be articulated entirely in this way. But large-scale patterns necessarily involve modes of social integration in specific settings coupled with modes of system integration which articulate one setting with another" (Cohen, 1990:37).

Integration reflects the enabling and constraining characteristics of 'structural properties' emphasising the basic characteristics of differentiation in society: '*integration is not synonymous with 'cohesion' and certainly not with 'consensus*" Giddens (1990b:76 italics in original).

Social systems compose of social relations and social interaction coordinated across time and space. These only constitute social systems if they 'regularly stretch across time-space and are mediated by communication other than the face-to-face sort' (Giddens, 1990a:302). The patterning of social relations across time-space depends on *coordinating mechanisms* that reflect social and system integration over different contexts of co-presence. Social systems are not clearly bounded totalities where systems can be easily distinguished from one another. The structures and institutions forming social systems can be implicated in other social systems. Whittington (1992) suggests Giddens' work on the nation-state exposes the multi-dimensional character of the world bringing capitalist production together with issues of ethnicity, gender, knowledge and the state

4.5.3 Structuration: Analytical Moments and Guiding Principles

Analysing the structuration of social systems involves 'studying the modes in which such systems grounded in the knowledgeable activities of situated actors who draw upon rules and resources in the diversity of action contexts, are produced and reproduced in interaction' (Giddens, 1995:25). The reflexive monitoring of action at the level of social integration can potentially, at least, become a guiding influence of system integration '*via the reproduction of institutions in the duality of structure*' (Giddens, 1990b:77, italics in original).

For the purpose of analysis, attention is given to the process of acting. Agents mobilise the modalities of structuration *interpretative schemes, norms* and other *facilities* that represent 'the central dimensions of the duality of structure in the constitution of interaction' (Giddens, 1990b). Modalities can be studied in one of two ways. For methodological reasons a distinction is made between the *analysis of strategic conduct* and *institutional analysis*:

> "The point of the distinction is to indicate two principle ways in which the study of system properties may be approached in the social sciences: each of which is separated out, however, only by methodological *epoch*" (Giddens, 1990b:80).

The first method of studying modalities is to study the *methods* in which actors draw upon and mobilise the structural elements (rules and resources) in their social relations. Giddens terms this methodological procedure the analysis of strategic conduct: 'social analysis which places in suspension institutions as socially reproduced, concentrating upon how actors reflexively monitor what they do; how actors draw upon rules and resources in the constitution of interaction' (Giddens, 1995:373). The second way is to analyse modalities as a *feature* of a system of social interaction. Institutional analysis places an *epoch* upon strategic conduct so that the skills and awareness of actors are placed in suspension with attention being given to 'treating institutions as chronically reproduced rules and resources' (Giddens, 1995:375). Bracketing is significant because at one level of analysis attention is given to the specific activities involved in system reproduction while at another (second-order) the analysis explicates the structural properties that mediate social and cultural reproduction.

These methodological procedures are only defensible if we remember the essential importance of the conception of the duality of structure:

> "In analysing social relations we have to acknowledge both a syntagmatic dimension, the patterning of social relations in time-space involving the reproduction of situated practices, and a paradigmatic dimension, involving a virtual order of 'modes of structuring' recursively implicated in such reproduction. Structure thus refers...to the structuring properties allowing the 'binding' of time-space in social systems, the properties which make it possible for discernibly similar social practices to exist across varying spans of time and space and which lend them systematic form" (Giddens, 1984:17).

To appreciate the relationship between the encounters of agents with social re-production Giddens (1995:72) argues that 'we must emphasise how encounters are formed and reformed in the duree of daily existence'. This is achieved by showing how encounters are sustained and by appreciating their contextual organisation. Therefore, emphasis is placed on the *recursivity of the positioning of actors and the structural properties drawn upon by those actors during social encounters.*

Positioning according to Giddens (1995:91) refers to the 'contextualities of interaction' that consist of traditional or habitual routines of action influencing the social position of actors and 'the level and nature of the penetration actors have of the conditions of system reproduction'. The situation of the individual 'depends upon certain specifiable connections between the individual agent and the social contexts through which that agent moves in the case of day-to-day life' (Giddens, 1995:60). These mechanisms of penetration indicate the patterning of social systems. This is expressed as reproduced activities of individuals 'who assemble to constitute locales at determinate intervals during their participation in system reproduction' (Cohen, 1990:38). Penetrating system reproduction depends on four core features (Giddens, 1995:91-92):

1. The means of access actors have to knowledge in virtue of their social location; referring to the spanning of both lateral and vertical separations in and between social systems;

2. The modes of articulation of knowledge; referring to the nature of the discourses;

3. Circumstances relating to the validity of the belief chains taken as 'knowledge'; referring to social pressures moulding the interpretations and beliefs held by members of social systems, and finally;

4. Factors to do with the means of dissemination of available knowledge; the types of media used to disseminate knowledge.

Penetration of system reproduction by agents and the resulting morphology of social systems are tied to *system regulation*. System regulation refers to the ways social systems are regulated. (i) *Homeostatic loops* are 'causal factors which have a feedback effect in system reproduction, where that feedback is largely the outcome of unintended consequences'. (ii) *Reflexive self-regulation* are 'causal loops which have a feedback effect in system reproduction, where that feedback is substantially influenced by knowledge which agents have of

the mechanisms of system reproduction and employ to control it' (Giddens 1995:375).

> "...by tying coordination and control to the administration of systemic activities across time and space, and by emphasising the kinds of resources reflexive self-regulation involves, as well as the types of indirect power relations which are established in this way, Giddens proposes a variety of lines of thought that vary considerably from accounts which hinge upon legitimation or normative regulation of organisations" (Cohen, 1990:41).

Although structuration theory does not provide a theory of change it does offer an analysis of what Giddens perceives as four major and interchangeable types of social change (Giddens, 1990a). The first and most generic form of change is associated with *system reproduction*. This form of change reflects the claim that 'all social reproduction is contingent, as it depends upon the knowledgeable following of conventions by situated actors (in conditions of differential power). Hence the very moment of social reproduction is also a moment of (potential) change' (Giddens, 1990a:304). Change is usually incremental and is by definition unintended and unplanned as it normally reflects the subtle modification of conventions over extended periods. The second type of social change, *system contradiction*, by contrast, is usually the result of a mobilisation of interests and groups in pursuit of particular interests. According to Giddens (1990a: 304) 'contradiction is an important source of social change because of the clashes of interest it intrinsically involves...How far contradictory elements in any given system actually produce change depends upon the degree to which definite groupings arise along the 'fault-lines' and enter into active struggle with one another'. The third type of social change is *reflexive appropriation*. This is a chronic feature of organisations. Reflexivity is common to all organisations and may produce smoothly flowing processes of change or may result in more radical interventions in social life that are highly political in nature. Finally, change can happen because of differences in *resource access*. Change is not reflexively mobilised rather 'changes neither intended nor foreseen by the members of a society may be brought about by the impact of scarcities in supplies of material resources' although it is equally plausible for 'struggles to monopolize or dominate the

distribution of resources' thus highlighting the mobilisation of sectional interests (Giddens, 1990a: 303-304).

4.5.4 Applying Giddens Framework

Studies using structuration theory include (Ackroyd, 1995; Barley, 1986, 1990; Becker, 1996; Bloor and Dawson, 1994; Coopey, Keegan and Emler, 1996; Edwards, 2000; Haines, 1988; Jackson and Van der Wielen, 1995; Jones, 1997; Jones *et al*, 2000; Lewis and Seibold, 1993; Macintosh and Scapens, 1990; Orlikowski, 1992; Poole and DeSanctis, 1990; Ranson *et al*, 1980; Thomas, 1994; Tolbert and Zucker, 1997; Whittington, 1992; Willmott, 1981; 1987; and Windeler and Sydow, 1995).

For those using structuration theory it appears their main concern has been to develop a better understanding of system reproduction. Although this remains an important project (Reed, 1997) it has seemingly been assigned to the margins of scholarly work (Layder, 1994). This is because it remains abstract and difficult to apply. Nonetheless, for those that have tried to draw lessons from the approach it is possible to identify a number of themes that distinguish structurational accounts from conventional studies not concerned with social reproduction.

Duality has been adopted to help explain the interactions between institutions and agency. When considering managerial agency (e.g., Willmott, 1987; Whittington, 1992; Coopey, et al, 1996) the notion of duality offers a number of opportunities to 'prise-open' the complexities of managerial work. Willmott (1987:260) suggests that structuration theory facilitates the resolution of 'the hiatus between 'behavioural' and 'institutional' accounts of managerial work' because it connects institutional and strategic aspects of this activity. In doing so, 'the social practices that constitute managerial work can be studied as the skilled accomplishments of agents and as an expression of the structural properties of systems of interaction'. Strategically developing and enforcing rules and resources forms the syntagmatic and paradigmatic dimension of institutions reflecting a virtual order of modes of structuring. The paradigmatic

dimension mediates and is an outcome of the syntagmatic dimension illustrating how sectional interests reflect the institutional domain of actors.

The paradigmatic dimension represents a plurality of rules and resources. Organisational actors can adopt multiple social identities at different times and places. Whittington (1992) equates multiple structures with the possibility that managerial interpretation varies over time and space. Although organisations are subject to routine and unintended consequences they are capable of being governed purposively and reflexively. Managers draw from a plurality of structural rules and resources, which offers a framework for analysing a wide variety of social influences. These include, political, national, domestic and professional influences. Hence, organisations can be contradictory in the way managerial agency is mediated.

Coopey et al, (1996) carry these insights to their study. In this, they argue the implementation of innovative practices reconstitutes the established system of social relations and the structure of rules and resources in organisations. Hence, innovation is understood as a range of structural properties implicated in the introduction, interpretation and constitution of new managerial practices. Managers negotiate and establish new configurations during the innovation process. The instantiation of new structural properties is not a neutral process as Windeler and Sydow (1995) illustrate in their study. Indeed, as their discussion of inter-firm networks suggests actors operate in locales that exhibit tensions between structural properties. Thomas (1994) (see chapter two) develops a power-process framework and uses duality as the core idea behind 'organisation'. Here, he contends that technology and organisations are engaged in an ongoing process of structuring. This focuses on the politics of organising and therefore the asymmetries of power that pervade all social relations. Thomas contends that to understand the inter-relationship between technology and organisation it is necessary to identify what agents are trying to do to organisations and by extension themselves by means of new technology.

The idea that organisations reflect differing rules and resources spread across time and space (Jackson and Van der Wielen, 1995), suggest organisations or social artefacts (e.g., technology) are open to interpretation and therefore contention. Hence, agents embark on a process of negotiation where systems of social interaction are enabled or constrained by the structural properties that inform certain interpretations, intensions or actions. Barley (1986, 1990) draws on the interpretative element of social reality when discussing how the introduction of new technology into a Radiology Department occasions 're-structuring'. Barley argues that technologies constitute rules and resources and as such new technologies can re-structure an institutional setting:

> "...the study of structuring involves investigating how the institutional realm and the realm of action configure each other...from the point of view of a theory of structuring, technologies are best viewed as occasions that trigger social dynamics which, in turn, modify or maintain an organisations contours" (Barley, 1986:80).

By re-structuring Barley refers to the configuration of social relations mediated by the introduction of a new technology. Orlikowski (1992) suggests that technology is an enacted environment whose construction and use is conditioned by organisation structures of signification, domination and legitimation. These views coincide because 'technology', defined as a set of structural properties is constructed not only around the institutional setting but re-configures the setting by its use. Poole and DeSanctis (1990) emphasise the significance of the social context and how this differentially structures group activities. Of importance is not necessarily the hardware or software *per se* but how technologies mediate the activities of agents. The constructed and therefore differential aspect of innovations is the theme of Lewis and Seibold's (1993) study. They argue it is the users involvement, their interactions and emergent understandings and symbolic representations that serve as the crucible in which innovation related structures are produced and instantiated. The location of agents within differing patterns of social structures is the focus of Bloor and Dawson's (1994) study. In this, they develop a model of the way professional and cultural cultures interact. According to Jones (1997:9), they are able to show 'patterns of signification, legitimation and domination occur

within a framework which encompasses the organisation's operating systems, environment and cultural system as well as broader societal and historical context in which the organisation operates'.

Central to all of these studies is the reproduction of social order. Social order may change over time according to intentional actions or because of the unintended consequences of such actions that transform the basis of system reproduction. Such changes are not necessarily smooth flowing as all social action reflects the power relations between agents and groups that can result in contestation and conflict (see Jones, 1997). There is a cautionary note to be made when advocating this perspective. In using Giddens theory it is easy to misinterpret the duality of structure and structuration. For instance Willmott (1981:471), criticises Ranson *et al* (1980) for referring to contextual constraints in their analysis:

> "Had Ranson *et al*, consistently adopted Giddens' theory of structuration, they would have avoided a reversion to conceptualising structure as something that is somehow separate from, and conditioned by, constraints in its external environment. For in Giddens' framework, structures are theorised as the properties of social systems that are the medium and outcome of the practices that constitute social systems".

This criticism not only reflects the sloppy use of structuration theory but also alludes to a serious criticism of the theory itself: the utility of a social ontology of practice.

4.6 Structuration Theory: Criticisms of Duality

Although structuration theory is linked to a broad range of interest areas: the nature of day-to-day interaction, class analysis, and time-geography to name a few (see Cohen, 1989; Held and Thompson, 1989; Bryant and Jary, 1991; Craib, 1992 for a broad overview). It has been open to widespread criticism (e.g., Archer, 1995; Clark, *et al,* 1990; Mouzelis, 1989) with perhaps the most significant criticism aimed against the notion of duality. Such a perspective has been considered conflationary such that it represses the distinct

properties, which constitute both action and structure (Archer, 1995). Archer (1982 cited in 1995:102) described this as 'sinking rather than linking the differences between structure and agency'. While, Layder (1994) complains that Giddens actually obscures the problem of agency and structure by pushing it to one side and by redefining structure in different terms. In defence of this approach it is important, to recognise that Giddens' work does not represent a tightly integrated theory of society. Instead, it offers sensitising devices that can prove useful in social analysis and social research (Layder, 1994). Consequently, structuration theory is not a panacea rather it is a toolbox, which can help to further our understanding of the innovation process.

Nonetheless, for Archer (1982; 1995), the duality of structure is flawed. This has much to do with Giddens's view of the problems afflicting social theory:

> "The reified notion (in his view) of emergent properties, as prior to and autonomous from action and the reductionist conception (in his view) of individuals, with personal properties which are independent and detachable from the social context of their formation and expression...Society as a skilled accomplishment restores dignity to agency whilst upholding that the practice of accomplishing life in society is itself ineluctably social" (Archer, 1995:94).

To treat agency and structure as inseparable it is necessary for structures to be understood differently. Structure does not refer to an identifiable form of social organisation it relates to the underlying organising properties that result in a visible pattern and perpetuate this pattern. This is also roundly criticised by Archer (1995: 132), who states that:

> "structures cannot be adequately conceptualised as *nothing but* part of the parcel that is 'social practices', for their relatively autonomous powers, the irreducibility of their influence and their pre-existence means they cannot be accommodated within a homogenous ontology of praxis, but need to be acknowledged as constituting a different stratum of social reality".

If we wish to defend the utility of duality the 'social practices' as the 'carriers' of structures it may be that we are perhaps guilty of 'flattening' social reality;

providing a 'thin' appreciation of 'structure' (Layder, 1994). Mouzelis (1989) like Archer criticises Giddens not developing a better sense of stratification or showing how actors as hierarchically organised differentially contributing to the reproduction and transformation of social systems. If one wants to defend this concept then perhaps structuration does lend insight into identifying the influences of structural properties that differentially mediate the activities and experiences of agents. The political process in organisations surely reflects the varying relationships between agents by virtue of their positioning (their access to rules and resources) that enables some courses of action and not others?

In addition, I think it premature to assume that because structures are instantiated in social practices they are somehow temporally dislocated from antecedent conditions (Archer, 1995). If an educational system is understood to represent routinised patterns of social interaction that spread across time and space cannot it be the case that the rules and resources that mediate these patterns are themselves *carried* across time and space. Admittedly, these only come into being once instantiated but it does not preclude, it seems to me, the idea that as virtual orders they do not continue to *influence* actions. What is more, if agents draw on multiple rules and resources then does this not imply the stratification of social systems (i.e., social reality is layered according to different properties), by the very fact that agents are located in and between social systems in social reproduction (Whittington, 1992)?

Although Giddens theory is subject to extensive criticism the theory provides a theory of action-structure that confronts one of the main problems afflicting social analysis (Layder, 1994) and as such may aid our understanding of the innovation process. Operationalising structuration theory relies on establishing adequate modes of explanation and understanding. In section 5.4, the link between the object of inquiry and the researcher is considered. While our statements are theory-laden explanations need only be *practically adequate*. The author discusses the nature of abstraction and proposes several research questions reflecting the notion of interactivity.

4.7 Conclusions

It has not been my intention to offer a defence to the criticisms of eminent sociologists like Margaret Archer who have given extended critiques of and alternative perspectives to structuration theory. My discussion of Giddens theory and related studies has been offered to explicate the significance of attempting a radically different conceptual and research methodology based on *interactivity*. The notion of duality, no matter how problematic is offered as a way to overcome the dualisms in social theory and research. It would be misplaced to consider structuration theory as a panacea to issues in social theorising. Nonetheless, the sensitising devices can be used in conjunction with other concepts to develop an interactive process perspective (chapter three).

Proposing an interactive process perspective depends on the deployment of alternative conceptual tools and the adoption of specific research logics. At the conceptual level organisational innovation is considered to represent a dynamic process involving both behavioural and institutional elements. The link between levels of analysis is achieved by considering the structuration of organisational orders. Drawing on second-order concepts it is claimed that the generative mechanisms mediating the innovation process can be 'identified' and theorised. This relies on assessing *innovation* as both the strategic accomplishment of reflective actors and as a *feature* of a system of social interaction. Organisational innovation involves constructing, communicating, exchanging and instantiating embodied and disembodied knowledge. This process relies on the *activities* of agents and yet is also reflective of those structural properties that mediate organisational reproduction. To understand the innovation process is to expose the interactivity of the two elements of social reproduction.

Structuration theory aids theorising if we consider it as providing the ontology of potentials. These are the concepts that organise the analysis. In relation to the behavioural features of social reproduction Giddens indicates that social

encounters and positioning is essential to system penetration. The innovation process relies on the social construction of organisational logics. Agents do not act freely rather they are conditioned according to the stratification of social systems. Taking this into consideration is important as the innovation process usually involves actors from multiple functions, departments and institutions.

If structural properties mediate innovation processes it is necessary, for the purpose of theorising, to formulate a clear picture of those processes spread across time and space. Hence, the necessity for intensive research logics. In this instance, adopting longitudinal case study methods was thought the most appropriate approach to aid 'identification' of generative mechanisms. This, in turn depends on the research 'tactics' used to make transparent that, which is by definition opaque (Miles and Huberman, 1994). Consideration of the *tactics* used in the thesis is the subject of the next chapter.

Chapter Five

Methodology

5.1 Introduction

In this chapter, I draw together the various conceptual and methodological strands of the earlier chapters and develop an analysis sensitive to institutional reproduction and the innovation process. The main assumption grounding this endeavour is that the choice of *research techniques* in social analysis is not a question of 'method' it is a project that reflects 'the process of representing social reality' (Morrow, 1994:208) which includes three key elements

(i) Defining the *object* of inquiry

(ii) Establishing the *purpose* of the research including the specification of questions to be resolved

(iii) Specifying the *method.*

Method includes the modes of explanation and understanding, the nature of abstraction and the research design and techniques to be used in the thesis. Each is treated as corners of a triangle all inextricably linked (Sayer, 1992).

When defining the *object* of inquiry it is important to establish the parameters of the analysis. This includes the institutional setting, the duration and substantive characteristics (social and technical) of the innovation process. When defining the object of inquiry it is also necessary to specify the key themes of the research project. The aim is to reveal as far as is possible the dynamic elements of the innovation process. This is achieved by considering the interactivity of the behavioural and institutional characteristics of constructing, communicating and exchanging knowledge in an organisational setting. Identifying and classifying the mediating properties of the innovation process is a methodological challenge that is in turn reliant on the *methods* adopted to represent social reality. These issues are considered at the end of this chapter.

5.2 The Object of Research: The TCS (Teaching Company Scheme)

In the UK as in other industrialised countries successive governments have tried to improve the competitiveness of indigenous industries by encouraging links between government, industry, the knowledge base (Freeman and Soete, 1997). Since the 1980s government economic policy has been a concerned with building 'the knowledge driven economy' (OST, 1993; 1998). This policy has many different strands including tight controls on inflation and interest rates to maintain economic stability. It also includes direct financial assistance to industry via, for example, the Teaching Company Scheme (TCS) which was recently identified as the government's premier technology transfer scheme (see QR, 1996).

TCS helps academia and industry to collaborate on mutually beneficial activities where certain elements of risk are shared through government intervention and funding. Since its conception in 1975, TCS has involved around 2,000 firms employed 3,500 Associates and has included collaborations with nearly every HEI in the UK (QR, 1996). At the time of the quinquennial review 600

programmes with over 1,000 Associates were in place or planned. Of these 69% were in SMEs while 300 academic departments were involved from over 90 universities (QR, 1996). Since 1990 SME involvement has been seen to be of increasing importance. In SMEs 'the TCS Associate can often make a major impact on the firms outlook and product range' (QR, 1996:27). Until recently, most companies in TCS programmes were engineering-based manufacturing businesses developing new products or processes. This is changing as new emphasis is now given to the service sector and management disciplines. In real terms this remains a small percentage (8%) with the most being in the manufacturing sectors (instrumentation and electrical manufacturing represent 23% of total).

Each programme is jointly funded by government grant and company contributions. Government funding originates from four Research Councils and five government departments (figure 5.2.1). An average grant is worth £66,890 (50%) although the total cost is £133,890. Additions include a contribution of £22,680 for the HEIs indirect costs (17%) and the industrial contribution of £44,320 (33%):

A typical TCS Budget for SMEs

Total Eligible Budget	£65,000
Sources of income	
Company Contribution	£19,500
Grant Contribution (TCD)	£45,500
Categories of expenditure	
Associate employment costs	£37,000
Academic support	£17,000
Associate development	£3,000
Travel	£2,000
Consumables and equipment	£6,000

Source: Quinquennial Review (1996:6)

The economic benefits of what each £1 million of TCS support "buys" in terms of net cumulative additional activity can be measured as follows:

* 58 jobs;
* £3.6 million value added;
* £3.0 million exports;
* £13.3 million turnover;
* £1.5 million capital expenditure;
* £0.2 million R&D expenditure (PACEC, 1998).

Figure 5.2.1: Sponsors of TCS

Sponsor	Planned Expenditure 1996/97 (£K)
DTI	8,400
EPSRC	5,927
ESRC	750
MAFF	725
DEDNI	650
WOITD	300
BBSRC	260
SOID	200
NERC	30
Total	17,242
Additional amount available for indirect costs	2,077
Total	**19,319**

Source: Quinquennial Review (1996:6).

As way of introduction, there are a number of key mechanisms that 'organise' the activities of participants and frame the innovation process. Programmes usually last two years. Associateships are appointed in the first instance for a period of two years. Depending on the complexity of the programme it may be necessary to employ more than one Associate so that different disciplines are

coordinated. For example, a "1-2-1" programme would involve two Associates over a three year period, with their placements overlapping during the middle year (QR, 1996:16). It is also possible to apply for further funding if it is agreed that a 'new' programme would benefit the company.

TCS programmes are designed to help companies access the scientific, engineering, technological and business management skills and knowledge in Higher Education Institutions (HEIs). In turn, programmes offer HEIs through contact with industry to improve the quality and relevance of their research and teaching. They also provide well-qualified graduates the chance to take up high quality careers in industry. The core parameters are as follows (QR, 1996:4-5):

> (i) New products and processes are developed by an Associate on a firm's premises under the guidance of industrial and academic supervisors;
>
> (ii) Associates test the opportunities for, and attractiveness of, employment in industry (often in SMEs) whilst gaining positive practical experience;
>
> (iii) Firms carry out innovative projects and investigate the scope for, and value of, employing graduates; and
>
> (iv) Academics gain valuable industrial experience and input to research and teaching.

The participants in programmes usually include the TCD consultant, TCS Centre manager, company representatives, academics and Associate(s). The consultant acts as a 'referee'; their key role is partner brokership and project guidance (programme length) while the TCS Centre manager and Centre staff provides initial project guidance and administrative support (application process). As a consequence, Centre staff are usually the first contact company representatives and academics have with "TCS". They act as 'hubs' facilitating the flow of information between the TCD consultant, academics

and company representatives. Nineteen Centres for small firms have been established and are sited in proximity to HEIs. Some centres provide a purely promotional role while others like the TCS Centre at Birmingham (represents the University of Birmingham, Aston University and the University of Central England) play an active role in assisting participants with grant applications. The Centre in Northern Ireland handles administrative work leaving academic supervisors to concentrate on their supervisory activities[1].

Industrial and academic supervisors try to ensure the project team including the Associate complete programme tasks. Industrial supervisors are responsible for supporting and supervising Associates on a day-to-day basis including, if and when necessary providing additional finances or equipment. Academic supervisors are expected to guide the Associate's technical, academic and professional development. Associates are company based with academic supervisors expected to make regular visits (half a day per week is recommended). On those occasions when the academic supervisor is unable to assist directly they are expected to involve colleagues or provide access to resources and facilities not otherwise available to the company (QR, 1996; TCS, 1997).

Funding is acquired once the programme partners have successfully completed a TCS grant application and proposal form. Only then are monies made available and permission given to recruit the Associate(s). On agreeing a 'start date' participants attend their first Local Management Meeting (LMC-0). At this point the consultant confirms future agenda items, budgetary protocols and responsibilities (both in meetings and more generally around projects). Only at LMCs can monies be pledged or changes to the programme sanctioned. LMCs act as the formal decision-making mechanism where decisions on project changes are sanctioned.

From conception through to the running of programmes TCD operate a tight regime of controls and measures to "engineer" programme success. It is

[1] Details gleaned from Centre Managers at the UK TCS Centre Manager Conference, Plymouth 1998.

perhaps unsurprising then that the level of success and failure has been the subject of much reflection and comment. An overview of recent research is discussed in the following section.

5.2.1 TCS Success and Failure: A Review of the Existing Evidence

A sense of the dynamics of the innovation process can be gleaned from the existing literature (e.g., Tiler and Gibbons, 1991; Peattie, 1993; Baker, 1995; Senker and Senker, 1994; 1995). That said there remains plenty of scope to develop a better understanding of the relationship between the programme content, context and process.

There are similarities between this research and existing literature where attempts have been made to assess the utility of TCS as a vehicle for, and a framework to understand, organisational change (Peattie, 1993). It is generally assumed that the organisational characteristics of TCS programmes aid the translation of tacit knowledge and in particular organisational learning (Senker and Senker, 1994). Broadly, they include the role and positioning of the Associate:

> "The Scheme is concerned mainly with tacit knowledge. It is not only the knowledge embodied within the associate which is drawn upon, but the associate acts as a conduit through which new knowledge can be integrated within the firm's activities...Thus, the associate can be seen as a flexible link between two networks of knowledge production and application" (Tiler and Gibbons, 1991: 51).

It is generally accepted that the acquisition of knowledge by individuals does not necessarily result in organisational learning. Instead, information and knowledge has to be embedded across organisations reflecting a broad mix of individuals, skills and talents (Nonaka and Takeuchi, 1995).

> "It is not sufficient for a firm to access useful knowledge. It has also to organise methods for the internal diffusion of new knowledge, to ensure that knowledge which is received from

> external sources is communicated and utilised effectively throughout the organisation" (Senker and Senker, 1994:81).

This is difficult if organisations do not have the skilled personnel to implement and guide the process. The strengths of TCS relate to the way Associates and supervisors help identify 'information which can add value to the business' and integrate 'new knowledge into a company's existing store of accumulated knowledge' (Senker and Senker, 1994:82). This is the *learning process* and may require a change of company culture, which is an important factor in ensuring the continued integration of new knowledge. Associates are a valuable resource in this process, not only because they are subsidised through the TCS grant, but because they apply 'science and technology as well as modern management and marketing methods properly and systematically' (*Ibid*). The Associate benefits from the involvement of the supervisors as the application of knowledge relies on 'learning through example and experience' (*Ibid*). Because Associates are located between the academic and industrial realms and are supported by the consultant and formal management procedures they have greater potential "than that of new graduate recruits with comparable knowledge, skills and experience" to initiate change and revise company culture (Senker and Senker, 1995:6).

Success or failure has been attributed to a number of factors, which according to Peattie's (1993) four case studies involved various issues associated with process, context and content. The logic of programmes is significant because it indicates moves to change the institutional order for a variety of socio-economic reasons that involve multiple complex processes of organisational innovation. The *process* issues concern those social activities that define the collaborative relations' among participants. In this respect, Peattie (1993:67-69) identified five issues that affected the likely success of TCS as an organisational change process:

1) *Associates' status and power.* Peattie suggested that their ability to complete programme objectives may be curtailed if employees are confused about the Associates' status. Thus, if senior management are in full support then there is a greater chance for success due to "power by association".

2) *Organisational friction.* It is suggested that to gain the full benefit of having an Associate a balance needs to be achieved between treating them too much, or too little, like ordinary employees. Treating Associates like employees can lead to them being taken off project work and used simply as "another pair of hands". Conversely, treating them as separate individuals may lead them to being excluded from important decision-making processes.

3) *Academic involvement.* Academics have to establish a working relationship that is proactive yet not heavy-handed. As with the issue of organisational friction striking the right balance is extremely hard to achieve.

4) *Internal ownership and support.* Support by senior management is thought to be essential in legitimising the activities of the Associate. Such support has to be constant and unambiguous if the programme is to have a successful outcome.

5) *Project control.* Despite the introduction of formal management systems (i.e., LMCs) and the coordinating role of the consultant during each programme it has been suggested that "a lack of programme direction" has been a major shortcoming of TCS (SERC, 1991). This suggests that despite efforts to establish formal decision-making processes the organisation of TCS can be problematic.

In this last respect Senker and Senker (1994) identified "fragmented projects" as consequential for programme success. In other words:

> "In these programmes, companies set...[Associates]...to work on projects which are likely to prove useful, but are essentially tangential to the company's central concerns. In consequence... [Associates]...are often re-directed to more pressing, trouble-shooting tasks" (Senker and Senker, 1994:85).

It is apparent that fragmentation can reflect a combination of issues. Success seems to be linked to the level of transparency and equity in the organisation of relations and responsibilities. Given this, it is perhaps unsurprising that TCD

continues to examine ways in which to engineer stricter formal channels of communication and definitions of responsibilities (see below). Peattie (1993) goes onto suggest that the *context* of the organisation can also affect the performance of projects:

1) *Company size.* Although Peattie found in his study that the Associates felt smaller companies "didn't know how to use graduates" such findings are not entirely consistent with more recent work (e.g., Senker and Senker, 1995) where firm size was not found to inhibit programme success.

2) *Financial health.* It has been found that adverse changes in the business can undermine the initial rationale and/or objectives of the programme members especially if these changes come from the industrial partners. In other words, "although a difficult competitive environment may stimulate organisational change, a dramatic deterioration in market conditions seems to reverse this process and prompt companies back to what they know best" (Peattie, 1993: 68).

3) *Changes to senior management, corporate strategy and culture.* Any change in programme membership can lead to uncertainty and de-motivation within the project team adversely affecting progress and programme success. This is equally plausible if significant changes are made to the strategic and operational orientation of host firms.

4) *Roving reporting relationships.* It is possible that if Associates are expected to report to different individuals over the course of the programme their ability to affect change can be undermined. Influence can be diluted due to changes in the management of the programme.
5) *Internal company politics.* This was identified as a key barrier to the success of programmes. There is the significant possibility that members of staff will resist the introduction of new processes.

6) *Bargain-hunting.* Because TCS programmes are subsidised there is always the possibility that firms will use this mechanism as a cheap way to employ

graduates, with the company failing to take advantage of the opportunities available through the scheme.

Senker and Senker (1994) also found that changes in circumstance restricted the attainment of many programmes' full potential. As with Peattie's (1993) findings weak top management (exhibiting a lack of commitment and direction toward the programmes' aims and objectives) was found to be a significant hindrance to success.

In terms of the *content* of programmes Peattie (1993:69) suggests that this "may be much less important in determining eventual success than the management of the process or the organisational context". It is interesting that reference to programme content has also been minimal in other studies (e.g., Senker and Senker, 1995; Tiler and Gibson, 1993). This seems to be an important omission given the importance attributed to the role of the Associate in facilitating the transfer of tacit and embodied knowledge. Arguably, to understand strategic choice it is essential to explore the knowledge creation process especially as the objectives of the programme may directly affect or mediate the programmes context through changes to the firms' management systems, production processes and products. In particular, Senker and Senker (1994) identify two recurring themes in successful and unsuccessful programmes (content):

1. The use of technology and scientific methods to attain and maintain quality standards,
2. The use of science and technology to help develop improved products.

As demonstrated in a case reported in Senker and Senker (1994:87) the content of the project significantly affected progress: 'The academic partner played an important role in recognising that the project work planned for the... [Associate]...was too complex. By modifying project objectives, it was ensured that goals were achievable'. Senker and Senker (1994) go on to report on a further case where the programme proved controversial because it involved transforming a 'craft' based production process into a more technological based approach. Here, the issue was not so much content but the context of change

and the reluctance of the Managing Director to support this change. However, it demonstrates the interconnectedness of content, context and process. Success or failure is linked to the tension existing between the nature of the programme and the pre-existing organisational arrangements. These reflect the paradoxes of choice and constraint affecting programme members.

Senker and Senker (1994:85) found, as did Peattie (1993), that some programmes were established on false premises and 'without any serious commitment to...[TCS]...objectives principally as a means of securing subsidies for work which they would have carried out'. Such evidence, suggests that the antecedents of programmes need to be considered if the political processes of organisational change are to be appreciated.

The current study recognises the significance of previous findings especially the innate relationship that exists between process, context and content (Peattie, 1993). However, while Peattie (1993) and Senker and Senker (1994) point to the influences that enter interactively into programmes they stop short of considering the processes and relationships through which innovations are shaped. To achieve this it is necessary to *demonstrate* the link between context content and process issues. In other words, attention needs to be given to the translation of ideas into reality, the way social interaction shapes innovations.

5.2.2. TCS as the Subject of Inquiry: Its advantages and limitations

TCS has a number of distinct characteristics that have their advantages and limitations. Put simply, TCS is an interesting paradox. The establishment and running of the TCS process demonstrates adherence to a view that innovation can be "engineered" through management techniques. This is based on several second-order beliefs: (i) the illusion of linearity, (ii) the illusion of predictability and (iii) the illusion of control (King and Anderson, 1995). The paradox is most apparent in the way programmes are monitored. Given the strict protocols of using for example Gantt charts to show deliverables it is easy to believe the process is and therefore can be "managed" and controlled. However, although such mechanisms facilitate the research process ensuring easy and regular

"tracking" the sense of order, conformity and consensus generated has without exception been flawed. The socio-technical processes shaping programmes are generally complex and not readily discerned via formal reporting mechanisms such as LMCs.

It is only by using intensive research logics that it becomes possible to comment on the actual translation of tasks into reality. Although the reporting of project tasks provides a succinct way of monitoring progress and commenting on the innovation process it says nothing about the dynamics of translating knowledge. It is easy to be confused by the reporting procedure and what actually happens on a day-to-day basis (both shaped by social interaction). Although tasks specify what the programme *should* involve it is misleading to assume this is what *has* happened. What has to be avoided is using 'the change project as the unit of analysis, and change itself as a single event or a set of discrete episodes somehow or other separate from the...[organisational]...context' (Pettigrew, 1987 cited in Peattie, 1993:65). Considering the innovation process in terms of the behavioural and institutional realms ensures that an investigation of knowledge creation accounts for the tension between the strategic conduct of participants and the institutional realm that mediates such actions. As Child (1997:70) argues:

> "Extant organisational designs and environmental conditions impose constraints upon the actions which are feasible at any one point in time, but they are also the objects of intended change towards which action is directed. This gives rise to the paradoxes of simultaneous choice and constraint, change and continuity".

Considering links between process, context and content is a key concern of the current study. What is of interest is the translation of the programme given the TCS management philosophy. What might be thought as limitations to the study (management system) has in fact been an important device to assess the social shaping of TCS programmes. Hence, much of the analysis is concerned with "outing" contradictions between the strategic conduct of participants and the formal decision-making process used to represent these activities.

Given the institutional characteristics of TCS and the current literature reporting on the success and failure of projects it is appropriate to introduce the four case studies considered in this research study.

5.3 The Organisational Settings and Background Information

A brief sketch of each organisation involved in the case studies is given in this section. Although the details of each programme remain unaltered the names of individuals, companies and institutions have been changed for the purpose of confidentiality.

Seven programmes were originally approached with six included in the project that began in the summer of 1997. One case study was dropped almost immediately as the participants failed to complete the grant application and proposal form. Failure could be attributed to several factors but a breakdown in relations between the academics and company representatives during these negotiations was the most likely cause. It appears the academics were slow to respond to the company representatives concern to start the programme quickly. Within in a couple of weeks of making contact the Managing Director informed me the company had withdrawn from the scheme and were "going it alone".

Of the six case studies where access was gained a further two were dropped during the subsequent two years of fieldwork. Aborting one of these two case studies was unavoidable as it took over twelve months to recruit an Associate. Although I had built a strong relationship with academics and company representatives it was difficult to justify tracking the project, as I would have had less than six months to conduct the research. Trying to track the other case studies was also proving very difficult and I felt that my time would be better spent concentrating on these programmes. Reasons for aborting the second case study provide different insights around the difficulties often experienced by researchers.

This case study proved difficult because both the Associate and academic supervisor were reluctant to cooperate. Unease about the research was not unusual yet what distinguished this study from the others was these concerns emanated from the academic and Associate not the company representatives. For the academic, this was his and his department's first TCS programme. My research was considered an additional pressure that could complicate the process. However, the academic did seem to relax as progress was made and my presence seemingly made no impact. As for the Associate he remained uncooperative and would not accept that his participation had any benefits. This made researching the case study onerous, as he made me feel unwelcome and was rude and dismissive of my questions. By the end of the first six months I decided to break contact. I felt that the level of effort necessary to try and maintain a workable relationship outweighed any benefit as the Associate was quite likely to try to stop publication of my results. In hindsight, taking this decision was correct given my growing antagonism toward the Associate. I believe the Researcher must build a relationship that is not only based on mutual respect but also workability. In this respect, I believe neither of us had much respect for each other and as such the relationship became increasingly difficult. Fortunately, this was not a problem repeated in the remaining four case studies the details of which are presented below (figure 5.3.1).

The four case studies are representative of both "typical" and "emerging" types of SMEs now becoming involved in TCS. Alpha, Beta and Delta are "typical" in so far as they are manufacturers. Gamma is representative of the emergence of service-based organisations participating in TCS. The programmes at Beta and Delta predominantly involved the introduction of management processes, which is a further departure from the usual TCS work that has concentrated on research and development into the manufacture of "widgets" and associated processes. At Delta, for example, part of the work included the introduction of softer processes and in particular an "innovative culture". To this extent, the case studies provide a representative cross-section of programmes being undertaken by SMEs in TCS.

Figure 5.3.1 – Summary of Case Study Firms

Firm	Size (staff)	Turnover (£)	Firm Business	Ownership	Innovation
Alpha	153	£13,940,000	Manufacturer of pharmaceutical additives and materials	Group	Process and product
Beta	25	£1,580,000	Manufacture and distributor of office cleaning products	Independent (management buy-out)	Process
Gamma	100	£3,914,000	Registered Housing Association	Charity	Process, service and product
Delta	48	£2,400,000	Manufacturer of filing systems and printing	Independent	Process and product

The choice of four case studies needs qualification given that the present study rejects the utility of factor analysis or the predictability of innovative activities (chapter 2 and 4). Social analysis is best served by establishing what it is *about* the object or relations that *enables* change to occur (making reference to the structure of the objects) (Sayer, 1992). Contingency is a core resource in this as it offers clues to the nature of events and the properties that mediate social relations. Thus, although the challenge of prediction is inherently flawed it is possible to make limited *comparative generalizations* (Morrow, 1994). Given the diversity of the case studies (type, sector, innovation) it is not useful to make comparisons at a single point in time. Instead, attention is given to changes in the pattern of each case (from the original set of tasks) over the duration of the programme. It is possible to *isolate* themes for limited comparison. This conforms to the approaches of previous studies (e.g., Tiler and Gibbons, 1991; Peattie, 1993; Senker and Senker, 1994; 1995) in so far as issues (i.e., process, context and content) can be extracted from the data. Hence, the comparative generalizations are used to "locate" the analysis of the innovation process. This allows the current study to be compared with the existing literature. However, instead of simply confirming the findings of previous research the aim is to make better sense of these issues by assessing how they were "worked out" over time. Considering social interaction in ways that draw out the mediating characteristics of pre-existing social structures aids our understanding of the processes through which ideas are translated into reality. It is not simply a question of classification it is a process of explication in terms of the nature of

these change activities and therefore an investigation of the paradoxes that enable as well constrain organisational change.

5.3.1 Case Study: Alpha

Alpha's Project Director (hereinafter "*PA*") began negotiations with the TCS consultant and TCS Centre manager, Birmingham in July 1996 and the formal go-ahead was given in November 1996 with the Associate beginning the project 1 January 1997. The TCS programme was a "1-1" and completed at the start of 1999. Recruiting the Associate was relatively simple as the graduate chosen for the project already worked at Alpha on a related project. This ensured a quick start and meant the choice of HEI partner was straightforward.

At this time, Alpha was a subsidiary of Alpha Group. The group employed 200 employees and was the world's second largest producer of synthetic food, drug and cosmetic colours exporting to over 75 countries. The Group has subsidiary operations in Canada, USA, Mexico, Australia, South Africa and Hong Kong/ Beijing. It also produces a range of flavourings, food ingredient chemicals and a limited range of liquid botanicals sold to herbal medicine and pharmaceutical industries.

The aim of the programme was to expand the quality and range of botanical extracts produced by the Group and to revise it's manufacturing procedures to comply with European quality legislation. The decision to seek funding came from the Project Director who had previously owned the site operating under the name of 'Flacom'. Shortly before the TCS programme Flacom was sold to Alpha Group. The acquisition represented an important strategic decision as its core business (colours) was being jeopardised by competition from the Far East and Asia. Flacom's business included flavourings, food ingredient chemicals and botanicals production. At that time although liquid botanical extracts only accounted for 2-3% of Alpha's sales it offered significant potential for providing new revenue streams. The programme offered:

- The development of new core manufacturing processes to support the new product range with each product being specifically detailed with the necessary information to enable its manufacture and quality control;
- The establishment of a waste management programme to cover the new products and processes, minimising the company's costs of disposal and ensuring compliance with impending legislation;
- To have full manufacturing specifications and detailed manufacturing procedures for all new botanical products.

It was forecast that the net profit before tax of this work would be £250 (000's pa) and represented 10% of the projected total profit in Alpha Group. Funding was important for two additional reasons. First, although Alpha's technical staff had experience of developing methods to extend botanicals production it was felt additional assistance was needed if the new production process was to include improvements to product quality. This meant developing analytical methods to assess product degradation at each stage of the production process. Secondly, the project would allow Alpha to undertake the work without overly extending capacity or finances thereby minimising the level of risk.

The academic knowledge and skills to be transferred to Alpha included

(a) Theoretical and practical process engineering methodology
(b) Assistance with developing appropriate analytical techniques
(c) Academic and practical knowledge of the nature and properties of the materials and compounds.

The project was designed with three phases (although these are presented sequentially the phases are not strictly sequential):

(1) Process Design
(2) Analytical Development
(3) Production and Manufacture

In phase 1, improvements and developments were to be made to the existing process for the current product range. Improvements and developments would also be made to the techniques used for the production of specific end products so that a generic process would emerge that would allow them to produce products in new forms on a commercial basis. In phase 2, improvements and developments would be made to the analytical techniques and methods used for the identification and assay of specific characteristics of the component parts of products. This would include adoption of analytical techniques and methods for the investigation and assay of finished products. In phase 3, the aim was to commission a new plant including improvements in waste management and the impact of potential adverse processes on the environment.

Alpha's management's plans included extending the existing product areas (i.e., liquid botanicals) to include dry extracts for pharmaceutical and herbal medicinal products and preparations for use in the manufacture of toiletries and cosmetics. A new range of 50 dry botanical extracts and 30 liquid extracts were to be developed for both home and export markets.

5.3.2 Case Study: Beta

Beta's Commercial Director (hereinafter "*SR*") began negotiations in June 1996, the go-ahead was given in May 1997 and the Associate began 1 August 1997. The programme a "1-1" was completed August 1999. Starting the programme took much longer than had been anticipated (it should usually take between 4-6 months to negotiate). To begin with, TCD had been unable to provide funding at an earlier stage. No reason was given officially but unofficially the TCS Centre manager thought it was because the funding allocation had been spent for that year. It also took a long time to recruit an Associate. As it was, the academic's (from *"Mid-Uni"*) recruited a graduate from their Business School.

Beta's staff numbered 25, manufacturing and distributing a range of cleaning products for computers and other office equipment. The customers included commercial distributors such as Unisys, Technology PLC, ICL - Sorbus,

computer suppliers such as InMac, Misco, Viking Direct, office product suppliers such as Acco, WH Smith - Niceday, Ofrex and central government institutions including The Stationery Office and Ministry of Defence. Beta's management team wanted to establish proper control of its purchasing and inventory control functions and to improve the efficiency and quality of information. This would allow for increased production, improved lead times and reduced purchasing costs across the whole range of company products. As it was, much of the raw material that had been purchased before the programme had been done so without rigorous evaluation of the options available and without balancing price against stock cost.

The decision to apply for TCS funding originated from SR in early 1996. In November 1995, Beta acquired SR's company that manufactured office equipment accessories, appointing him as the new Commercial Director. After a short period in post SR became aware that Beta's purchasing and inventory system was woefully inadequate to cope with the merger (Beta had effectively doubled in size with the merger and sales growth). SR's plan was to develop a just-in-time purchasing, inventory and supply system that would enhance an in-house TQM philosophy. The deliverables were to be six-fold:

- A system that will enable accurate evaluation of vendors, and assign ratings based upon historical performance
- A negotiation procedure to obtain the basic service (product quality, delivery and price) for raw materials purchased by the company
- A quality control process that will improve incoming goods inspection routines and reduce rejections
- An improved stockholding system that will reduce wastage whilst sustaining production and improving the costs of stock and cash flow
- An accurate database of information, recording worldwide vendors and potential vendors of current and potential raw materials and component products

- A working purchasing and inventory system to benchmarked standards, with potential for further integration with other business operations such as marketing.

Of particular interest was expertise and knowledge of just in time inventory control and purchasing and inter-company supply chain management systems. The project was designed with three phases in mind (presented as sequential phases)

(1) Developing a supplier evaluation and negotiation system;
(2) A quality control and stockholding system with finally
(3) Extending and implementing these systems firm wide.

In phase 1 the core objectives were to identify past problems, investigate the suitability of alternative software packages to support purchasing, inventory control and supplier profiling. To build a prototype monitoring system conduct a supplier audit (i.e., establish purchasing partnership programme); and establish a single source partnership supply chain. In phase 2, the aim was to investigate the current inventory system, establish stockholding against requirements, and investigate the potential contribution of a bar-coding system. Finally, it was envisaged that minimum stock levels for key components would be established. In phase 3, the aim was to extend the system for future suppliers in all supply areas, establish a formal purchasing supply manual, regulations on suppliers, quality procedures and requirements for all suppliers. In addition, a review and evaluation of the proposed system of purchasing, supply and inventory management would be conducted as well as training on the new systems and integration of purchasing and marketing and inventory into an organisational MIS system. It was expected that Beta's gross profit would increase during the programme by £56,000 and by £77,000 the first year after completion, £90,000 in the second year and £105,000 in the third year.

5.3.3 Case Study: Gamma

TCS was introduced to representatives of Gamma's management team by academics working with them on a project called 'Green Futures'. The Green Futures project was established in 1995 by Gamma (lead partner) with a group of architects, local Borough Council and the Intelligent Buildings Research Centre of Mid-Uni. Negotiations began in April 1996 and the formal go-ahead was given by in March 1997 with the Associate beginning on 1 September 1997. The programme was a "1-1" and completed in September 1999. The delay in gaining approval and start-up (15 months) can be attributed to two key reasons. First, the programme proposed by Gamma in partnership with academics from Mid-Uni was significantly different from the usual manufacturing-type projects. As Gamma was a housing association (e.g., it has charitable status) the management team could not easily complete the grant application and proposal form, as it could not show 'profits'. Any surplus was ploughed back into Gamma to help generate greater social, economic and employment benefits. This was difficult to show on the application form. The proposal went through twelve drafts before being accepted. Secondly, because of the delay in gaining approval the partners missed the Graduate recruitment "season" and spent many months trying to secure an appointment.

Gamma is a housing association employing 100 staff with a housing stock of over 1200 units. Its main activities include house letting, renovation and construction made possible through capital funding by competitive bidding. To win more development funds Gamma's management team felt it necessary to further differentiate its product. A business opportunity was identified through the delivery of environmentally friendly energy efficient dwellings. The aim has been to identify the best building technology, through a novel simulation process, that would enable Gamma to commission houses that were cheaper to run, provided better living conditions, used fewer non-renewable materials and less energy and resulted in less pollution and waste. New technological solutions would be identified by the application of a new design methodology. The methodology would be applicable to on-going refurbishment and new housing projects and would therefore be of benefit to other housing providers, through additional sub-

contract project management, technology transfer by consultancy commissions. This would be the new business for Gamma and would compliment the activities already undertaken through the Green Futures project. It was intended that the programme would deliver the following benefits:

- A databank of house building technology to improve Gamma's business;
- A holistic simulation process of the life cycle performance of houses which can identify the optimum combination of design elements; producing housing which commands a rental premium and is easier to let or sell;
- A design methodology that identifies the best combinations of building components, through simulation given the best available technology;
- Presentations of the design methodology and records of its application;
- Housing provision/management contracts with other housing providers.

Of particular interest to the management team was access to the academics expertise in computer simulation and the facilities for life cycle performance simulation. The programme was designed with four phases:

(1) Databank development
(2) Developing a computer simulation process
(3) Developing a method for using computer simulation for design guidance
(4) Presentation and dissemination of development.

In phase 1, the aim was to identify and evaluate building materials and techniques and to construct a database. In phase 2, the aim was to select and refine computer simulation software and to construct a robust process that evaluated the relative merit of different materials, components, assemblies and construction techniques. It also included identifying the relative merit of combining these alternatives and to incorporate real weather data with these simulations. In phase 3, the key aims were to develop a method for using the simulation process and to optimise design element selection and combination that would lead to recommendations for the design team. In phase 4, the aim was to develop a product portfolio (written audio-visual and computerised

media) for sale to the Green Futures network. It was expected that the total units managed after the project would represent an increase of 484 units.

5.3.4 Case Study: Delta

Negotiations began at Delta in April 1997 with the Associate starting 1st September 1997. The programme was a "1-1" and completed September 1999. Delta employed 48 staff manufacturing and distributing filing systems including files, rotary card filing systems, lever arch rack units and filing platforms as well as providing commercial printing. The main market for its products was in the UK with exports accounting for less than 5% of turnover. Catalogue re-sellers currently dominate the customer base (e.g., John Heath & Co. Ltd., Spicers Ltd., Viking Direct, and Niceday Ltd) while product innovation design and development relied heavily on the intuitive skills of its senior management team. To ensure growth, the Managing Director (hereinafter "WW") saw fit to create a formal capability and associated processes for innovation. The programme was to provide a timetabled structure for new products as well as product innovation and acquisition processes. The aim was to ensure new products were available through in-house design or acquisition thus allowing the management team to respond to its major supplier's move to rationalise their suppliers:

- The company to have a timetabled, logical process model for developing new products;
- The company to have developed an organised system for documenting specific product information drawings, dimensions etc;
- The profile and thus the marketing of the company to be enhanced by the regular addition of new products;
- Systematic focus on new products to cause the business to be evaluated more regularly;
- A formal capability to enable the company to attract and retain the higher calibre professional staff it will require for continued growth; and

- The disciplines implemented by the formal processes to have knock-on effects into other company functions where they interface, leading to improved operational efficiencies elsewhere.

The academic from A-Uni's Business School had knowledge of managing innovation in mature SMEs, environmental scanning for new technologies and business opportunities. He also had an understanding of government policies for stimulating innovation in SMEs and knew of the importance of creating innovation networks. The programme was designed with six phases:

(1) Establishing processes for market/customer requirements
(2) Establishing technical capabilities
(3) Reviewing materials and manufacturing processes
(4) Designing a new product development timetable
(5) Developing acquisition screening processes
(6) Generating final recommendations.

In phase 1 the aim was to document and evaluate existing procedures for New Product Development (NPD), assess existing market and customers and consider potential markets and customers. In phase 2, the aim was to document and evaluate existing technical capabilities, including gap analysis, plan for improving the design and innovation process, develop an algorithm for "make-or-buy" and devise a continual review process. In phase 3, the aim was to examine the existing range of products including materials, technologies and manufacturing processes and devise a continual review process. In phase 4, the aim was to create outline proposals for NPD timetable, modify and finalise the timetable for speedy and successful introduction of new products, investigate longer-term potential for new products encompassing new materials, technologies and processes and devise procedures for regular evaluation of existing products. In phase 5, the aim was to establish criteria for potential acquisitions, identify and investigate a small number of firms that were potential acquisitions and modify and finalise screening process for acquisitions. In phase 6, the aim was to provide recommendations for the development of new markets and new customers,

implement processes for continual review of materials, technologies and manufacturing processes and implement a process for regular analysis of markets and customers. It was expected that Delta's gross profit would increase by £15,000 during the programme and by £30,000, £50,000 and £65,000 in each of the following years.

5.3.5 Summary

Having provided a thumbnail introduction a summary of the interviews and meetings with the TCS Centre manager and the TCD consultant is recorded in figure 5.3.2 and interviews and meetings with case study participants is given in figure 5.3.3.

Figure 5.3.2: Summary Table of Interviews and Meetings

TCS Centre Manager (Birmingham)	Regional TCD Consultant
(1) 27/08/96	(1) 20/06/97
(2) 21/01/97	(2) 22/08/97
(3) 06/03/97	(3) 21/01/98
(4) 11/03/97	(4) 17/04/98
(5) 20/03/97	(5) 20/20/98
(6) 30/04/97	(6) 18/12/98
(7) 15/07/97	* A number of informal discussions were conducted after LMCs.
(8) 22/07/97	
(9) 04/08/97	
(10) 13/10/98	

Figure 5.3.3: Summary Table of Interviews and Meetings

* SG was on maternity leave from 01/01/98 - 30/04/98.

Case Study	Associate (No of interviews)	Industrial Supervisor (No of interviews)	Academic Supervisor (No of interviews)	Local Management Committee (LMCs)	Meetings (as noted)	Other (as noted)
Alpha/A-Uni	PM **(1) 10/11/97** **(2) 25/02/98** **(3) 27/03/98** **(4) 24/04/98** **(5) 14/01/99** **(6) 19/01/99** **(7) 21/01/99**	PA (1) 29/7/97 (2) 02/09/97 TD (Tec. Director) (1) 09/10/98	SG (1) 24/04/98 (2) 03/02/99	(Minutes only) (0) 19/12/96 (1) 14/04/97 (2) 28/07/97 (3) 10/11/97 (4) 16/03/98	(Project) (1) 02/99	(Report) (x2)
Beta/Mid-Uni	PB (1) 02/10/97 (2) 22/12/97 (3) 29/04/98 (4) 07/10/98 (5) 20/01/99 (6) 18/02/99	SR (1) 23/09/97 (2) 09/11/98 (3) 20/01/99	GB (1) 19/02/98 (2) 19/01/99 (3) 18/02/99	(Attended) (0) 17/08/97 (1) 07/11/97 (2) 11/03/98 (3) 21/07/98 (4) 14/12/98	(Project) (1) 01/98 (2) 06/98	(Report) (x2)
Gamma/Mid-Uni	SG* (1) 19/08/98 (2) 08/02/99 (3) 01/03/99 (4) 08/04/99 (5) 04/08/99	LY (1) 12/07/99 (2) 04/08/99	RB (1) 26/06/97 (2) 08/04/99	(Attended) (0) 22/08/97 (1) 03/12/97 (2) 24/04/98 (3) 22/07/98 (4) 06/11/98 (5) 10/06/99	(Project) 26/09/97 10/10/97 21/11/97 16/07/98 02/10/98 09/11/98 04/12/98 21/12/98	(Confer.) (x1)
Delta/A-Uni	MC (1) 18/02/98 (2) 04/03/98 (3) 03/07/98 (4) 28/09/98 (5) 05/03/99 (6) 19/04/99	WW (1) 13/10/98	OJ (No interviews were arranged - OJ is my supervisor and we spoke about Delta informally on many occasions)	(Attended) (0) 28/10/97 (1) 09/02/98 (2) 18/05/98 (3) 17/09/98 (4) 21/01/99 (5) 04/06/99	(NPD - minutes) 03/03/98 24/03/98 16/04/98 14/05/98 17/06/98 30/07/98 24/08/98 29/09/98 18/02/99 18/03/99	(Reports) (x3)

5.4 The Innovation Process: Research Design and Questions

5.4.1 Modes of Explanation and Understanding

Critical realism is a philosophy *not* a substantive social theory. It provides what might be termed 'sensitising devices' which act as 'the germ of the analysis' (Hammersley and Atkinson, 1993:212) helping the researcher conceptualise and abstract particular constituents and their effects (Layder, 1994). In making use of such devices it is important to consider the nature of social phenomenon:

> "Method suggests a carefully considered way of approaching the world so that we may understand it better. To make judgements about method it helps considerably if we have some idea of the nature of the relationship between ourselves and that we seek to understand. Yet it is at this fundamental level that many arguments about method go wrong, they fail to consider knowledge in its context" (Sayer, 1992:12).

Explanation and understanding depends on how we investigate and explain knowledge. Hence, it is necessary to consider the dimensions through which knowledge is constructed and expressed: (i) *work* and (ii) *communicative interaction*. It is through work that we gain knowledge of our environment and can change it (*through knowing*). Likewise, through communicative interaction we as individuals 'using shared resources, in particular a common language' acquire knowledge of society (Sayer, 1992:14). In acknowledging work we recognise agents in society are not merely the carriers of knowledge they also produce it. As producers agents rely on language to communicate and express prepositional knowledge which is confirmed inter-subjectively *as practically adequate*.

Knowledge is a system of meaning and has to be confirmed within the agent's language community (Sayer, 1992). Knowledge is neither fixed nor invariant it is activity based; knowledge development is a social practice (Foucault, 1980). Hence, 'we cannot develop knowledge outside of a society in which we learn to think and act...the social conditions and the social relations under which the production of knowledge proceed will influence its content and direction' (Brocklehurst, 1997:103). Researchers are dependent on linguistic,

conceptual, cultural and material resources to interpret knowledge. They and that which they are researching are buried in their own language communities. Social research involves reading and interpreting both sets of meanings the double hermeneutic (Giddens, 1995).

Acknowledging the dynamics between subject (researcher) and the object of inquiry indicates social analysis is more than just a question of observation. Reality does not stand in 'glorious isolation' but is mediated via the meaning systems and communities that object and subject inhabit. Reality is constructed and formalised according to the resources available to those participating in society. It is because social phenomena are concept-dependent that the researcher must do more than just provide simple 'descriptions' of what it is they find. They must make sense of the underlying mechanisms that make such activity possible. As Sayer (1992:31) states:

> "In the case of using money, we could observe the physical behaviour of handing over the little metal discs until the cows came home and we could use every statistical technique in the book to process our observational data, yet if we did not know the meanings on which the use of money is dependent in society under study, we would still not have any idea of what was actually happening, or what kind of action it was... This kind of understanding requires not the amassing of empirical data, but a conceptual and philosophical analysis of the action and rules implicit in it".

This does not imply that meanings are reducible to the individual, their beliefs or opinions. To understand social interaction is to recognise and interpret the *properties* of language (Giddens, 1995; Morrow, 1994). Material and social objects are both concept-dependent the use and functioning of material objects relies on interpretation (although they exist separately of the meanings we give them) while meanings and beliefs more often than not need to be objectified in some material form if they are to communicate those meanings. We can argue that a change in meaning will usually be matched by a change in practice.

Reading epistemology in this way means re-formulating our notions of theory and fact. It is misleading to consider observations as factual. All observations of 'reality' are mediated by language and as such it is impossible to assume they

are theory-neutral. It is because we cannot take ourselves out of the language communities we populate that our observations will always be theory-laden. Whatever we describe or discuss has to be couched in language, which has its own properties. The distinction often made between theory and fact hides this condition (Sutton and Staw, 1995; Weick, 1995). Theory is a chronic condition of being; to be is to theorise or to prescribe a particular way of conceptualising something. Given this, critical theorists make the distinction between 'thought objects' which includes all theoretical and factual statements about the world and the 'real objects' that are states or properties of the world that can only be known through 'thought objects' (Morrow, 1994). This separation means that when we talk about objects we recognise that our statements are theory-laden and therefore may be contested. Although our knowledge of the world (material and social) may be partial, incomplete and ultimately fallible it does not mean that all knowledge is equally fallible.

> "It is precisely because the world does not yield to just any kind of expectation that we believe it exists independently of us and is not simply a figment of our imagination. If there were no cases of our statements being confounded, if wishful thinking worked, there would be no reason for being a realist, we could say that truth was relative to our conceptual scheme" (Sayer, 1992:67).

If it is not possible to represent material or social objects truthfully then our knowledge of them should be 'practically adequate' (Sayer, 1992). Thus, we might argue that some thought objects (practices, discourses or paradigms) are more practically adequate than others.

Proposing practically adequate explanations of *social* objects is problematic. For instance, if agents are reflexive then what is to stop them changing their representations to the researchers? How can we be sure that our explanations are *practically adequate*? I suggest that although the subject has an impact on the object of its inquiry (inevitable) this does not necessarily mean that social behaviour and in particular its constituent structures and properties will be 'obscured' to the extent that an adequate explanation is no longer possible. Instead, it reinforces the need to accept the fallibility of knowledge construction and understanding. Given that all observations are negotiated then it is

necessary for the researcher to reflect on their involvement in order to make transparent (as far as it is possible) the impact of the research process on the object of inquiry. In proposing practical adequacy it is important that it too 'cannot be divorced from a given political context within which the pursuit of knowledge takes place. The production of knowledge is a social practice where the selection of problems, the issues worthy of investigation and the criteria used for evaluation are all influenced by structures of power and domination' (Brocklehurst, 1997:104-5).

To sum-up, I take a critical realist view in relation to epistemology and ontology but accept the fallibility of identifying the properties and structures that mediate *social practice*. Given these caveats it remains to explain how properties or meanings no matter how partial or problematic can be abstracted from the totality of social interactions for the purpose of analysis?

5.4.2 The Nature of Abstraction

To make sense of the world (material and social) the researcher is obliged to identify its constituent objects their attributes and relationships. Borrowing insights from network analysis it might be argued that the researcher has to 'choose' a part of the *total network* for the purpose of analysis (Mitchell, 1969). This is because the total network 'the general ever-ramifying, ever-reticulating set of linkages that stretches within and beyond the confines of any community or organisation' is too vast to study in its totality (Mitchell, 1969:12).

> "At the outset our concepts of concrete objects are likely to be superficial or chaotic. In order to understand their diverse determinations we must first abstract them systematically. When each of the abstracted aspects has been examined it is possible to combine the abstractions as to form concepts which grasp the concreteness of their objects" (Sayer, 1992:82).

For analysis a *partial network* has to be abstracted (Scott, 1991). This begins by deciding the definitional focus of the study (Laumann *et al*, 1983) and reflects a number of rules of inclusion that set the parameters of the networking activities to be included. These rules relate to three sets of components'

(i) Actors

(ii) Relations

(iii) Activities

One or more of these sets can be used to establish the partial network. The first definitional focus is based on finding a common element linking actors in a network. The second definitional focus is dependent on the participation of actors in some specified type of social exchange. The third relates to some event or activity that selects individual actors and the social relationships among them. This method can be used to construct *action-sets*. These are special kinds of networks that are established to realise some preferred objective (Conway, 1997). Abstraction also depends on anchoring. Anchoring the partial network around a particular actor is termed *ego-centred* networks while anchoring around a group of actors is termed *socio-centred* networks (Conway, 1997; Scott, 1991). For the purpose of this analysis the rules of inclusion used to 'construct' the *action-sets* is a combination of *relations* and *activities* constituting organisational innovation anchored about a *socio-centred* network involving academics, company representatives, and the Associate.

Given the partial network is defined around the activities of the 'project team' in the TCS programme it still remains to construct a framework to represent the knowledge creation process, organisational innovation and the duality of structure. It is necessary to make transparent the reproduction of the organisational order in terms illustrating the core transitional processes linked to the innovation process and the enduring configurations of the institutional setting. This is made possible drawing on a range of concepts described in earlier chapters.

The notion of 'structural activation' introduced in chapter three is used to make sense of innovation and organisational change. Organisational capabilities represent firm specific knowledge and it is this knowledge in its embodied and un-embodied forms that constitutes an *organisational repertoire.* The repertoire represents the co-ordination of (i) everyday activities, (ii) activities associated with change and (iii) activities undertaken in response to special occasions

(Clark and Staunton, 1989:184-185). Organisational repertoires are made up of many *poses*. As in the case studies, when handling the construction, communication and exchange of knowledge the firm will adopt an *innovation pose* in conjunction with its *basic operating pose*. The organisational repertoire, its multiple poses, constitute the *zones of manoeuvre* the antecedents, pre-existing organisational arrangements that both constrain and enable innovative activities. Exploring the innovation process requires an analysis of the social practices that reflect the re-structuration of the existing repertoire through the activation, merger or replacement of the embodied and un-embodied knowledge found in the firm's zones of manoeuvre.

Each TCS programme is *represented* as an ensemble of *tasks* that mediate and constitute the new bundles of knowledge enabling organisational reproduction. The term *task* is consistent with the terminology used at LMC meetings and in programme documents. "Tasks" refer to the activities of programme participants involved in the translation of innovative ideas into a business solution. Tasks are considered in a way similar to Barley's (1986; 1990) use of *scripts* in his study of organisational re-structuring. *Tasks* like scripts orientate or mediate the actions of agents. They encapsulate the mechanisms or modalities, through which knowledge is first defined and then constructed, communicated and exchanged. To this end, the *tasks* also delineate future practices – the tangible processes of knowledge creation. The mediating properties of each *task* are viewed critically to ascertain the social construction of socio-technical artefacts and processes. Drawing on Giddens (1995) notion of the duality of structure (chapter four) the mediating features of these *tasks* (structural properties) are considered in relation to the enduring properties of the organisational repertoire (pre-existing and extended structural properties). By exploring the mediating properties of tasks through the lense of an interactive perspective (intensive research logic) it is possible to develop a better understanding of the innovation process. Focusing on the properties of change and the process through which such elements are negotiated and instantiated illustrates the interaction of action and structure in social reproduction.

To be able to identify and verify these properties it is necessary to adopt a number of 'tactics'. The tactics adopted in this analysis include, noting patterns, themes, contrasting and comparing and building a logical chain of evidence (Miles and Huberman, 1994). First, "noting patterns and themes" involved considering the *patterns* of processes in each of the case studies organised around discussions concerning programme *tasks*. To ensure that these patterns were subject to critical review or 'scepticism' (Miles and Huberman, 1994:246) tasks and the events surrounding them were discussed (where possible) with all members of the action-set. Considering patterns of activities from multiple actors was important because it drew-out inconsistencies and allowed contrast and comparisons. Using this tactic it was possible to compare events and observations within and without the various case studies. Appreciating such variations and commonalties facilitated attempts to build a logical chain of evidence that was also *practically adequate*. Following the events of four case studies over a two-year period was logistically challenging yet the advantage was to be found in the insight it provided concerning both behavioural and contextual issues influencing organisational change. It was possible to construct a schema of themes in and between case studies (see chapter six).

Outlining social interaction does not explain social phenomena, which is the prime error of functionalism. What is required and what is proposed using the notion of mediation and modalities is the development of second-order accounts to clarify 'first-order' representations. As Sayer (1992: 104-105) argues:

> "On the realist view, causality concerns not a relationship between discrete events ('cause and effect'), but the 'causal powers' or 'liabilities' of objects or relations or more generally their ways-of-acting or mechanisms"

This conception of causality goes beyond common sense explanations (see chapter four) that tend to assume that it is the object or set of relations that *produces* some form of change. Causal analysis is better served by establishing what it is *about* the object or relations that *enables* change to occur (making reference to the structure of the objects). This kind of analysis or 'retroduction' (Sayer, 1992) presupposes that all social action is context-dependent. In doing so, the claim that certain actions will be predictive across contexts is rejected.

This is not a weakness, as contingency supports the idea all social interaction depends on pre-existing social structures, material resources and meaning systems (Morrow, 1994). Contingency is a core resource in social analysis as it offers clues to the nature of events and the properties that mediate social relations. This logic underpins the proposed adoption of an interactive process perspective. It offers tools to represent and interrogate the innovation process in ways that offers a new direction conceptually and methodologically to the approaches identified in chapter two. Considering innovation in terms that focus on what it is about these relations and their processes (i.e., *phases* and *tasks*) that enables change is an attempt to make sense of the complexities incumbent of the innovation process.

The approach is significant because it confronts those 'issues that irrevocably define the constitution of...[the]...subject matter and the analytical and methodological terms on which it is to be researched and explained' (Reed, 1997:21). However, in proposing this direction it is not my intention to infer that a structurational account of organisational innovation is the only avenue for future research. Here it is used as a sensitising device for the purpose offering revised insights for improving our understanding of organisational innovation.

5.4.3 Purpose and Research Questions

My concern is to represent and explain the innovation process in ways that are sensitive to resolving the dualisms and methodological limitations noted in the previous chapters. I begin by asking relevant research questions. My research questions are two-fold in that I combine looking at issues concerning the mediational characteristics of the innovation process with a critical appraisal of the reproduction of an organisational order via the same process. This research project is a micro-sociological account of the innovation process and tries to reconcile explanations drawing on individual agency *and* social structures via the adoption of an alternative mode of explanation and conceptualisation.

To be able to appreciate the social morphology and origins of the interpretative frames (technical and social) informing decisions about organisational change it

is useful to outline the process through which these frames and decisions are first broached and ultimately sanctioned. *How do company representatives and academics define the business problem and propose appropriate solutions?* To answer this I begin the analysis by outlining the complexities of establishing TCS programmes (chapter six). Subsequent consideration of the four case studies is based on the development of an interactive perspective orientated around key themes introduced in earlier chapters and summarised above. This research project is based on the proposition that *institutional and behavioural contexts interactively influence organisational innovation.* To explore innovation it is necessary to consider several other research questions:

1. How are TCS Programme aims and objectives translated into reality; consider the social shaping of innovation?

To do so means exposing the processes, by which knowledge is constructed, communicated and exchanged to illustrate the negotiated characteristics of social interaction and organisational reproduction. Considering the way project *tasks* are operationalised or perhaps problematised offers an insight into the way agents negotiate or dominate this process. Here it is possible to show what it is about the *tasks* that enable certain actions and not others hence identifying their mediational characteristics *and* the core paradoxes in social interaction.

This builds on previous analyses (e.g., Nonaka and Takeuchi, 1995) but also develops new insights as I explore the actual process by which knowledge is translated into something that is useable by an organisation.

2. What is the relationship between the interdependencies mediating the innovation process and the success or failure of the four Programmes?

Tasks indicate the rules and resources (physical and intellectual) necessary to change the organisational repertoire. Exploring the mediational effects of these communicative resources it is necessary to consider the practical processes of translating tasks into tangible processes and embodied technologies such as physical machinery. This illustrates the strategic aspect of change activities and

their precarious nature. To this end, it is useful to consider:

3. How and to what extent does an interactive process perspective contribute to our understanding of TCS as a model of organisational innovation?

At this point it is perhaps useful to clarify what the research is not trying to achieve. In particular, although the research comprises four TCS programmes involving SMEs and HEIs it has not been my intention to contribute directly to debates linking SMEs and the knowledge base. This is not to deny the significance of these arrangements in the innovation process (see chapter two). The nature of the firm (e.g., size), the links with academics and the establishment and running of each TCS programme are treated as contingent elements of the innovation process under investigation. They represent the terrain and contextual features implicated in the innovation process and as such each case study is treated on its own merits. Nonetheless, as described earlier, limited comparative generalizations are possible while this is used by the consultant to show the programme management processes.

To ensure it is possible to make sense of both empirical and causal elements it is essential that both the researcher and researched (as far as is possible) speak the same language. Consequently, to understand the object of inquiry the research design and techniques must be appropriate to the task.

5.4.4 Research Design and Techniques

As outlined in chapter four discussions about research methods are usually couched in terms of quantitative and qualitative methods (Bryman, 1988). The shortcomings associated with this were made apparent in the same chapter. Instead, I argue that a better distinction is achieved when comparing intensive and extensive research. In doing so, I argue that decisions about research design must complement the *research context*. In this respect, context relates to the *innovation process* and the social interactions associated with the

construction, communication and exchange of knowledge in an organisational setting.

This is best served using a case study approach (Yin, 1994) combined with participant observation techniques including unstructured and semi-structured in-depth interviews, direct participation and documentary analysis (Silverman, 1985; 1993; Denzin, 1970). Participant observation techniques facilitate an ethnographic approach providing detailed and rich data from a variety of sources (Hammersley and Atkinson, 1993). The advantage of these techniques is that respondents are 'free' to define what they consider to be the core relations, events and issues that characterise their work (Foddy, 1993). The insights gleaned during the two years of fieldwork would not have been possible using an extensive research design based on postal questionnaires.

Securing the case studies required protracted negotiations with a number of individuals in both my host university and the Teaching Company Directorate. The choice of TCS was not my original idea. For this I must thank the erstwhile head of Aston Business School, Fred Hewitt, who tabled the idea at a presentation I gave to members of the Research Committee. Gaining *access* took seven months (December, 1996 - September 1997) with the first task being to persuade the Birmingham TCS Centre manager to act as my 'champion' with the TCD. This proved straightforward as the manager was keen to make use of the research output. Having gained his support it was then possible to obtain the 'inside track' to the TCD Director and TCD consultant. This was not totally successful as my first application for access was refused (December, 1996). However, with the support of the manager it was possible to agree a compromise (March, 1997). The key concern of the TCD Director was that the research would not be under his control. For me it was important to ensure neutrality during the research process (I did not want to be seen as a TCD 'plant'). It could easily have become problematic if the respondents thought I was reporting back to TCD at the first sign of trouble. The compromise involved the TCD Director agreeing not to veto my research as long as I made sure the participants knew the research was not sanctioned by the TCD. This enabled me to confirm my 'neutrality' and distance from the TCD.

With this agreed, I was introduced to the TCD consultant. The timing of this meeting proved fortunate as the research output was quickly viewed as a potential resource. At the time of negotiating access the TCD Director asked his regional consultants for ideas to improve the administration of TCS (it coincided with the quinquennial review). To this end, the consultant viewed the research as a useful platform on which to clarify current procedures (I provided him with a process model – summarised in chapter six). This was fortuitous as the consultant provided a detailed account of his work. For instance, four iterations of the process model were made over a twenty-month period. This provided useful background to the processes and procedures associated with the establishment and running of TCS programmes.

Arranging the case studies relied on the Centre manager. I had little choice in the TCS programmes suggested other than ensuring they were SMEs. This might be seen as a failing of the research design. However, at that time it seemed a necessary concession to ensure the manager would support the research. Without his introductions it would have been very difficult to gain such a positive introduction to the participating institutions. I took the decision not to query his choices of company, as it did not present the analysis with any substantive problems. As long as the companies were either negotiating or had just started their programmes then no problems were envisaged. Unfortunately, it was not possible to visit the companies prior to their decision to apply. This is because all the companies chosen had already shown interest (the manager recommended them). Instead, a retrospective view of each company was acquired.

Access to each of the case studies also depended on negotiations with the Managing Director, nominated industrial supervisor, academic supervisors and the Associate. It was essential that each of these individuals was aware of my intentions and the level of involvement. In presenting the research I tried not to indicate a specific objective only that I was interested in developing a process perspective of organisational innovation. Contact was decided on an ad hoc basis with the meetings kept to a minimum at any one time. Meetings were arranged on a monthly basis although there were times when respondents were

not interviewed for several months. This had more to do with trying to juggle four case studies, teaching commitments, reading, writing articles and reflecting on the vast array of data including transcriptions (which are time consuming to complete) than problems with access (see above regarding failed case studies). In this sense, I agree with Hammersley and Atkinson (1993:206) that:

> "Fieldwork is a very demanding activity, and the processing of data is equally time-consuming. As a result, engaging in sustained data analysis alongside data collection is often very difficult".

Regular attendance at Local Management Committee meetings (three meetings every four months for each programme) was not matched by regular attendance at team meetings (weekly/monthly), which proved more difficult. On the occasions when I was unable to attend these meetings minutes were requested (if available).

Interviews, without exception, involved one person although I would often see participants one-after-the-other to make best use of my visits. Interviewing this way gave them the opportunity to provide 'uninhibited' answers. These interviews were either un-structured or semi-structured depending on the circumstance. At each of the interviews (with Associates and supervisors) I would use the programme tasks as a guide. Tracking progress using the task descriptors and time-line was a key objective for each interview. However, during discussions about the tasks it was sometimes appropriate to let the respondent discuss related items of work. Associates were often required to work on other activities other than the tasks. These 'diversions' were sometimes invaluable when making sense of issues impacting a programme. At times the interview schedule (based around tasks) was abandoned and the respondent was allowed to freely discuss whatever seemed most pressing.

During each interview I attempted to make connections with previous discussions or other data. Sometimes this was not possible until after the interview when I would write brief notes. This practice became quite regular resulting in the creation of a 'research diary' to keep ideas and thoughts. These tools have been very useful in systematising field-notes and ensuring their

reliability (Silverman, 1993:146-147). On occasion it was necessary to use interviews to clarify data gathered at previous meetings. This helped validate issues and interpretations including comparing views of different respondents. For example, one Associate tended to mumble her words and speak very quietly. In this case, it was necessary to ask the respondent to clarify themes covered in previous interviews. This problem improved after I began placing the tape recorder 'under her nose' and asked her to speak louder. This worked and soon became a source of amusement between us.

Conducting regular interviews helped "funnel" discussions and ensured that the research did not just drift along (Hammersley and Atkinson, 1993). The contact with Associates did on occasion have unintended consequences which offers insight into the research process and the relationship between subject (researcher) and object (respondent). The distinction between subject and object in my own experience is constantly blurred. For example, in one interview an Associate stated that she was having problems with her academic supervisor. This involved the use of a particular software package, which she felt was unreliable and not user-friendly. At the time I asked whether she had written a 'pros and cons' list comparing her preferred software package and the academic's? By the time I saw her next she had written a report comparing packages. She may have written this without my intervention but it does suggest that in my efforts to extract information I may have influenced her actions.

Taping interviews meant I could concentrate on the respondent and make notes. My use of the tape recorder was negotiated at the beginning of every interview and while most appeared awkward with its presence to begin with all seemed to ignore it in time. Its use was a problem at one case study when the Managing Director felt that for reasons of commercial confidentiality it was inappropriate. In this case I took detailed notes. Unfortunately, the Managing Director told the Associate that he should not be recorded during interviews. This could have been a major problem as the case study promised to be complex and would have been difficult to follow without the help of tapes. To resolve this I suggested, at the first interview with the Associate, that the tape recorder only be used when discussing technical details. At the first interview the

tape recorder was turned off. However, once it was turned on the Associate soon forgot it was there and went on to discuss a range of issues. At the next interview I asked the Associate if he was happy for the interview to be recorded. I remarked that he had seemed at ease during the last interview and if there were things he was worried about the tape recorder would be turned off. This was a much better arrangement. Ultimately, the tape recorder was never turned off at any of our subsequent interviews even though the Associate did provide some controversial observations.

Attendance at programme meetings was agreed with all participants including the TCD consultant. This was confirmed before the first Local Management Committee of each case study. Meetings were useful for getting a 'feel' of the dynamics of programmes (dominant personalities, working relationships). They were also an opportunity to help confirm issues and the perspectives of participants. Equally, these meetings could provide an opportunity to discover when issues were 'deliberately' over-looked. In most programmes there were occasions when points of contention were left off the agenda. It is interesting that the forum for discussing programmes (e.g., Local Management Committee) rarely included detailed negotiations about changes. In the majority of case studies (as far as I could tell) many key decisions took place behind the scenes and out of earshot of the consultant. Finally, to aid my understanding of TCD more generally I attended the UK TCS Centre Manager Conference, the TCD sponsored TTI '98 Conference and TCS Supervisors workshop. On each occasion I was able to talk informally with a range of people involved in TCS programmes about current issues affecting their work and so on.

As part of the process of collecting data it is necessary to consider the validity of the findings. *Validation* is a necessary element of the research process. By this I mean 'explicating how we claim to know what we know' (Denzin and Lincoln, 1994: 496). The aim is to 'establish a correspondence between the sociologist's and the member's view of the member's social world by exploring the extent to which members recognize, give assent to, the judgements of the sociologist' (Bloor, 1978: 548-9, cited in Hammersley and Atkinson, 1995). This can be partially achieved through 'respondent validation' (see Silverman, 1985; 1993).

In this research I have (as far as possible) asked respondents to confirm their descriptions of events. The development of the TCS process model, developed over twenty months with the help of the TCS Centre manager and TCD consultant being a good example. Confirmation was assured either by sending interview transcripts to respondents for comment or as was more common to discuss the content of interviews in the follow-up interviews. There were times when it was difficult to check the Associates representations. This is because discussions with supervisors may have compromised the confidentiality of the Associate (and visa verse). In such cases, I had to rely on these issues 'finding their own way' to the discussion table or using other data (observations during meetings) to confirm 'inconsistencies'. Finding 'inconsistencies' is significant because this 'additional evidence may materially alter the plausibility of different possible interpretations of the data' (Hammersley and Atkinson, 1995:228).

There are limitations to respondent validation. As Brocklehurst (1998:118) states 'if an informant is not telling the 'truth' then the informant will merely confirm the 'non-truth' of what the researcher feeds back'. The problem with representing the 'truth' relate to three points (see Van Mannen, 1983; Hammersley and Atkinson, 1995). In the first instance, respondents may be the recipients of false information. On these occasions it will be almost impossible to find out the 'truth'. The cross-referencing of information will help to find 'non-truths' yet this will not help when there is a collective cover-up. Secondly, respondents may be are unaware of what they do or why. Hammersley and Atkinson (1995:229) observe much 'social action operates at the subconscious level, leaving no memory traces'. Identifying the hidden rules and meanings governing behavior can only be partial although conducting a long-term discourse with respondents through interviews and meetings provides an opportunity for them to reflect on their activities. Thirdly, respondents may choose to mislead the researcher. For Van Mannen (1983) and Hammersley and Atkinson (1993) such misrepresentations should be treated as another valuable source of data and insight. According to Van Mannen (1983:42), researchers are presented with "presentational data". As a consequence, respondents may be putting a 'gloss' on their descriptions in order to present themselves (or others) in a favorable light. Once again, the

only guard against this (and this may only be partially successful) is to try and ensure that data is obtained from multiple sources so that inconsistencies become the focus of attention rather than being disregarded.

5.5 Conclusions

Developing an interactive process perspective of organisational innovation demands an intensive research methodology based on longitudinal case studies concerned with teasing-out the generative mechanisms that both enable and constrain change in the organisational repertoire. Utilising a number of sensitising devices it is my intention to offer a revised perspective of organisational innovation. Such a project relies on making sense of how tasks are translated within an organisational setting. This will involve detailed appraisal of the strategic conduct of programme members in relation to the contextual factors mediating their actions. In turn, it will rely on being able to demonstrate how such contextual factors are both the medium and outcome of translation and organisational reproduction.

In the next chapter I begin by constructing a model of how the programme tasks are first constructed. This is a simplified process model and although presented as a linear sequence of events illustrates how the generative properties of the innovation process are first defined and sanctioned. This provides a basic introduction to the analysis that follows which provides a shorthand review of the main characteristics of the innovation process in each of the four case studies. In this discussion the sensitising devices presented in this and previous chapters are used to represent each innovation process and provide insight into the transitional processes and negotiations incumbent of each case study. It is not until chapter seven when a detailed analysis of two of the four case studies is presented that the author explores the mediational effects of translation and organisational reproduction.

Chapter Six

The Innovation Process: Summary of Themes and Processes

6.1 Introduction

Here I consider the transformation of four organisational repertoires based on an analysis of the modes through which social systems are reproduced. It is proposed the reflexive monitoring of action at the level of social integration is significant to system integration. This is because "innovations" are likely to affect system integration as the members of programmes try to change the conditions by which organisational repertoires are reproduced.

Tracking the formation and implementation of the programme tasks in each of the four case studies provides an indication of the complexities of translating ideas into tangible artifacts and practices. It has emerged that the sharing and construction of knowledge across communities can be reduced if individuals or groups erect barriers and indicates that the innovation process depends as much on social processes as market forces. Hence, to understand how and why innovations emerge, develop, grow and perhaps lapse or terminate relies

on the connection between the behavioral and institutional properties of the innovation process *and* organisational reproduction.

I begin in section 6.2 by 'modeling' programme start-up in order to confirm the guiding principles organising would-be participant's involvement. Not only do these activities inform participants of the key principles and interpretations used to judge each programme they also instantiate the rules and resources, remembered as codes of conduct that should guide future actions. The codes of conduct relate to the administrative protocols used to sustain and organise programmes and the bundles of knowledge essential for re-structuration. In section 6.3, an *innovation matrix* is presented to illustrate gaps between the expected and actual benefit of each programme (Clark and Staunton, 1989). The matrix provides a useful visual representation of change indicating the degree to which repertoires were reconfigured. Further insight is offered through a discussion of the process, context and content issues affecting each study (chapter five). In section 6.4, these issues are considered in an integrated analysis of the process through which tasks are translated into reality. Here, several concepts are developed to demonstrate the nature of the paradox between knowledge as enabler and barrier during innovation. These are explored in greater detail in chapter seven.

For the purpose of continuity the Alpha and Beta studies are only briefly discussed during this chapter. This is because the key themes emerging from these studies are explored in greater detail in chapter seven. The restricted discussion of Alpha and Beta avoids needless repetition or overlap.

6.2 Knowledge communities: meaning, legitimacy and resources

Each case study was established after lengthy negotiations involving firm representatives, academics, the TCD consultant (hereinafter *consultant*) and TCS Centre manager for small firms, Birmingham (hereinafter *manager*). To gain support would-be participants had to ensure the proposed programme would deliver financial benefits at least equivalent of the grant and be sufficiently complex to require the help of a third party or academic. Put

simply, public funding would support advances to the firm's competitiveness, bringing otherwise discrete elements together to solve a business problem at a time when it was beyond the firm's normal means. This meant defining the business problem thereby establishing the limit of the firm's *zones of manoeuvre*[2] as well as establishing the knowledge bundles thought necessary to resolve the problem. This constitutes the substantive element or *obligatory passage point* (Callon, 1996) of the programme. Constructing the tasks first required company representatives and academics clearing a number of *hurdles.* Hurdles formed part of the *eligibility criteria* and are similar to Bijker's (1987) selection and stabilisation processes:

> "I see there is a whole series of hurdles, one of the hurdles is that you go and talk to somebody and then you say nothing for two weeks and then see what happens. So if you like they start chasing, they make the running and then you put in place the various things the various hurdles. So if you think, if there are other issues you say well I am not going to do anything until you send me the accounts. You are expecting the company and academic to jump the hurdle without any assistance" (consultant).

Eligibility included demonstrating the firm was able to support the programme the academics had the necessary skills and expertise to guide innovation so that the *content* of the proposed programme was "beyond the usual means of a firm". Eligibility was also measured against the conduct of the would-be participants. Those involved had to show dedication to the process; eligibility not only depends on establishing a robust 'technical frame' for generating value-added it also relies on participants demonstrating commitment to these aims and objectives.

6.2.1 Modelling the establishment of a TCS Programme

The process model discussed below is constructed from oral and written material gathered from the consultant and manager over twelve-months and represents the rules-of-the-game organising programmes. As such, it might be considered 'ideal' because it originates from those who have a vested interest in confirming the logic of involvement. It might also be considered an

[2] "Zones of manoeuvre" was not a term used during these negotiations.

over simplification as it presents the construction of programmes as a linear sequence of events. What is of importance is not the order of the 'process' *per se* but the substantive characteristics of the episodes. Hence, the subsequent discussion refers to both points of contact and substantive themes. *Face-to-face* discussions and related *decisions* form the key moments in instantiating the *language of programmes.*

Although it has not been possible to reference the experiences of individuals in each case study[3] it is reasonable to assume the process model provides insight to the themes affecting project start-up. The *language of programmes* is a significant organising principle as it provides the normative, constitutive and semantic basis of programmes. The process involves a range of activities represented as follows:

(1) The initial enquiry;
(2) The initial presentation;
(3) Awareness session;
(4) Validation and matching; and the
(5) Partners initial meeting and decision to proceed (see figure 6.2.1).

These negotiations usually begin when a company representative makes an *initial enquiry.* In response, the manager gives an *initial presentation.* Such presentations may vary from company to company but the overall aim "is to make people think about what they are letting themselves in for" (manager). This is usually the first time company representatives receive details about TCS and the TCS Centre. It is also usually the first time the manager receives details about the company and the proposed business problem. The details discussed during the *initial presentation* include:

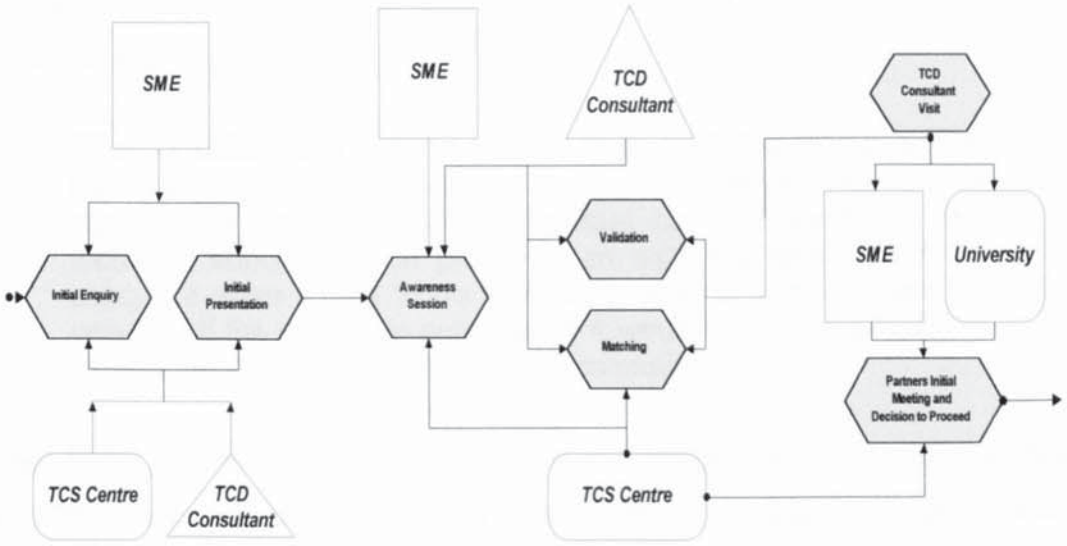
(a) TCS objectives;
(b) Programme life cycle;
(c) Budget;

[3] Each study had moved beyond this point before the fieldwork began.

(d) Commitment; and

(e) Company information and details of the business problem

figure 6.2.1 - Preliminary Negotiations



When discussing these themes the company representative and manager begin to form a common language for the programme based on social and economic exchange. The themes are not arbitrary, as they constitute a set of principles used to organise the innovation process. In trying to gain funding company representatives *and* academics are expected to adopt these rules and resources (semantic, economic and normative) that will in time mediate their activities. Whether they succeed in this endeavour and to what effect is the subject of this and the next chapter. Following this introduction (see chapter five for details of TCS) and if the company representatives want to continue, an *awareness session* is provided. Here company representatives are introduced to the *operational parameters* and *eligibility criteria* used to assess the firm and programme. The parameters and criteria constitute the guiding principles orientating activities. Operational parameters define the *administrative principles* organising future interactions while the *eligibility criteria* confer the organisational and behavioural characteristics expected of participants.

Operational parameters include administrative and managerial responsibilities and cover topics as diverse as the Local Management Committee (LMC) meetings, training, and participant responsibilities including the consultants. For example, the consultant described his role as that of a *Solicitor*, *Barrister*, *Judge*, and *Referee*. As a 'solicitor' he helps with the wording of the proposal, as 'barrister' he champions proposals during the approval phase, as 'judge' he decides whether a proposal should be submitted and as 'referee' he monitors the behaviour of participants:

> "The consultant can pull the plug on both academic and industrial supervisors if they are failing to meet expectations. This is also true for the associate...The consultant can put academic and industrial supervisors on probation an example would be if the associate were asked to do work other than that to do with the scheme. If the associate complained it would be the responsibility of the consultant to set things right" (consultant).

Operational details include information about budgetary control, supervision, and the monitoring of progress. In combination they constitute the "*critical success factors*" (consultant) whereby representatives have to show they are capable of developing a business plan and can identify the business problem, programme objectives and benefits. As such, the business plan is an integral component of the TCS programme providing guiding principles to measure success. Finally, evidence is also sought of the firm's ability to support the project (personnel and physical resources) so the additional activities do not create more problems than they solve.

The eligibility criteria are defined in precise terms and include information about the size of the company (is it part of a group?) that is used to determine the type of grant the company is eligible to receive. Details of the type of business, markets, exports, customers and market share are used to assess the strategic implications of the programme while information on assistance and deliverables is used to quantify 'added-value':

> "The profit before tax is what we are looking for so if a company reduces its inventory it saves that amount of cash by reducing its inventory as a one-off saving...so that is money released by the programme" (consultant).

Details of the academic (knowledge and skills), Associate profile and IPR (intellectual property rights) are also discussed (who owns the IPR?) and are summarised on a *one-page brief*. If company representatives want to proceed the consultant reviews their last annual accounts (or management accounts if published accounts are older than 9 months) and the one-page brief. Here, the accounts need to show the company is financially viable (confirm current assets, liabilities, fixed assets and long term creditors) and able to afford the programme while the brief should show the project has benefits of strategic importance. If this is approved it is forwarded to an academic partner usually nominated by the consultant. It is also usual for the consultant to visit the premises at this point to see if the site is "appropriate" (e.g., there is not the administrative infrastructure to support an Associate)? If not, the application can be stopped.

- *Validation*: Refers to a set of pre-defined criteria that establishes, to the satisfaction of the consultant, the 'company' and its representatives are able and willing to conduct a programme. In the process of vetting the would-be participants these individuals are introduced to a range of guiding principles and resources that will mediate future activities. These are administrative by nature and are organised around a strict managerial regime organised around quarterly LMC meetings.

- *Matching*: Defining the business problem and proposed solution establishes the core substantive theme of the programme and the would-be participants likely social and economic relations. At this point, the basis of matching is based on the *potentials* of reciprocation. Confirmation will not be secured until the company representatives and academics engage in negotiations to formally define the business problem and the details of the solution.

Only at this point are the company representatives and academics introduced and invited to discuss the programme. The *partners initial meeting* culminates in writing and submitting the grant application and proposal form, which can

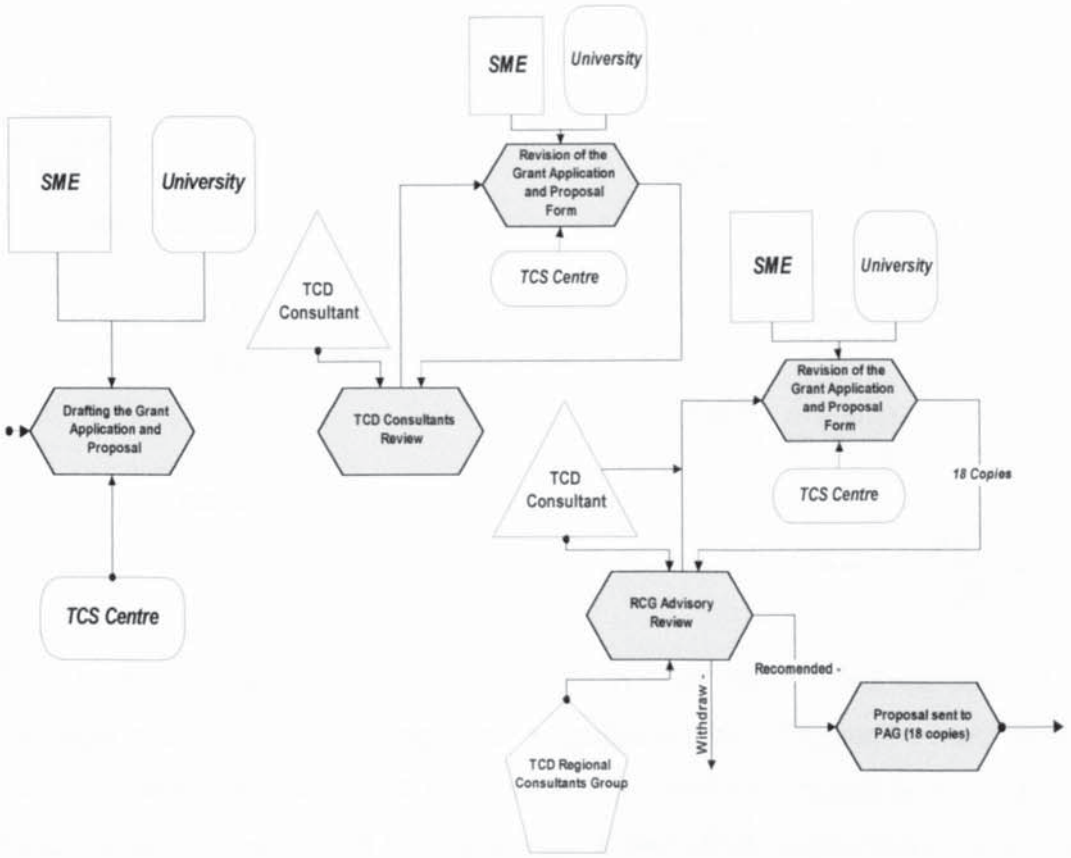
take many months of rewriting draft documents. This is significant because it confirms the substantive elements of the programme. This forms a set of interconnected tasks and phases that embody the social and economic relations by which individuals and artefacts are deployed in the knowledge creation process. Once the grant application and proposal form is completed it is passed on to the consultant for review. This is to ensure the document has a *clear* description of the "technology" and deliverables: "It needs to be technically as good as possible what technology is to be transferred what benefits will be achieved" (consultant).

- *The Grant Application and Proposal Form*: Constructed as a set of tasks, and phases it is used to configure participant activities and defines the relations between human and non-human artefacts. The programme tasks and phases are embedded within an administrative regime in combination they confer the programmes *obligatory passage point*.

If approved the form is submitted to the Regional Consultants Group (RCG) for further feedback before the consultant forwards it to the main selection board – Programme Approval Group (PAG) (figure 6.2.2). The RCG is an advisory body that provides an initial but not binding appraisal. Its purpose is to propose advice on 'fine-tuning' applications before submission to PAG. Once submitted to PAG several outcomes are possible. If 'not supported' the consultant and the RCG will be asked to consider if it should be withdrawn or revised. If the proposal is accepted but needs minor modifications these are communicated in a 'letter of clarification'. It is for the manager and consultant to advise on these revisions. If the proposal is accepted in its entirety then an 'Offer Letter' is sent which includes details of the conditions of the offer and payments of the grant (figure 6.2.3). Only after this is the Associate recruited, LMC-0 arranged and the new supervisors workshop is attended. LMC-0 is the first meeting of the 'programme' and provides the consultant an opportunity to restate the project management protocols. The 'Workshop for new partners in TCS' is a one-day course and is usually attended after LMC-0. It is designed to help supervisors *realise the maximum benefit from their TCS Programme*.

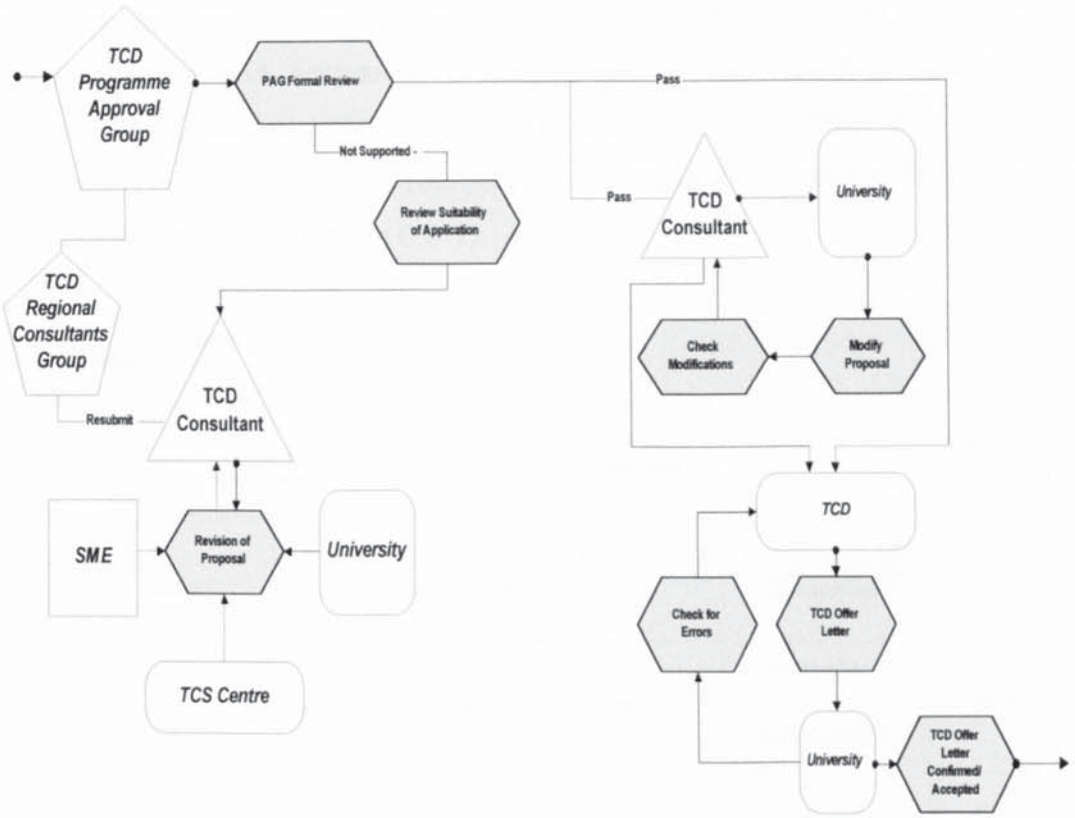
Topics include advice on how to manage, measure, review and achieve appropriate target outcomes.

Figure 6.2.2 - Drafting and Advisory Review of the Grant Application and Proposal Form



Establishing programmes involves negotiating and closing (as far as is possible) the *substantive* and *administrative* elements mediating programmes. The properties constitute virtual codes of conduct. They are instantiated at the point of enactment starting with LMC-0. Participant's actions are organised around the operational parameters communicated under the auspices of the consultant. In turn, programme tasks are a hybrid of human and non-human elements that also represent virtual codes of conduct their instantiation related to the knowledge creation process.

Figure 6.2.3 - Review and Confirmation by TCD

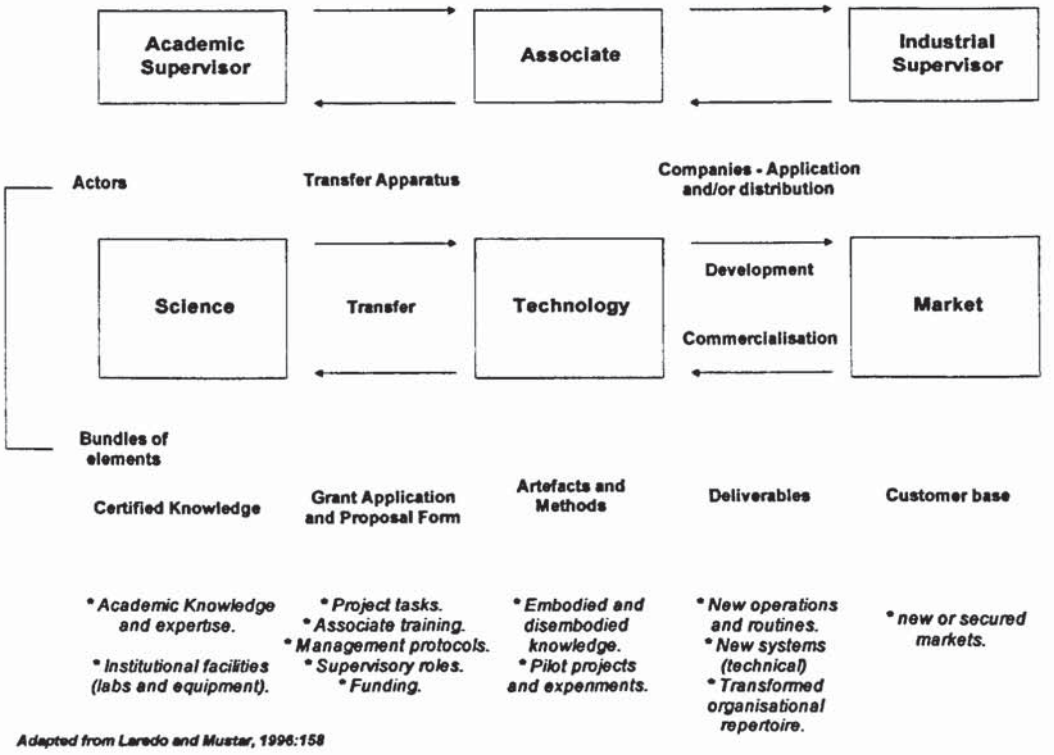


This 'model' represents a loosely coupled 'system' reproduced not only by the manager and consultant during these negotiations but of related events spread over time and space. Success *stories* are used to communicate and sustain the logic and principles of TCS (quinquennial review 1996, supervisors' workshop). Lessons from unsuccessful programmes are used to refine future programmes. This represents a feedback loop where the logic and form of programmes is chronically reviewed. For instance, the grant proposal and application form was changed on three occasions during the research when there was concern the application was not stringent enough so that some marginal programmes had been approved. Such incremental changes reflects what Giddens (1990a) calls *reflexive appropriation*. Reflexivity is common to all organisations and may produce smoothly flowing processes of change. In this case, such changes confirm that the logic of TCS is not in stasis but is under constant re-assessment.

6.3 Re-structuration and the Innovation Process

Programmes involve multiple activities (tasks) related to the construction, communication and exchange of knowledge in organisational settings. In combination tasks specify what has to be done, by whom and for what purpose. This arrangement represents a "network" of elements anchored around distinct "poles" (figure 6.3.1).

Figure 6.3.1 - The Innovation Network



Adapted from Laredo and Mustar, 1996:158

Programme tasks are anchored to several core themes or normative elements that co-ordinate the social relations in every programme and define the ties between members:

- *Aims for the company*: Usually identified as new product(s), new process technologies and/or services. Programmes have to be commercially important and generate income to at least the value of the TCS grant.
- *Aims for the academic institution*: Usually means consolidating existing research interests but ideally building new research collaborations. It

should provide the academics with opportunities to address commercial problems.

- *Academic expertise to be used*: This should match the core substantive elements of the programme e.g., product and process, skills and expertise. Previous experience in a commercial environment where similar problems have been addresses is seen as extremely valuable.

When applying expertise and skills to resolve the business problem the aim is not only to accomplish this it is to enhance the academic and Associates experience and knowledge of the commercial exploitation of ideas. Although programmes consist of a convergence of interests there still remains the potential for conflict if expectations or mutual *value* are not forthcoming. Measuring "value" is a key component in the evaluation of programmes:

- *Business value:* Usually articulated as the development of new manufacturing processes product ranges and services. An indication of income generation is also identified.

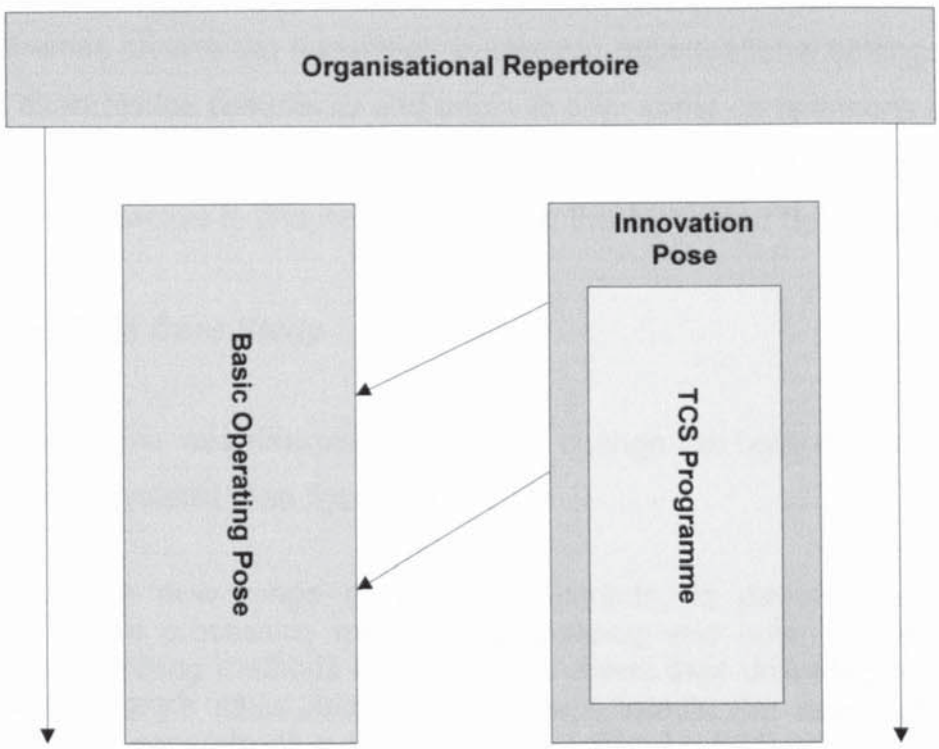
- *Academic value*: Usually articulated as an ideal vehicle for the extensive use of expertise and as an opportunity enhance the teaching and research base within a Department.

- *Associate value:* Usually articulated as a set of activities associated with the development of a new process, product or service or a combination. The Associate is the "carrier" of changes to the zones of manoeuvre. Benefit derives from translating these ideas into reality.

Translating the hybrids of elements into tangible benefits or outcomes relies on the construction and appropriation of phases and *tasks*. Phases are the thematic representations of programmes while tasks embody these themes. They offer a *route map* of the aims of each phase, how it is to be achieved and what hybrid of elements is required. Tasks embody the properties that mediate innovation *and* by implication the re-structuration of organisational

repertoires. However, as appropriation occurs alongside system reproduction translation is mediated by elements also embodied in the firm's existing zones of manoeuvre (Clark and Staunton, 1989). Tasks mediate social reproduction alongside other organisational *poses* (core-operating pose) in the repertoire (see figure 6.3.2).

Figure 6.3.2 - The Organisational Repertoire, Poses and the TCS Programme



Although each case study was to instigate change the eventual trajectory of the innovative activities did not always coincide with the original plan. An innovation matrix is used to "measure" re-structuration in terms of "market" and "technological" change. Each case study is interesting in so far as each offers new insights into the innovation process or the translation of tasks over a two-year period. This study offers a unique opportunity to consider how the various bundles of knowledge that constitute innovations are constructed, communicated and exchanged.

In all these cases a relationship exists between the practicalities of knowledge creation and the socio-economic processes defined and enacted by agents participating in the programmes. Although the outcomes vary between cases

it is reasonable to assume that those involved in these programmes gradually "delimit the rules, relationships and rewards of the innovation process at the same time as communicating and sharing the relevant knowledge" (Scarbrough, 1996:225). What follows, is a summary of the Alpha and Beta case studies and a more detailed explication of the Gamma and Delta case studies. The decision to treat the case studies differently is deliberate as the Alpha and Beta studies are considered in much greater detail in chapter seven. For the purpose of explication the analysis in this chapter describes the key themes around the translation of tasks in organisational settings. The aim is to characterise complexity and begin to offer some comparisons before assessing the conceptual and methodological implications of developing an interactive perspective in chapter seven (using the Alpha and Beta studies).

6.3.1 The Alpha Case Study

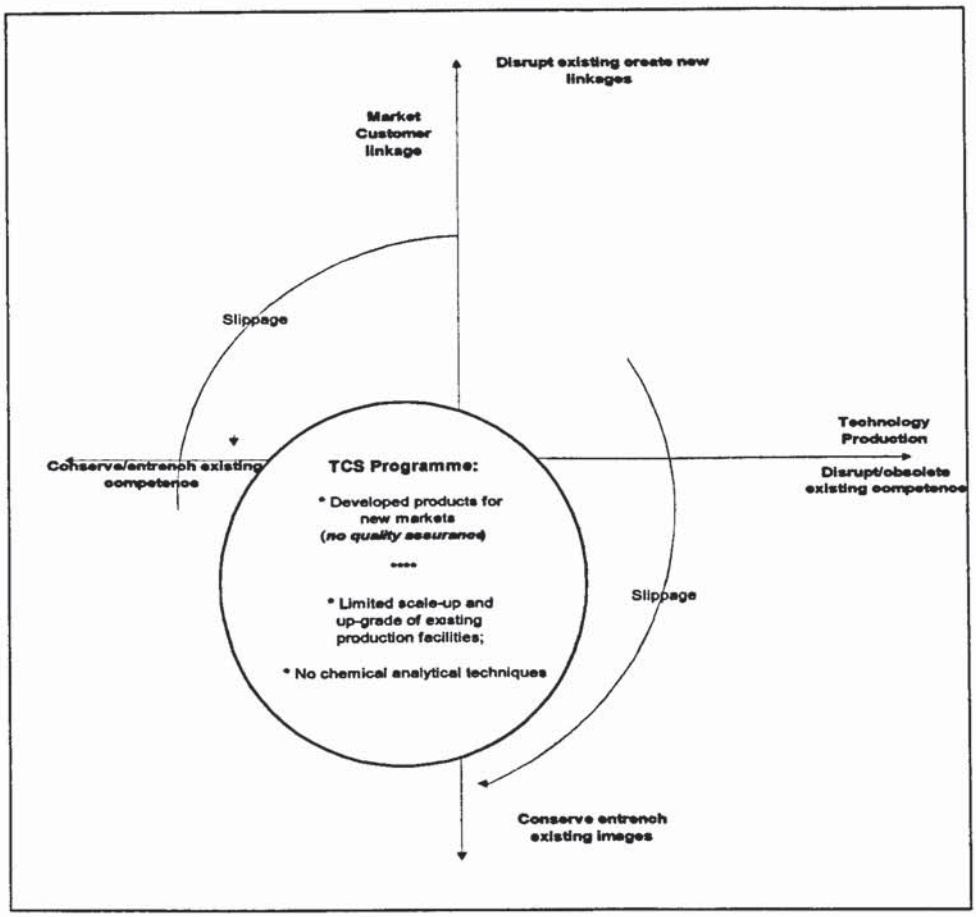
Alpha's programme was designed to radically change the botanicals technical and production systems (see figure 6.3.3):

> "Identify a new range of botanical extracts, to develop the appropriate processing methods, to scale-up and optimise the most promising methods to commercial levels thus delivering to the company's sales and marketing departments the technical means to generate new sales of at least £2m by 31.3.99" (TCS Programme Proposal Form, 1996:1).

As it was, the actual programme did little to reflect these initial objectives. Consider the actual outcome of the programme in the bottom left segment of the matrix (figure 6.3.3). Progress was restricted to incremental change that did little to improve the botanicals processes or open new markets. Alpha's *absorptive capacity* (Cohen and Levinthal, 1990; Cooke and Morgan, 1998); the ability of its management to take full advantage of the value of the programme, assimilate it, and use it for business ends was affected by process, context and content issues (Peattie, 1993). Contradictions of a political, economic and technical origin in combination gradually undermined the rationale of many of the tasks, leading to a suspension in the translation of

the programme tasks. In short, an impasse (paradox) emerged around the knowledge creation process and system regulation.

Figure 6.3.3 - Alpha's TCS Programme: radical to entrenching



Contradictions emerged when the logic of the programme no longer coincided with the organisational understandings of Alpha's senior management. During the first year senior management in Alpha *Group* decided to relocate flavour production (which provided 90% of the sales revenue) away from the Alpha site. This destabilized the economic viability of the programme and the site. According to the original plans the work on improving botanicals relied on flavours' being the key profit making activity. To ensure continued viability or *"organisational reproduction"* the industrial supervisor decided to scale-up botanicals. Although there were commercial reasons for this decision it quickly skewed the programme's chronology and accentuated technical problems that

curtailed the timely and effective creation of analytical protocols in phase two. In the process of trying to ensure botanicals filled the income-generation gap the time horizons of certain tasks were reduced. This was further complicated when the original decision was reversed. Further disruption followed, only six months after this decision, as efforts were directed toward returning flavours to the Alpha site. These episodes occasioned *critical moments* when the mediating properties of tasks were displaced by existing organisational understandings.

Following the work of Peattie (1993) it is useful to consider these issues in terms of process, context and content. According to Peattie (1993:67-69) process issues concern those social activities that define the collaborative relations' among TCS programme members (see chapter five). By adopting the headings affecting the success of TCS programmes in Peattie's (1993) own casework it is possible to illustrate similar issues in the case studies:

- *Associates' Status and Power:* The status of Alpha's Associate became confused at the time of, and subsequent to, the movement of flavours' production. "Confusion" was not limited to the opinion of shop floor staff it included management, for example, the Associate was unable to work to the programme during the period flavours were being moved because the industrial supervisor decided the Associate should lead the move to rapidly scale-up botanicals' production. Although the Associate began the project with clearly defined objectives these were quickly revised at which point their status radically changed. The Associate now had responsibilities that were not strictly defined by the "programme" and as such was increasingly treated by colleagues as a member of Alpha's workforce.
- *Organisational Friction:* The Associate's status was inextricably linked to the relocation of flavours. Changes in responsibility and the blurring of roles between the programme and the challenge to increase botanicals' production characterised this period as the Associate was increasingly treated an "an extra pair of hands".

- *Academic Involvement:* Although changes to programme tasks are to be expected the academic had little involvement in the decisions to rapidly scale up production. It is unclear whether he was unable or unwilling to offer a different view but his inaction made it very difficult for the Associate to resist these new demands. It was only when flavours returned, by which time the two-years had almost ended that moves to return to the original programme were initiated.
- *Internal Ownership and Support:* At the start of the programme there is no doubt that Alpha's management team were keen to see the programme succeed. Unfortunately, the strategic choices of Alpha Group's managers undermined the logic of the programme. Given the length of time between flavours being removed and then returned (six months) it was difficult (but not insurmountable) for phase two to have been completed. However, with the shortening of available "programme" time the Associate's work had become a casualty of circumstance. Although the industrial supervisor was instrumental in these changes his actions have to be considered in the context of Group level decisions which were made without his input.
- *Project Control:* Although the programme was tightly managed this actually had negative implications as the industrial supervisor ensured decisions reflected commercial realities. Although commercial issues were extremely consequential for Alpha and by implication the programme little dialogue among programme members occurred about such displacements. Despite the existence of formal channels decisions were taken behind closed doors. Asymmetries of power became increasingly pronounced during the two-year programme as the academic was effectively distanced from the day-to-day activities of the Associate.

According to Peattie (1993) context relates to the organisational factors that influence these processes:

- *Company Size:* There is little conclusive evidence to suggest that size is consequential for programme success (Senker and Senker, 1995). That said, Alpha lacked the skilled personnel to assist in the rapid scale-up of

botanicals' production. Although this may have had something to do with the size of firm what is important is that such deficiencies increased the likelihood of the Associate, who had a good appreciation of production and engineering, being involved in these activities rather than the programme.

- *Financial Health:* As described above the movement of flavours was a key contributing factor to displacements in the programme. Ironically, concerns about flavours were not linked to changes in the market place rather they relate to concerns about the location of production within the Group. It is hard to understand why the Group's management took these decisions at a time when the programme was only just getting underway. Unfortunately it was not possible to question managers directly about these decisions but it is plausible that senior management at Group level saw this period as an opportunity to both rationalise flavours and develop botanicals. As it was, this not only caused disruption to the programme but management was unable to consolidate the move as re-location resulted in a significant loss of flavours business.
- *Changes to Senior Management, Corporate Strategy and Culture:* The decisions of Alpha Group's senior management had direct implications for the industrial supervisor. With the decision to move flavour's the industrial supervisor's options were radically reduced. It was at this time the level of discretion among programme members was significantly curtailed.
- *Roving Reporting Relationships:* According to Peattie (1993) the ability of the Associate to complete work can be linked to changes in management. Although this was not apparent at Alpha there was a *hierarchy* of reporting relationships. Day-to-day the Associate reported to the industrial supervisor while the academic supervisor provided limited input perhaps visiting the site once or twice a month. Given this it is perhaps unsurprising the Associate was drawn away from the letter of the programme as the academic failed to dilute the commercial pressures.
- *Internal Company Politics:* Resistance to change usually refers to conflicting opinions between the champions of the project and reluctant employees in the host company. There is no evidence to suggest that such frictions existed at Alpha rather the politics of the situation moved to

the opposite extreme where even the champions of the programme moved to reduce programme related activities.

- *Bargain Hunting:* There is no evidence to suggest the Associate was employed for any other reason than to fulfil the programme. It is therefore ironic that with the decision to move flavours the company representatives facilitated a reduction in the potential benefits to be accrued from the Associate and academic.

Peattie (1993) suggested that content issues were less important than those of process and context. As discussed in chapter five this is not a position supported in the current study. Instead, the evidence suggests a number of issues surrounding the social shaping of innovations including unpacking, practicality, and synchronisation. These issues were not discussed by Peattie (1993) but reflect events in the current study. They are discussed separately for the purpose of analysis in reality they are inextricably tied:

- *Unpacking:* This involves the Associate with their supervisors making sense of each task, how it is to be achieved and for what purpose. The unpacking of tasks relies on the generation of interpretations and "logics of action" (Karpic, 1978). Logics of action reflect the 'cognitive dimension' of participants that allows them to interpret and operationalise tasks. The Associate and academic supervisor are especially important as they bring new interpretations to the company that allows for the transfer of knowledge across organisational boundaries. Such processes involve the creation of technical frames around which artefacts and processes are constructed, communicated and exchanged. The technical frames defining the programme tasks at Alpha were challenged so that the interpretative foundations of tasks were challenged. The physical manifestation of tasks altered with changes to these interpretative foundations and coincided with the events surrounding the movement of flavours (see chapter seven).
- *Practicality:* Appropriation is inherently problematic and difficult to achieve (Clark and Staunton, 1989). This involves bringing different bundles of encoded and disembodied knowledges to bear on a problem or set of

problems. Appropriation also influences the organisational context as the new knowledge and processes replace existing configurations. Practicality involves the use of media (e.g., software tools) for experimentation, the testing and validation of knowledge. Such processes are not always straightforward as they require the user to engage in a process of trial and error. Appropriation was problematic at Alpha because of the complexity of the tasks including issues of reliability (mechanical), extrication (separating relevant data from the spurious), interpretation and application (translating the results in a practical way) (see chapter seven).

- *Synchronisation:* This is closely tied to the unpacking and appropriation of tasks. The sequence of tasks is significant as the premature or late start and completion of tasks is likely to have implications for the trajectory of the knowledge creation process. The same implications hold when tasks are re-interpreted. During the programme at Alpha the synchronisation of tasks was significantly undermined both in terms of chronology and time taken to complete. Appropriation was only partially achieved as the logic of tasks was undermined and as their combination became increasingly problematic (see chapter seven).

Considering process, context and content in this way is useful as it begins to highlight the complexities of translating tasks into reality. Unlike Peattie (1993) who fails to elaborate on the link between process, context and content the current study (section 6.4 and chapter seven) develops a conceptual bridge by considering the mechanisms mediating these issues during the innovation process.

6.3.2 The Beta Case Study

The programme at Beta was to be radically altering:

> "To develop and implement a sophisticated modern purchasing management system within a TQM philosophy appropriate to the rapidly expanding and increasingly international market place that the company now operates" (TCS Proposal Form, 1997:2).

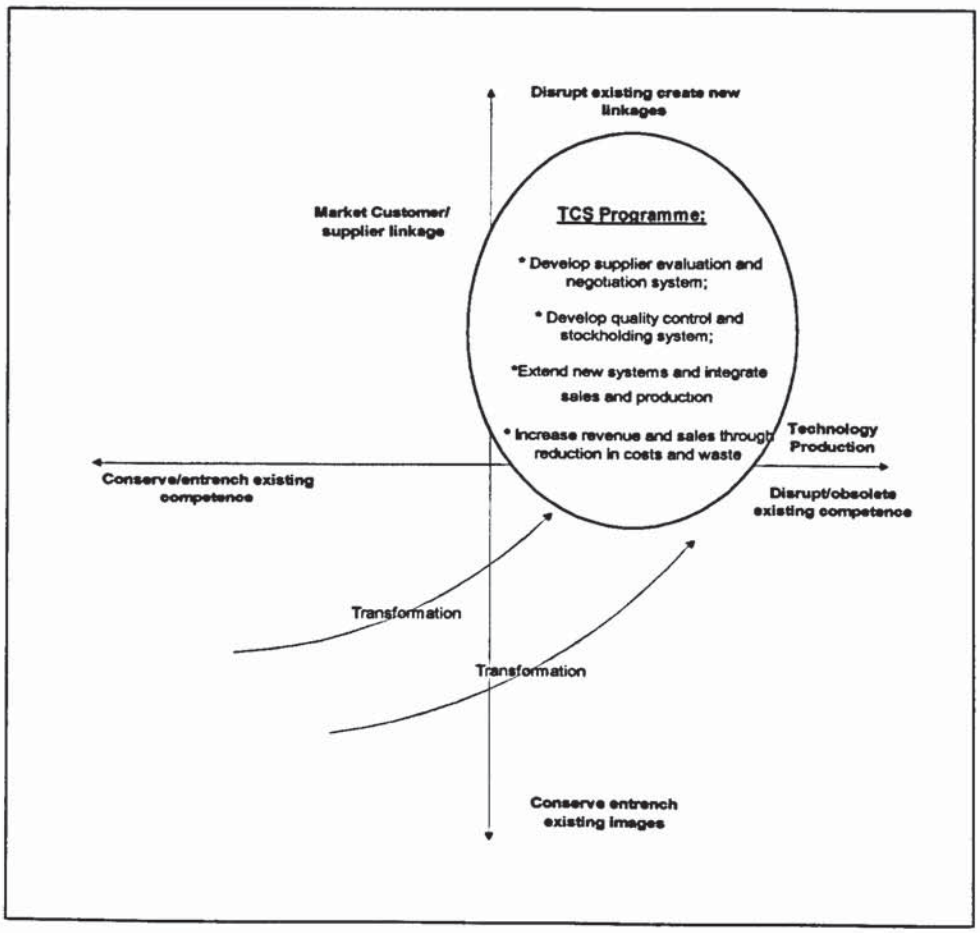
At Alpha, failure to deliver market and technical changes indicated some kind of programme *slippage* or reinterpretation while at Beta the programme was instantiated as original agreed. Figure 6.3.4 indicates that translation radically altered the organisational repertoire with savings, by its end, totaling £88,900. These were made through the introduction of new systems such as monitoring suppliers and creating active supplier and customer relations based on quality rather than purely price. Lower levels of inventory ensured better cash flow while existing competencies were disrupted and improved with a new computerized management information system. Beta is significant because appropriation was achieved at a time when the firm was going through organisational change. This created uncertainties in the management team and programme members. Translating ideas into reality was a complex process because Beta's institutional realm was riven by conflicting orientations. Although displacements at the level of the firm disrupted the social relations in the programme slippage was avoided because participants re-organised alliances in ways that overcame these difficulties.

This is in stark contrast to the events at Alpha. The reasons why the logic was sustained at Beta and not Alpha has much to do with notions of legitimacy and practicality. In other words, appropriation relies on the mechanisms through which tasks are translated from ideas into reality. Such mechanisms are implicated in the contractual (professional obligations) relations and the skills and resources (intellectual, financial, human capital) brought to bear during of the translation of tasks. At Beta, on the occasion when barriers were erected or problems arose the management team demonstrated, through the manipulation of existing resources and relations, how change could affected even during periods of uncertainty. The study at Beta confirms that translation not only relies on the practical skills of making sense of ideas, constructing and communicating knowledge it also relies on socio-economic processes that legitimise (normative frameworks) the status of participants and the economic value of programmes.

These processes are inextricably linked in so far as methods are deployed to effectively construct, communicate and exchange the knowledges identified in

tasks agents define and order their different interests and relationships and by implication the economic and professional value of programmes.

Figure 6.3.4 - Beta's TCS Programme: radical transformation



During the programme Beta's management team embarked on a broad plan of organisational change which created considerable uncertainty in both the firm and the programme. A decision was made just prior to the start of the programme that seriously undermined the thinking underpinning its creation. In particular, it had been agreed the Associate should work with Beta's purchasing manager so that the old system would operate at the same time as the new system was appropriated. Instead, before the Associate was appointed Beta's management team decided, without consultation, to remove its purchasing manager. This not only meant the Associate was given little instruction about existing practice it also meant they had also been given direct

responsibility for purchasing (Beta's management had no intention of replacing the purchasing manager). This created a new set of displacements; as far as the industrial supervisor was concerned the Associate was the new purchasing manager while the academic would assist as and when necessary. As it was, the logic was radically flawed because the Associate was a "purchasing virgin" having had no prior experience of purchasing while the academic was expected to offer assistance outside the remit of the agreed programme.

The original purchasing manager was removed because it was thought they would not embrace the proposed changes. Although his removal reduced the expected resistance from within Beta it was not anticipated their "replacement" would have difficulties in operating the system. In time, the industrial supervisor and other members of Beta's management team began to work more closely with the Associate but not before the programme and the firm experienced extreme difficulties within and without the remit of the programme. Conflict among members of the management team about the validity of the proposed organisational changes spilled over into the programme as efforts to implicate change in the former caused strains in the later. Similarly, uncertainties around the "programme" exaggerated and amplified these same issues and concerns only being resolved once certain barriers had been removed.

Against such uncertainties translation continued almost as planned. Although Beta's programme was affected by several displacements, for example, the removal of the purchasing manager that lead in turn to increased expectations of the academic, it is significant that the management were able to establish alternative arrangements. Beta's managers re-defined their relations with the Associate once it had been established the academic was not going to provide the support necessary to enable the Associate to work on purchasing unsupervised. Although this resulted in the academic being sidelined from the decision making process it did facilitate growing trust and respect among the remaining team members. This was made easier because the various tasks were straightforward in so far as they involved the introduction of relatively simple systems that could be readily controlled by the Associate. A number of

key themes linked to these events are summarised below beginning with process issues:

- *Associates' Status and Power:* The Associate's status was variously and at different points undermined by the Managing Director (before management buy-out) the Marketing Director and on occasion the industrial supervisor (chapter seven). This only improved once the Associate proved herself to be an accomplished purchaser as her status was ultimately tied to non-project tasks (purchasing decisions). Ambiguity over the Associate's status was apparent from the start; at no time was the Associate referred to as "the Associate" by colleagues instead she was always known as the purchasing manager.
- *Organisational Friction:* Friction coincided with the Associate being used as "another pair of hands". The distinction between the programme and these other responsibilities gradually blurred as the introduction of systems via the programme became routinsed. Nonetheless, the initial decision to give the Associate responsibility for purchasing placed the Associate under scrutiny and pressure at a time when she needed to focus on her core (programme) tasks. On this occasion, friction was a symptom of the management team's failure to provide a "change-over" period with the purchasing manager. This improved with the Associate became more proficient yet despite this it still undermined the alliances within the programme.
- *Academic Involvement:* The academic was almost immediately isolated. Divisions emerged between the academic and the other members of the programme when the academic failed to fulfil the industrial supervisor's and Associate's expectations. Further divisions arose when the head of the Business School, after being made aware of concerns about the Associate tried to have them replaced. In both instances the academic's succeeded in undermining their credibility and distancing them from Beta's management team (see chapter seven).
- *Internal Ownership and Support:* The Associate received ambiguous support during the programme. In the first instance, the Managing Director, in place at the start of the programme, did not support the ideas or activities

designed into the programme. In fact they were wholly reticent to the plans of the industrial supervisor concerning any changes to the way Beta was managed. Even with the management buy-out which precipitated their removal support remained ambiguous. In this case of the newly employed Marketing Director soon raised doubts about the Associate's abilities and business acumen. Despite these pressures the Associate persuaded the industrial supervisor and Marketing Director to support rather than replace her. On this occasion, management welcomed her determination to remain an active member of the firm and the programme (see chapter seven).

- *Project Control:* Joint decision making was quickly undermined as opposing views emerged about the responsibilities of the Associate and academic supervisor. As it was, the first LMC was the one and only time any divisions were aired in front of the consultant. These were never formally resolved although an understanding was reached that future divisions are considered in private. Hence, the academic's displaced from decision-making was not apparent during LMCs rather the display of a partnership was maintained purely for the benefit of the consultant.

It is apparent from the discussion of process issues that context was relevant to the changing dynamics between the programme team members:

- *Company size:* As at Alpha, the size of the company may have had an impact (indirect) in terms of available skills' and resource allocation. The decision not to replace the purchasing manager other than via the Associate was perhaps related to the opportunity to acquire a cheap graduate. As it was, this logic was flawed because they appointed a graduate without any previous experience of purchasing.
- *Financial Health:* Beta's financial health was never in doubt during the programme although the purchase of the management information system (last quarter of the programme) was delayed due to the combined affects of a down turn in business, excessive inventory which resulted in cash flow problems (a mistake blamed on the Associate) and financial pressures that

were imposed following the management buy-out (returns to the venture capital firm).

- *Changes to Senior Management, Corporate Strategy and Culture:* There was a considerable amount of change at Beta during the programme. As already mentioned the purchasing manager was removed before the start of the programme. Then, with the management buy-out the Managing Director was removed. In each case, the intention was to facilitate change. Ironically, but perhaps not surprisingly such efforts created their own uncertainties and paradoxes which generated initial but not insurmountable barriers to these changes. In the case of the programme such uncertainties were only broken once the Associate became more proficient and once management were able to provide greater guidance following the management buy-out.
- *Roving Reporting Relationships:* This was a problem because the Associate was expected to report to different managers depending on whether the issue was "programme" or "purchasing'" related. This was complicated by the academics reluctance to offer commercial advice. By the programme's end the Associate had stopped reporting to the academic (see chapter seven).
- *Internal Company Politics:* Issues around company politics provide a useful indication of the levels of uncertainty during the programme. Although these were indirectly related to the primary responsibility of the Associate they had important implications because they altered the basic understandings of the programme members. What is remarkable is that the Associate was able to appropriate most of the original tasks given the responsibilities afforded her by Beta's management (see above and chapter seven).
- *Bargain Hunting:* It could be argued that the Associate was employed as a cheap replacement for the purchasing manager. What is interesting is that this did not result in Beta failing to benefit from the opportunities available. The changes in circumstance only changed the balance of responsibilities it did not affect the logic of the programme. In time the industrial supervisor and Marketing Director ensured the Associate completed the programme.

Although the content of the programme did not prove problematic appropriation was still dependent on the Associate working with management to ensure the translation of tasks:

- *Unpacking:* The Associate worked with both supervisors in making sense of the programme tasks. Although this work was made more difficult with the commercial pressures the successful completion of tasks legitimised the programmes objectives. Tasks were quickly routinised not only because the work was relatively straightforward but also because without their prompt introduction the commercial viability of Beta would have been threatened (with the removal of the purchasing manager the "systems" for prompting purchases had been effectively dismantled). This work continued even after the breakdown in relations with the academic although this did result in a change of system design. However, by the time Beta's management was ready to commission the management information system the academic had forfeited their right to contribute to decision making; with their failure to assist on earlier purchasing decisions they had undermined the alliances established via the programme.
- *Practicality:* No problems were experienced in translating the tasks because the industrial supervisor was able to assist and advise on the new routines. They had come from a firm with the normal range of administrative and organisational routines; those same routines that were missing from Beta. Appropriation was tied to the Associate's commercial responsibilities or her ability to understand purchasing. In this sense, translation improved as the Associate became better able to integrate day-to-day purchasing with the programme tasks. The only part of the programme requiring additional advice involved the introduction of the management information system. In this instance, the Associate with external consultants set the specification, implemented the change over from an older system and trained staff.
- *Synchronisation:* The only problem involved the management information system which was delayed due to financial issues. Apart from delays in implementing this task all other tasks were conducted in a timely manner

and support the view that the programme remained an important strategic concern to Beta's management team.

What is important about the study at Beta is not necessarily the outcome of translation rather it is the process through which appropriation was achieved. To this end, chapter seven considers how the social and systemic components of the innovation process are entwined. Until then, it is worth mentioning that this case demonstrates how resources can be drawn from sources other than those specifically allocated (i.e., the academic) to overcome emerging barriers. In combination, Beta's management team was able to "replace" the academic by supporting the Associate and by bringing to bare skills and resources from a variety of sources not connected to the academic partner.

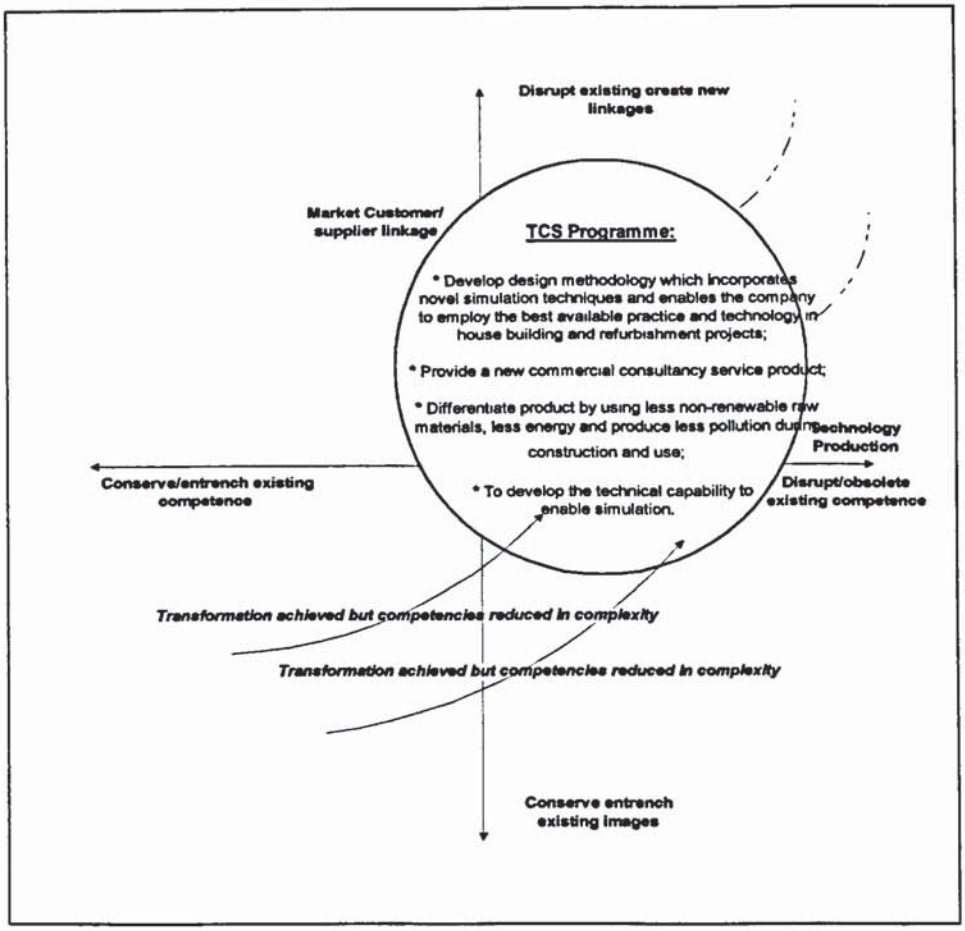
6.3.3 The Gamma Case Study

Gamma's programme was to be radically altering:

> "[Gamma] aim to increase market share by developing a design methodology which incorporates novel simulation techniques and enables the company to employ the best available practice and technology in house building and refurbishment projects. The methodology will be applicable to the full range of housing occupancy in any location. This will make the company more competitive and provide a new consultancy service product" (TCS Programme Proposal Form, 1996:1).

As it was, the programme was revised shortly before its start and then later during its second year. Figure 6.3.5, indicates that translation was mostly achieved although the deliverables from the programme changed. This study is similar to Alpha because problems with tasks reflected difficulties in the practicalities of knowledge creation it is also similar to Beta in so far as members' re-defined participation and altered the synchronisation of tasks.

Figure 6.3.5 - Gamma's TCS Programme: radical transformation



Sustainability was as a key policy issue internationally and nationally during the 1990s. Internationally, the Rio summit (1993)[4] brought attention to the impact of commercial operations across the globe. Nationally, policy statements like local agenda 21 ensured the idea of sustainability had implications for local profit and non-profit making organisations. During 1995 following a visit by representatives from Gamma to a Berlin housing group that were assessing the environmental impact of refurbishing derelict housing, a similar approach was proposed for the UK. Linking regeneration and the environment offered commercial opportunities for Gamma:

[4] The Rio summit held in Rio De Janeiro in 1993 covered climate change and the environment. At its close it was agreed by those present to begin to try and reduce CO2 emissions through the burning of fossil fuels.

> "We took on environmental impact as a vehicle for illustrating our innovative approach and for differentiating ourselves from bigger organizations who have got loads of money" (Industrial Supervisor).

At Gamma, managers were already involved with similar issues through work being undertaken by a collaboration of partners in the *Green Futures* project:

> "The Green Futures project was about sustainable housing and the TCS programme was about one aspect of that which was to look into life cycle costs of buildings by means of simulation" (Academic Supervisor).

TCS offered an opportunity to develop Gamma's business with the creation of competencies for a new consultancy service. Unfortunately, it quickly became apparent when trying to recruit the Associate that the programme could not be rolled-out in its original form:

> "Circumstance caused us to change tack a bit during the programme and immediately prior to [the Associate] starting. It meant that we had to tailor the work we were going to do to what was realistic and we had to subsequently tailor it again during the programme to what was realistically achievable because we had a lot of software problems" (Industrial Supervisor).

Because the partners could not appoint someone with the skills to create the front-end of the computer platform for simulation purposes it was necessary to re-think how the simulation work could be achieved. The academic advised Gamma's management, after seeing a promotional video of 4D, to purchase the licence of the 4D-simulation package:

> "We had to back track on the complexity of the product development. What we had to work at was the development of the application of the simulation software and that is what [the Associate] is particularly focused on. Rather than the writing of new software it is the writing of procedures and the creation of procedures and practices which enable the software to deliver the results which the client can understand" (Industrial Supervisor).

> "One of the original intentions was to build a front-end with user-friendly software for doing simulations which would perhaps be useful for VR [Virtual Reality] so that the simulations could be presented to the lay-man. We had to compromise the original programme because there were no suitable candidates and then

> we decided to reduce the specification of the Associate so we just asked for experience with simulations rather than experience with computer programming. But as a consequence we could not expect that person to understand computer programming without suitable training. Virtual Reality and the front-end just had to be abandoned" (Academic Supervisor).

A necessary part of the development work was to calibrate the environmental performance of materials and other elements (ventilation and heating) used in house construction. As it turned out, this proved arduous and erratic because of problems with the simulation package. When trying to pilot the process 4D failed to deliver what the manufacturer (IES) promised, for example, it did not complete all the simulations while it was seemingly impossible to interrogate the results of others:

> "Well, the trouble with it is it gave you like an annual heating load, but you need more than that you need a breakdown to find out where all the heat losses are happening and it did not. Also, when you are doing simulations I like to make sure that the results are reasonable and to make sure that I have not done something silly or whether there is a bug. I want to make sure that you can vet it, so I wanted to go in and check that with a reasonable amount that windows are working like windows and you could not" (Associate).

Problems with the software package emerged almost immediately the project began and continued during the first six months with the Associate only being able to provide limited progress on the methodology. Attempts to resolve the problems were problematic because of technical difficulties and because the Associate went on maternity leave soon after the start of the programme. In an attempt to resolve these, the academic started negotiations with IES to gain a refund on the license. Negotiations were long and protracted, so much so, that by the time the Associate returned there was still no agreement. In response, the academic bought a temporary license for another package – TAS. This proved more reliable and enabled the Associate to continue to develop the methodology. In the meantime, negotiations with IES had moved forward with them announcing the introduction of a system called Apache. At this time, technical support for 4D was suspended and the supervisors were offered a new license for Apache.

By the last quarter of the first year the Associate had access to three separate packages yet had been unable to develop the methods as far as had been envisaged. In the case of TAS, although the Associate had experience of using the package it did not offer the kind of functionality claimed of the IES systems. In turn, it remained unclear whether Apache like its predecessor 4D would deliver what was claimed:

> "I do not want another system [Apache] with the same problems as the one we have got [4D]. Like before, I thought okay we will work through it and in the end I will get a system that works. Having got so near and then for them to change it, I do not want to be doing the same and then get so near the end and not fulfil my expectations" (Associate).

Matters were complicated as with each new package the Associate had to adopt another approach to create simulations. Here we see the difficulties of appropriation. For the Associate "unpacking" packages was problematic for different reasons. To begin with, she had not used Unix systems; 4D and Apache required the user to type in command codes to create the simulations. Although the Associate was reasonably computer literate she had only used windows based packages. Now she had to learn lines of code which was made even more difficult because 4D and Apache came without operating manuals. Instead, the Associate relied on a few days training received from the software house assistance from the academic supervisor and paper based manuals she wrote herself. Although the Associate found TAS, a windows-based system, most friendly and reliable neither the academic nor industrial supervisor saw a future in it because it offered a limited set of simulations. Nonetheless, TAS would provide a lifeline as soon after the Associate returned from leave it was decided to move things forward with the consultancy work and launch the service. This decision had its origins from just before the Associate's maternity leave when the academic supervisor presented to the Green Futures conference:

> "The Green Futures project was bringing a clientele to the TCS consultancy and it was so successful in doing that we had to change tack again. We shifted the emphasis from being software and capability driven onto consultancy launch rather than consultancy development. So although we had in the second year

> to develop the consultancy service what happened was that the development was compressed into around 6-8 weeks during the first year" (Industrial Supervisor).

The interest generated from the conference represented a *critical moment* in translating the programme as it led to new expectations that reinforced the validity of the programme yet created additional pressures:

> "The objectives of the programme have changed. The emphasis has moved to consultancy and that has been demand led. I would say that originally we would have said the software development was 75% of the programme and the consultancy was 25% of the programme. It has moved more to 40% - 60%, 40% software, computing and 60% to the consultancy" (Industry Supervisor)

This shift not only reflected commercial opportunities it also had significance for Green Futures. Ensuring a commitment to Green Futures required income and the consultancy offered new avenues where others had been exhausted (i.e., European Regional Development Funding had finished). Translating this decision into the early launch relied on the alliances being re-negotiated. As at Beta, changes to the programme were accompanied by a conflict of interests and as at Beta the academic at Gamma had difficult in accepting the new change of emphasis:

> "So the main difficulty for me was to keep the programme on track and not to depart from its original objectives. But simply because there has been a pressure coming from the industrial partner to gain knowledge in many other fields which has no relevance to the scheme they simply decided to treat some of these additional things as part of the consultancy [work]" (Academic Supervisor).

Because Gamma's management wanted to assess the environmental impact of new house building and maintenance not just simulate these processes the original programme was no longer wholly appropriate. In the original, the aim was to simulate and then validate these results with some form of assessment or monitoring of newly built houses. With the launch of the consultancy it was necessary for Gamma to develop its own monitoring capability. This went beyond what the academic considered the acceptable limits of collaboration:

> "The monitoring of buildings is not part of the programme because it was not mentioned in the original application and they are

> treating it as if it was. [Gamma] has a need for doing simulation and we are able to help" (Academic Supervisor).

Although monitoring *was* mentioned in the proposal: "Deliver results of alpha-beta tests with data obtained from *monitoring* of existing buildings to validate the simulation process" (TCS Proposal Form, 1996:9a – *my italics*) the aim was to only assess not develop the competence. Nonetheless, the Associate and industrial supervisor were keen to develop the competencies especially as it had important commercial implications. As for the academic he had his own interests to protect:

> "I feel he [the academic] has got an ulterior motive for being in the scheme and it is his company not the university's interests, so I feel a bit frustrated..." (Associate).

The academic would not monitor any houses without being paid an additional fee nor would he allow the Associate to observe the monitoring process. Here, the academic insisted monitoring was not a "task" and access to these skills depended on separate negotiations. On this matter the academic could not be dissuaded and so was paid an additional fee for the work. By the close of the programme the Associate delivered several consultancy jobs using both TAS and Apache. As for the developmental work this was "ongoing" with the Associate being offered a post to continue the work.

In summary, difficulties in knowledge creation reflect problems with unpacking the programme tasks. First, the partners could not appoint someone capable of developing the computer platform to support the simulation software package which meant the platform had to be obtained from a third party (software house). Despite this being successfully negotiated it remained extremely difficult for the Associate to unpack the software packages in ways that enabled her to deliver benefit. Secondly, work on the simulations was "overtaken" by commercial opportunities linked to the launch of the consultancy service.

The shift in emphasis did not pass smoothly as it created tensions among the programme members. Once the industrial supervisor had decided to respond to the commercial opportunities associated with the consultancy work the basis of

the alliance was altered. The shift from development to launch was significant because to ensure a successful launch the management team tried to redefine aspects of the academic supervisor's role. As it turned out the academic was less than willing to address the new responsibilities because launching the consultancy service ahead of time jeopardised potential future collaborations. What was to be made available encroached on the academic's own consultant service.

In combination, these events reflect the intersection of various processes which for the purpose of presentation can be organised according to Peattie's (1993) categories (cited from Pettigrew, 1985) beginning with the process issues:

- *Associate's Status and Power:* Gamma's senior management team was meticulous in ensuring the Associate was introduced to employees within the housing association and that everybody knew her role. To this end, the industrial supervisor worked very closely with the Associate offering advice and encouragement during the programme. This was especially evident at the LMCs when, on one occasion, the Associate was brought to tears by the industrial supervisor's compliments. The Associate was allied to her industrial partners and was inclined to view the academic's reluctance to assist in the consultancy service as a betrayal of the idea and essence of the programme. Its success has much to do with the support of Gamma's management team.
- *Organisational Friction:* Gamma's management team was seemingly fully behind the programme and the Associate. At no time, was the Associate used as just "another pair of hands" nor was she excluded from strategic decisions within the housing association. The Associate was not only seen as a valued member of the association they were also given the space to work on the programme.
- *Academic Involvement:* The academic's involvement was controversial due to the lack of support provided. The relationship deteriorated when the academic's own commercial interests conflicted with the needs of Gamma. Overall the Associate was critical of the academic supervisor because she

did not feel he was interested in the project or prepared to spend intensive periods working to resolve the various glitches found with the software packages.

- *Internal Ownership and Support:* Support was in strong evidence during the programme although Gamma's influence over the academic seemed limited. Nonetheless, Gamma's management team ensured the changes in emphasis were achieved and the consultancy service developed.
- *Project Control:* Failure to develop the simulation methodology by the end of the programme and the monitoring capacity reflects limitations to project control. Such control is linked to knowledge and the leverage of knowledge during the programme. As claimed by the Associate doubts surfaced about the level of academic support. Such concerns were confirmed when the academic refused to co-operate with monitoring. The failure to persuade the academic reflects a lack of control over the source of knowledge and indicates fundamental contradictions in the programmes alliances after it was decided to shift emphasis from development to launching the service.

In addition to these process issues there were organisational issues affecting the performance of the programme. At Gamma, content issues seem not to have generated adverse influences to the translation of tasks:

- *Company size:* It seems unlikely that size affected the translation of tasks although the promise of revenue from the consultancy service did bring forward specific tasks and redefine some of the core objectives. This it seems had more to do with access to regional development funds than the size of Gamma. As for the management team they were experienced with employing graduates, controlling externally funded projects and meeting deadlines.
- *Financial Health:* Changes in external opportunities certainly affected the rationale and objectives of the programme but this did not undermine the overall endeavor.
- *Changes to Senior Management, Corporate Strategy and Culture:* The only change affecting the programme emanated from interest generated

by the Green Futures Conference. As mentioned above, this caused a re-think in the direction of the programme which was effectively managed despite differences of opinion between programme members.

- *Roving Reporting Relationships:* There were no discernable changes in the management of the programme at Gamma. The Associate had regular meetings with their managers while contact with the academic supervisor was at times sporadic.
- *Internal Company Politics:* There was no discernable resistance to change within Gamma.
- *Bargain-hunting:* This was not apparent at Gamma as the management team were keen to make as much of the programme and the Associate as possible.

In terms of content a number of issues around knowledge creation influenced the programme at Gamma:

- *Unpacking:* A complaint of the Associate was that the academic supervisor did not offer enough "hands-on" intensive support. The Associate was not a computer expert yet most of the problems of translating the tasks or performing the simulations were technical in origin. There was no problem with confirming what had to be done, the range of simulations needed and the type of validation and testing required, but the packages used proved virtually impossible to interrogate (see practicality). As it was the Associate relied on a less sophisticated package (TAS) which although limited in its application allowed for the delivery of the consultancy service. In addition, the interpretative basis of some of the work was challenged just prior to the start of the programme and then after the Green Futures Conference. In both instances, the basic premise of the programme shifted requiring a reorientation of objectives and deployment of different skills.
- *Practicality:* To confirm simulations it was necessary to compare results with actual data from a house that had been monitored. In this instance, the Associate found it practically impossible to compare results because she was unable to re-calibrate the simulation software. The software was

difficult to navigate because it was based on Unix, which she had never used before. Given the degree of technical difficulty it is perhaps surprising the only support offered by the academic was access to manuals and on occasion dialogue. This lack of involvement may have contributed to the simulation work having not been completed by the end of the programme.

- *Synchronisation:* As might be expected the early start of the consultancy service coincided with a change in the sequencing of tasks. This did not jeopardise the simulations although synchronisation was problematised by the technical difficulties mentioned above.

These events suggest the programme' was mediated by a combination of events linked to commercial interests and the practicalities of unpacking and appropriating social and technical ware. To fully appreciate these issues it is necessary to consider the points of connection between these various processes. However, before making some initial comments in section 6.4 the Delta case study is presented below.

6.3.4 The Delta case Study

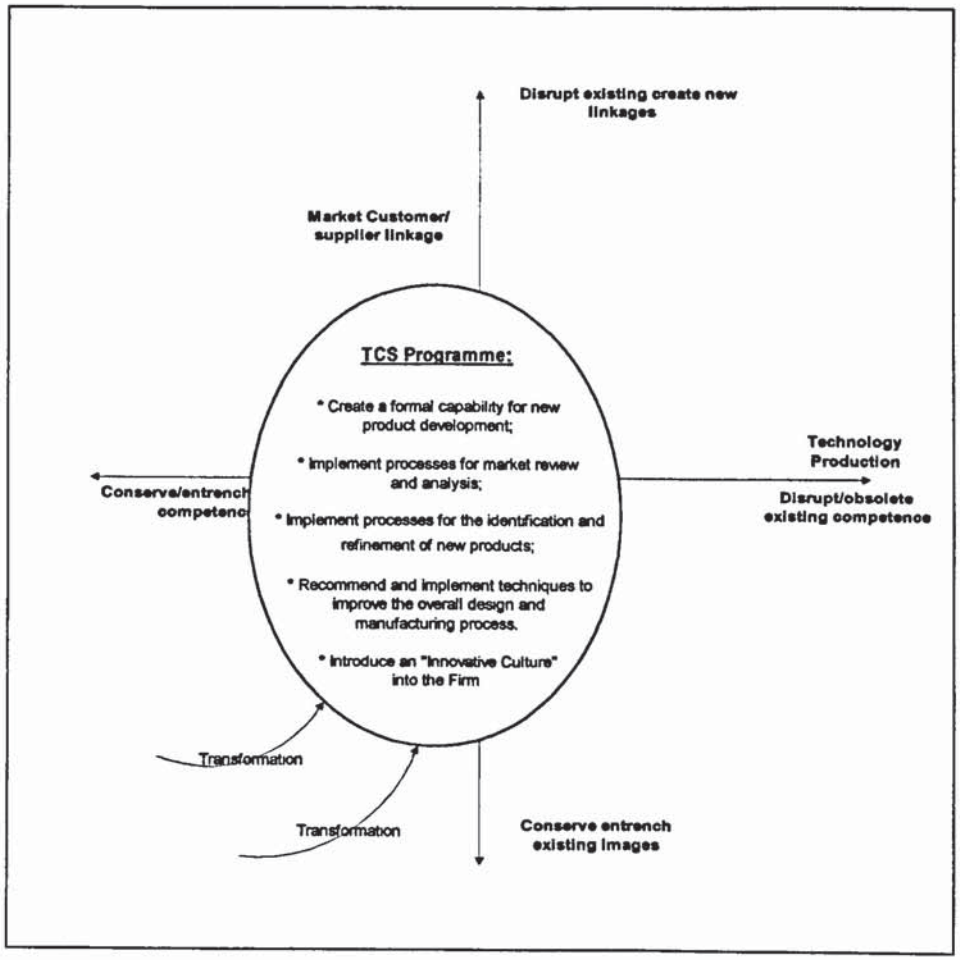
Delta's programme was to be radically altering:

> "The programme will create a formal capability for new product development by implementing processes for market review and analysis, and for the identification and refinement of new products (including acquisition); and recommending and implementing specific techniques within the overall design and manufacturing process (TCD Proposal Form, 1997:2).

In addition to creating these formal processes, which had previously relied on the *intuitive skills of senior managers,* the aim was to establish an "innovative culture". As it was, although the Associate established a NPD committee less success was had with creating an innovative culture. This study illustrates a divergence of opinion when translating tasks at which time certain dominant perspectives became established. Put simply, senior management was more concerned with improving the *bottom line* (profit) than with encouraging staff to participate in development activities. This is depicted in figure 6.3.6 in so far

as the location of the "programme" is nearer the apex of entrenching than altering. This is not to deny radically-altering change did not occur rather the introduction of new and improved products was not accompanied by the introduction of an innovative culture. Instead, the programme entrenched pre-existing antagonistic relations among senior management and the shop floor workforce.

Figure 6.3.6 - Delta's TCS Programme: radical transformation



This programme offered new capabilities to compliment existing marketing strategies and customer relations. NPD was to be merged with these other operations because its customers, the producers of office supply catalogues, marketed their products at specific times of the year. Hence, it was necessary for the Associate when unpacking the programme to appreciate the operating parameters of its existing customer base:

> "Well that is the thing about [how the programme was set out because the demands of current customers] was not taken into consideration. It was something that was not addressed. That it is crucial for the company to launch new products at a specific time of year [was not accommodated]. It is just the way the industry works that they do their product selection that time of year and so by developing a product that is ready for market say in July is not really much use because the catalogue you want to get into is not out for another six months. So, even after that product selection there is another six months or something before the catalogue is produced. That is why time is important to the company" (Associate).

Appreciating the publishing deadlines served to be a key issue. Recursivity or the "rhythmic persistence" of Delta's operations was a key organising principle in the innovation process. Of equal importance, it was posited, was building a culture where management and the shop floor were committed to NPD:

> "You can't build Rome in a day. Things do take time especially from this cultural issue. You can't teach an old dog new tricks at least in a hurry and these things probably do take a long time but as long as we are seeing little changes taking place" (Associate).

Ensuring company-wide participation in NPD was not an easy task as senior management was reluctant to encourage participation on the shop floor:

> "You have to be careful, not everyone's like you and me. Most people out there are not bothered about the company. They're just happy to come to work, do as little as possible and on Friday pick up their pay packet. It would be a waste of time getting them involved, they don't know the products, they don't know the market, they have very little to offer"[5].

Regardless of this skepticism the Associate worked to encourage participation with the introduction of a suggestion scheme. In the case of the NPD committee the Associate was responsible for taking the ideas generated in these meetings and the suggestion scheme and turning them into concepts, prototypes and end products. The committee not only generated ideas it also considered ideas from the shop floor. In turn, ideas were *scored* according to parameters established by the NPD committee:

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[5] This quote was obtained from the academic supervisor from conversations he had with the MD.

1. Growth markets,
2. Low risk,
3. Current product range and
4. Existing skills.

"Scoring" demonstrates how Delta's existing zones of manoeuvre mediated translation. By concentrating on growth markets, low risk improvements based on existing products and skills the actions of the NPD committee were committed to mainly cosmetic, incremental low cost changes. This is not to assume "innovation" is or should only ever be radical rather it demonstrates how existing knowledge influences change processes:

> "Every idea that comes forward is within office supplies. Its not as if they have been asked for ideas that fit in with office supplies but that is the way people think. We are office supplies and that might dictate what comes out at the end because that is how everyone is thinking and you do hear in the meeting that when people pick up these ideas and develop them then you do hear people say that is not what [Delta] is known for" (Associate).

In this way, translation was mediated by criteria based on quick returns and existing competencies:

> "You know when I first met up with [the academic] and looked at the structure of the proposal that looks very tangible I will get stuck into that and get things through. The one thing this plan does not take into account is the fact that they [Delta's senior management] want new products at the end. Well obviously by trying to develop the culture it is going towards getting the new products out at the end so that is not necessarily contradictory, but I don't think the original plan meets the company's requirements" (Associate).

While the broad objective of improving competitiveness fitted with increased profits and turnover through the development of new products the industrial supervisor (MD) attached little importance to whether or not they were made in-house. What is more, the MD was not committed to improving the skills of shop floor workers by providing training. This ran counter to introducing an "innovative culture" and reflected closure around a reduced interpretation of the programme:

> "Introducing innovatory ideas on the shop floor are primarily concerned with mechanisation rather than improving the efficiency of work. Therefore, management's ideas about innovation are diametrically opposed to the interests of shop floor workers who want to earn more for less effort" (Industrial Supervisor).

In contrast, the academic supervisor was keen to encourage improved links among managers and shop floor workers suggesting a stakeholder approach would benefit the firm and its workers. Even though the industrial supervisor accepted the basic premise of the academic's argument - stakeholding could contribute to innovation, he rejected the idea of directly involving shop floor workers:

> "My main objective is to improve sales, markets and profits - I'm not here to make sure that Joe Bloggs feels warm, fluffy and happy".

The focus on the bottom line became increasingly apparent when considering the Associate's activities. Although the Associate was key to establishing the NPD committee and suggestion scheme Delta's senior management saw the value-added of the Associate not exclusively in terms of the "programme" but in his ability to help the firm respond to market opportunities. Once when I asked the Associate to comment on the programme he responded, "you know I hardly ever consider this schedule". Asked why this was he said, "it may say about developing the NPD timetable and algorithm but in the end that is not really what the company wants". This is not to say tasks were not completed during the life-time of the programme rather a great deal of the Associate's time was spent in the design, prototyping and tooling of new products. In this sense, the Associate spread his time across a range of activities broadly defined as NPD. Although the Associate made good the demands of senior management he was still concerned with trying to involve shop floor employees in change activities. Hence, although his actions indicate a commitment to profit making he remained tied to the logic of the programme. This is apparent when the academic asked whether he had considered working at Delta after the programme?

> "I would need to have a definite offer which included wages and responsibilities. But even so, there are some things about

> working here, which I don't like - particularly the way shop floor workers are treated by managers. If I was going to stay I would want to try to do things differently - get workers more involved."[6]

Seemingly, issues at the level of the firm mediated the appropriation of Delta's programme. What is of interest is why these views remained dominant. The answer seems to depend on the way tasks were mediated during the process of enactment or how the dominant perspectives became accepted currency during the programme (section 6.4). Before considering these themes it is again useful to summarise the process, context and content issues, beginning with process:

- *Associate's Status and Power:* The Associate came up against resistance from senior managers when endeavouring to involve the workforce in new product development. Although the Associate benefited from the support of the Managing Director it remained difficult to persuade key members of the management team of the worth of gaining the views of the shop floor. In turn, the Associate had to persuade and cajole colleagues on the shop floor who were at times equally sceptical about the value of the work. This was a protracted process as the Associate was expected to work not only with people in the main Birmingham site but also the manufacturing site in Bristol. Although the Associate's status benefited from the support of the Managing Director it also grew from their professional attitude towards the programme and colleagues.
- *Organisational Friction:* The Associate was responsible for NPD activities including organising meetings, writing minutes, conducting research and processing data. They were also responsible for making mock-ups and eventually new product introduction. In this way, the Associate was readily involved in both programme matters and the development of a new business unit. Hence, the distinction between the programme and Delta's own routines became increasingly blurred as the NPD committee began to develop ideas and translate them into new products. In no way, was the Associate simply used as "another pair of hands".

[6] This quote was obtained from the academic supervisor.

- *Academic Involvement:* The academic achieved a balance between being proactive yet not heavy-handed. Although they were not involved in the day-to-day activities of the Associate they did give clear support and advice. On those occasions when the academic tried to directly influence the programme only limited success was achieved, for example, the industrial supervisor accepted the suggestion of becoming more strategic arranging a 'strategy away day'. However, in contrast there is little evidence to suggest the industrial supervisor accepted the academics argument to introduce a stakeholder approach to NPD.
- *Internal Ownership and Support:* Support from the industrial supervisor was consistent and unambiguous although their interpretation of many of the programme's tasks did not reflect the views of the Associate and academic supervisor. Here, the dominance of the industrial supervisor in co-ordinating activities was reflected in the actions of the Associate. For the industrial supervisor the Associate was core to NPD and not shop floor workers. In this sense, the focus was giving as much support as necessary to ensure the Associate improved their skills and business acumen.
- *Project Control:* There was no lack of programme direction at Delta. In fact all members worked closely together to meet the targets for new product introduction. Any concerns about shop floor involvement were off set by the financial benefits accrued or pending via the programme. Ultimately, the programme's success at Delta was measured in terms of revenue not employee involvement. Despite the concerns aired by the Associate and academic supervisor it was generally accepted if not wholly agreed that the key measure of success was increased revenue.

The organisational context was also significant in affecting the performance of the programme at Delta:

- *Company size:* It is unlikely firm size affected the programme at Delta. The industrial supervisor managed the Associate in a way that enabled them to implement the programme and develop their own skills and business

knowledge. Although not all the objectives were met the Associate was given plenty of support and guidance during the programme.

- *Financial Health:* There is no evidence to suggest changes to the financial health of the company during the programme resulted in any significant changes to the tasks.
- *Changes to Senior Management, Corporate Strategy and Culture:* There were no changes to the programme team during the programme. Likewise, there were no significant changes to corporate strategy. In this sense, the industrial supervisor remained consistent in their opinion about the need to improve revenue generation through the introduction of new and improved products even if this sidelined changes to the company culture.
- *Roving Reporting Relationships*: The Associate's prime responsibility was to the industrial supervisor although they also worked closely with the academic supervisor. At this time, the Associate tried to navigate between competing demands on the one hand ensuring targets set by management were met while also endeavoring to ensure greater shop floor involvement.
- *Internal Company Politics*: Senior management were generally supportive of the programme although one member, the Finance Director, was very resistant to greater shop floor involvement. As it was, this only made the Associate more determined if not successful, to change how management managed and treated the shop floor workers.
- *Bargain-hunting*: There is no evidence that Delta's management treated the programme as a way to subsidise the employment of a graduate. As it was, considerable value added was achieved during the two years of the programme (see figure 6.3.6).

As with context the programmes content is an important part of the knowledge creation process:

- *Unpacking:* This proved difficult because the original programme timeline did not take into consideration the seasonal deadlines of the catalogues used to market Delta's products. These deadlines were a key organising principle in the programme so much so that the Associate had less than

three months to establish the NPD committee, generate ideas for new or improved products and turn them into products before the first deadline. Because income generation was the main concern efforts to change company culture were effectively sidelined as the majority of the Associate's time was given to the design, development and introduction of new products.

- *Practicality:* Establishing the NPD committee provided the mechanism through which new ideas were generated and translated into products. Appropriation was readily achieved because the majority of participants in NPD were committed to the new organisational arrangement. Once the new product idea had been generated it was then left to the Associate to design and organise the fabrication of prototypes either by employing external experts or using Delta's own engineers in Bristol. The academic supervisor provided most guidance when creating the NPD committee once this had been achieved and the new ideas were being translated into new products the Associate relied more on colleagues at Delta mainly because the academic was not a qualified engineer or designer.
- *Synchronisation:* As mentioned above synchronisation was inexorably tied to the demands of Delta's customers and the catalogue distributors. Tasks were either compressed in order to meet these deadlines or they were stretched as these demands took the Associate away from developing the innovative culture. Ensuring the translation of ideas was the key concern for Delta's management. Synchronisation was skewed toward the day-to-day necessities of testing and implementing new ideas it was not about trying to involve the work force in creating numerous suggestions it was about getting products to market. Once the ideas had been identified the rationale to involve the shop floor was no longer apparent to the industrial supervisor.

Given these observations the key issue is to make sense of the connections between the strategic conduct of programme members and the mechanisms that mediate these activities. However, before considering "interactivity" it is

useful to summarise the four case studies in relation to the process, context and content issues previously discussed (figure 6.3.7).

Figure 6.3.7 – Summary of the Case Studies: Process, Context and Content.

	"Process"					"Context"							"Content"	
	Associates' Status and Power	Organisational Friction	Academic Involvement	Internal Ownership and Support	Project Control	Company Size	Financial Health	Changes to Senior Management/ Corportate Strategy and Culture	Roving Reporting Relationships	Internal Company Politics	Bargain Hunting	Unpacking	Practicality	Synchronise
ALPHA	Power Reduced Subordinate Position	Extra Pair of hands Ongoing friction linked to the role of the Associate	Reactive role Distanced from decision making process	Subverted Programme increasingly in doubt	Unilateral (firm) Undermined by external issues	No apparent relevance	Undermined In a state of flux during programme	Disparate Strategic goals were confused	Hierarchical Limited academic involvement	Resistance Paradoxical	Not applicable	The basis of tasks were challenged	Mechanical interpretative problems	Compressed and altered chronology of tasks in response to changes in business environment
BETA	Ambiguity Equitability emerged	Extra pair of hands Ongoing friction linked to the role of the Associate	Reactive role Distanced from decision making process	Ambiguous but increasingly supportive Programme not in doubt	Increasingly unilateral Undermined by changes in expectation	No apparent relevance	Not in doubt despite the M-B-O	Resistance removed by the M-B-O and the exit of MD Programme supported	Confused and ever-changing within the firm and the programme	Resistance resolved Degree of uncertainty resolved at end of programme	Arguably a degree of opportunism	As planned Academic forfeit role	As planned Without academic	As planned with minimal change
GAMMA	Occasionally Compromised Generally equitable	Integrated into the firm and the programme	Limited on a day-to-day basis Mediated on occasion by vested interests	Clear and decisive Management team in full support of Associate	Some failure to lever necessary knowledge Conflict of interest	No apparent relevance	Not in doubt Consultancy service seen as important opportunity	Green Futures created new emphasis	No issue	No resistance	No evidence	Extensive problems with the technical ware	Limited flexibility in the available software	Radically altered with new business opportunities
DELTA	Subordinate to the demands of managers Profesional approach of Associate	Integrated into the firm and the programme	Pro-active yet not heavy handed	Dominance of the Industrial Supervisor interpreting tasks	Integrated yet focused on immediate business needs	No apparent relevance	Not in doubt	No changes	Prime responsibility to the Industrial supervisor	Some resistance to the role of shop floor from senior managers	No evidence	Focus on NPD rather than culture	Disparate involvement depending on the nature of the issue - engineering or design	Reflected the timeline of catalogues Tasks compressed on occasion

By considering these various factors it is possible to begin to make sense of the internal dynamics of the innovation process. Such a perspective closely resembles Greenwood and Hinings (1996:1024) view of 'organisations' which they view as 'heterogeneous entities composed of functionally differentiated groups pursuing goals and promoting interests'. In this sense, organisational behaviour and by implication translation is 'a function of these internal

dynamics'. The process, context and content issues described above reflect the mediating effect of an organisations normative embeddedness. The main patterns involve issues of 'control' (programme and organisation) in relation to the accomplishment of knowledge creation and organisational reproduction. In other words, the lines of tension within programmes seem to be a function of the counterpoising of organisational control (context) the role of individuals as an administrative arrangement (process) and the knowledge creation process (content). As shown, although these issues may differ substantively in terms of the rewards and relationships accomplished during translation the common themes are the underlying "mechanisms" related to social control, economic exchange and communicability. These themes are considered in relation to the following categories: contradiction, slippage and dysfunctionality.

6.4 Translating TCS

The reason why translating ideas into reality is not simply a question of plugging in new features is because it involves the convergence of processes based on some form of "social closure". The translation of tasks is mediated by a complex simultaneous equation of independencies and relates to "the means of access actors have to knowledge by virtue of their social location; referring to the spanning of both lateral and vertical separations in and between social systems". It also relies on "the modes of articulation of knowledge; referring to the nature of the discourses" and the "social pressures moulding the interpretations and beliefs held by members of social systems". And, it depends on "factors to do with the means of dissemination of available knowledge; the types of media used to disseminate knowledge" (Giddens, 1995:375).

In each of the case studies it has been possible to comment on the strategic conduct of agents who have taken advantage of their locale in the innovation network by virtue of their access to knowledge and influence over the discourses mediating action. Translation relates to the link between sustaining control, status and ensuring that specific interests are sustained. When, for example, considering the industrial supervisor's status and interests it is

necessary to assess how the knowledge of the Associate and academic was levered during the programme. This includes considering the social pressures moulding the views of programme members and the means of dissemination of relevant knowledge. The interplay of these factors represents an ongoing dialogue that is constantly in flux and only rarely closed (see chapter seven).

Figure 6.4.1 - Programme Tasks: A Sociological Perspective

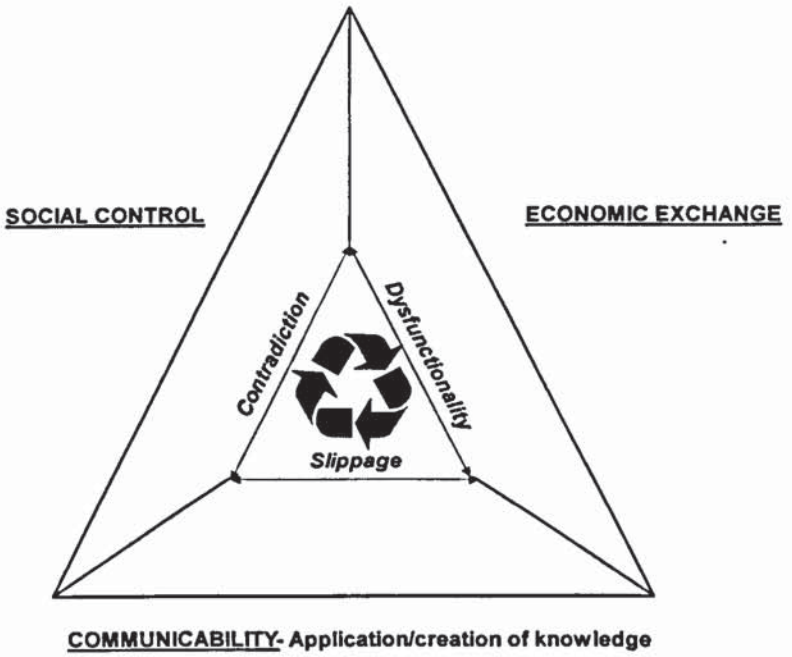
Adapted from Scarbrough (1996:27)

Translation involves *a complex simultaneous equation* (see section 6.5) of interdependencies: social control, exchange relations and communicability (Scarbrough, 1996). Communicability is affected not only by the nature of knowledge and its conversion (tacit and explicit) but also the various social and economic relationships and rewards that are defined and legitimised during such activities (figure 6.4.1). Before considering the nature of these interdependencies it is useful, for the purpose of comparison, to assess the process, context and content issues discussed earlier.

Process issues refer to the organisational aspects of programmes, context issues refer to the institutional setting or the status of the firm in respect of the programme while content issues refer to the knowledge creation process

including the physical practicalities of translating ideas into reality. In turn, these issues are linked to the following processes: *contradiction, slippage and dysfunctionality* (figure 6.4.2).

Figure 6.4.2 - Slippage, Dysfuntionality and Contradiction during Translation

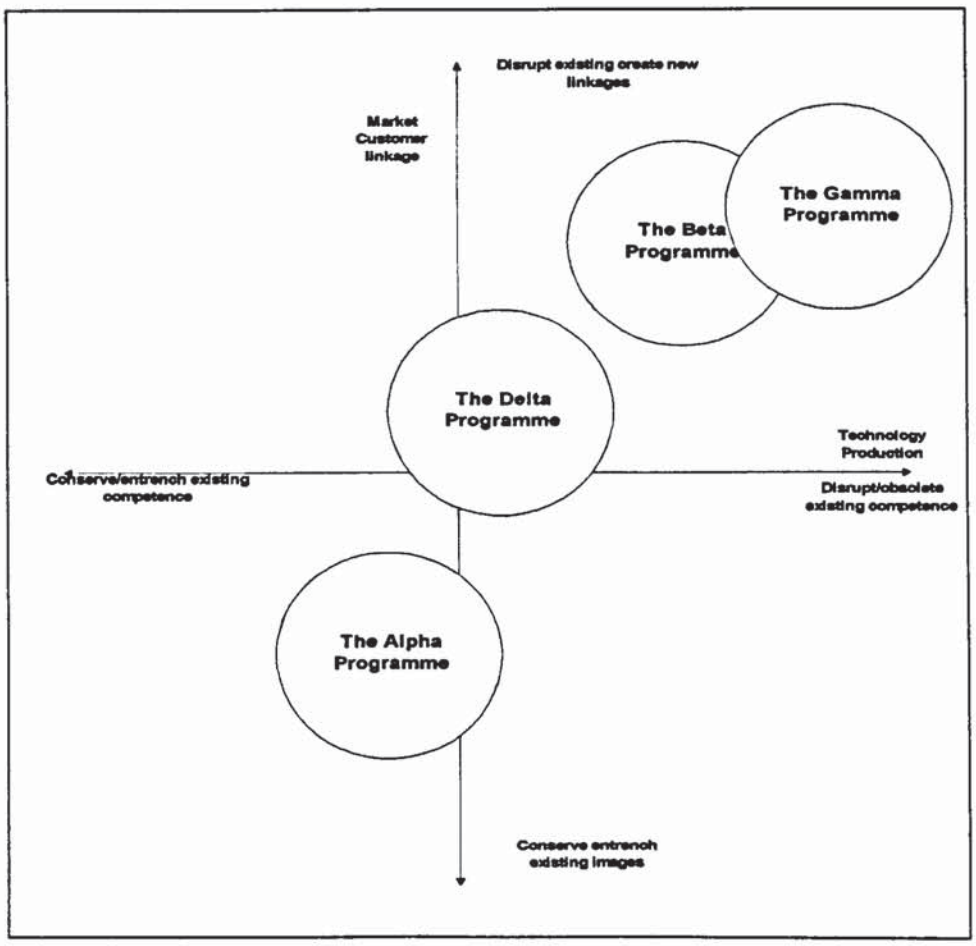


Adapted from Scarbrough (1996:27)

Contradiction refers to interpretative flexibility and the co-existence of different meaning systems emerging or fading during programmes. *Slippage* refers to the re-design of the original programme. This can involve the exclusion of tasks, the reinterpretation of tasks, the re-synchronisation of tasks and/or a failure to translate tasks. *Dysfunctionality* refers to the re-definition and/or curtailment of productive links among programme members and is related to socio-political processes mediating activities. Slippage may coincide with dysfunctionality as well as contradiction (Alpha) yet this may not always be the case. Even with the curtailment of productive links it is possible for agents to stop slippage (Beta). The emergence of contradictions usually results in the deployment of coping strategies to ensure the dominance of specific meaning systems. What is of interest is why dysfunctionality coincided with slippage

and the reduction of radical changes at Alpha and Delta but not at Beta and Gamma (figure 6.4.3). The answer seems to relate to the coping strategies adopted and the nature of the contradictions affecting programme participants.

Figure 6.4.3 - The Innovation Profile



Coping strategies reflect the means of access to knowledge by virtue of a participant's location, the circumstances relating to the validity of knowledge and the means of dissemination. The strategies adopted at for example Alpha demonstrate that such strategies are not necessarily associated with trying to halt slippage or overcome dysfunctionality rather they illustrate sophisticated attempts to manipulate existing organisational mechanisms to achieve "new" objectives (contradiction). Likewise, coping strategies were adopted to ensure translation as at Beta when the industrial supervisor concerned that tasks

were in jeopardy sidelined the academic supervisor. In both, the key themes relate to the processes through which specific interpretations dominate and how participants ensure compliance to these meaning systems.

Figure 6.4.4. The Alpha Programme – Issues and themes

	Contradiction	Slippage	Dysfunctionality
Process			
Associates Status & Power	- New business concerns	- Subject to bus concerns	- Programme Vs Business
Organisational Friction	- Focus on scale-up	- Chronic	- Associate's responsibility
Academic Involvement	- Focus on development	- Limited & ineffectual	- Excluded from decisions
Internal Ownership & Support	- Entrenching	- Loss of direction	- Bias toward commercial
Project Control	- Original aims displaced	- Manipulative	- Asymmetries of power
Context			
Company Size		- Available competency	
Financial Health	- Volume production	- Botanicals development	- Future of botanicals
Changes to Snr Mgt Corporate Strategy & Culture	- Re-prioritisation	- Flavours Vs botanicals	- Business opportunities
Roving Reporting Relations	- Industry ascendant	- Academic displaced	- Hierarchy
Internal Company Politics	- Conserve flavours	- Flavour focused	- Secure viability of site
Bargain-Hunting			
Content			
Unpacking	- Value-added	- Interpretative flux	- Focus on scale-up
Practicality	- Scale or quality?	- Translation difficult	- Political will to succeed?
Synchronisation	- Immediate high volume	- Re-synchronised	- Commercial priorities

To assess such strategies it is useful to juxtapose the notion of contradiction, slippage, and dysfunctionality against the process, context and content issues described earlier. Beginning with Alpha, changes in operations (contradiction) led to displacements in productive links between the industrial supervisor, Associate and academic. This coincided with task slippage including failure to translate tasks in phase 2 and the re-interpretation and re-synchronisation of tasks in phase 3. The link between these events and the issues described earlier are summarised in figure 6.4.4. The processes affecting translation relate to the rules of involvement and the interpretative schemes that were established during the period of operational change (flavour production). The key element is the relationship between the positioning of members and the emergence and dominance of the new schemes (section 6.5). The summary

in figure 6.4.4 indicates, in an abbreviated form, how contradiction, slippage and dysfunctionality were mediated through the process, context and content issues.

If we consider financial health and changes to corporate strategy (context) in relation to internal ownership and support and project control (process) and practicality (content) it is possible to infer a link between Alpha's existing zone of manoeuvre or flavours production, the dominant interpretations informing commercial decisions and issues of translation. Coinciding with the emerging asymmetries of power between the industrial supervisor (dominant) and the other members of the programme were development difficulties and revisions to the Group's strategies. In combination, these processes indicate why Alpha is located at the bottom left hand quadrant of the innovation profile (see figure 6.4.3).

The Beta case study was not adversely affected by slippage although there were some re-interpretations and delays (the choice of MIS). Dysfunctionality was not linked to the perceived timeliness and relevance of tasks instead it related to the alliances, responsibilities and obligations of participants. Here, as at Alpha, events within the organisation mediated the actions of members in so far as commercial criteria undermined established views about roles and responsibilities. In contrast to Alpha, the core or substantive element of tasks was not questioned rather dysfunctionality reflects the industrial supervisors attempt to broaden the responsibilities of the Associate and academic. This contradiction was only resolved once it was recognised that the anticipated widening of responsibility was not achievable and once coping strategies were put in place to ensure the Associate delivered the programme and was able to adequately fill the purchasing role. The Beta study demonstrates how the innovation process can upset pre-existing social relations creating unintended contradictions. Innovation did not happen in isolation instead it was mediated by events that blurred the responsibilities of agents within the social network. Slippage was avoided because the interpretative flexibility was not linked to the substantive validity of tasks or problems with knowledge creation (content) rather it was based on wider issues about "organisational reproduction" and

purchasing (process and context). Thus, the curtailment of productive links was related to the re-definition of links, which was eventually resolved with a re-alignment of alliances.

These coping strategies involved the deployment of existing competencies to fill the gap left by the displaced academic and the removal of key members of senior management (i.e., the Managing Director) who were opposed to the proposed changes. Most process issues are clustered around discrepancies in member responsibility and are related to the organisational changes in purchasing and senior management (context) (figure 6.4.5). Beta is in the upper right quadrant of the innovation profile because the industrial supervisor levered resources to offset resistance and the unintended contradictions that emerged from these change processes (see figure 6.4.3).

Figure 6.4.5. The Beta Programme – Issues and themes

	Contradiction	Slippage	Dysfunctionality
Process			
Associates Status & Power	- Core priorities unclear		- Responsibilities widened
Organisational Friction	- Purchasing function		- Another pair of hands
Academic Involvement	- Responsibilities rejected		- Redefined w'out consultation
Internal Ownership & Support	- Role ambiguity		- Associate's support uneven
Project Control	- Redefine supervision	- Interpretative focus	- Asymmetries of power
Context			
Company Size	- Organisational change		- Associate's responsibilities
Financial Health		- Affordability	
Changes to Snr Mgt Corporate			
Strategy & Culture	- Who manages purchasing?	- Task relevance	- Programme legitimacy
Roving Reporting Relations	- Academic's responsibility		- Supervisory discontinuity
Internal Company Politics	- Supervisory responsibility	- MD's resistance	- Associate's isolation
Bargain-Hunting	- Associate's responsibility		
Content			
Unpacking	- Conflicting opinions - detail		- Re-define social alliances
Practicality	- Academic's displacement		- Re-define social alliances
Synchronisation		- Resources	

The Gamma case study offers yet another perspective on the dynamics of translation (figure 6.4.6). As at Beta, the programme resulted in radically-

altering innovation with the introduction of new competencies and the creation of linkages in the market (figure 6.4.3). When problems arose (simulation and monitoring) various strategies were adopted to ensure the delivery of value-added. In this respect, the coping strategies coincided with tensions between members as alliances began to be called into question and re-defined (figure 6.4.6).

Figure 6.4.6. The Gamma Programme – Issues and themes

	Contradiction	Slippage	Dysfunctionality
Process			
Associates Status & Power	- Level of academic support		- Friction with academic
Organisational Friction			
Academic Involvement	- Conflict of interests (bus.)		- Unclear commitment
Internal Ownership & Support			
Project Control	- Who levers knowledge	- Opportunistic	- Asymmetries of power
Context			
Company Size			
Financial Health		- New revenue stream	
Changes to Snr Mgt Corporate			
Strategy & Culture	- Re-focus programme	- Green Futures funding	- Redefine core alliances
Roving Reporting Relations			
Internal Company Politics			
Bargain-Hunting			
Content			
Unpacking	- Unix Vs Windows	- Complex technologies	- Limited academic help
Practicality	- Running three packages	- Simulation problems	- Useless user support
Synchronisation	- Development Vs Service	- Radical re-focus	- Compress tasks

Slippage was an unintended consequence of attempts to design-out the development issues of the original programme. Adopting the 4D-simulation package was supposed to offer development opportunities without having to find an Associate to develop a new computer platform. As it was, there were numerous problems in the development of the simulations (content). Slippage also reflects developments ahead of time of the consultancy service following the Green Futures conference (context). As it is, Gamma is featured in the top right hand segment of the innovation profile because radically new techniques were appropriated that enabled the association to operate in new markets. Of

interest is how radically-altering innovations were achieved when productive links were re-defined following the premature start of the consultancy work and concern was being aired about the simulation work.

The coping strategies are significant because they reflect how in the case of the problems with the simulation work the programme members worked to find a solution. Although there is a question mark over the academic's level of assistance (availability) sufficient support was available to ensure that TAS delivered the consultancy work. This shift in emphasis was accompanied with a re-interpretation of priorities and needs. On this occasion, the academic, as described above, was unwilling to offer his services without additional financial reward. Here we see the significance of levering knowledge and expertise for other interests.

Figure 6.4.7. The Delta Programme – Issues and themes

	Contradiction	Slippage	Dysfunctionality
Process			
Associates Status & Power **Organisational Friction** **Academic Involvement** **Internal Ownership & Support** **Project Control**	- Level of discretion - Value of Stakeholders - Pro-stakeholder culture - Rhetorical not substantive - Narrow interpretation	- Industry lead - Myopic view of NPD - Limited influence - embedded notions - Bottom-line driven	- Focus of responsibility - Exclusion Vs inclusion - Leverage - Internal to firm - Asymmetries of power
Context			
Company Size **Financial Health** **Changes to Snr Mgt Corporate Strategy & Culture** **Roving Reporting Relations** **Internal Company Politics** **Bargain-Hunting**	- Social Vs economic value - Non-equitable influence - Management defined	- Myopic interpretation - Industry focused - Shopfloor/Mgt mistrust	- Focus on bottom-line - Limited negotiations - Management apathy
Content			
Unpacking **Practicality** **Synchronisation**	- Bottom-line relevance - Shopfloor/Mgt mistrust - Commercial prioritisation	- Catalogue deadlines - Culture change prob. - NPD core responsibility	

In contrast to the experiences of the industrial supervisor at Beta Gamma's management were unable to access expertise from new sources not because

alternative experts could not be found but because the academic was also a partner in the Green Futures project. To secure future alliances it was politically expedient to meet the academic's demands. This is the only study where the academic was able to resist the commercial demands of the company representatives and suggests that alliances are built on "systems of mediation" of which the means of access to knowledge is a crucial element (see section 6.5).

At Delta, there was movement towards the introduction of radically-altering innovations especially with the formalisation of the new product development process. However, there was also considerable entrenching in so far as the management team did not encourage an innovative culture (see figure 6.4.7).

On this occasion, slippage (partial) was accompanied by dysfunctionality in some of the links between the Associate, academic and the industrial supervisor. This study illustrates how productive links can reflect narrowing interpretations. The Associate was encouraged to lead the NPD committee, conduct most of the developmental work, prototype and introduce the new product ideas. Effectively, the Associate was being groomed to act as the firm's entrepreneur its ideas-man, boundary spanner and NPD manager. It was apparent that improving the bottom line was not reliant on developing an innovative culture. The academic was powerless to intervene in so far as they did not lever advantages other than the close support and guidance imparted in starting the NPD committee. Dysfunctionality was not characterised by a breakdown in productive links, as at Alpha and Beta, rather, it was subtler, reflecting a lack of *positive enforcement* for some tasks. In addition, affecting a change in attitude at Delta would require a considerable amount of effort in persuading the shop floor of its merit. It was apparent to the Associate that many on the shopfloor found management to be both removed and condescending. Doubts about developing an innovative culture were not only aired at programme level but also permeated from the shopfloor upwards.

Translation is as much a social process as a technical operation such that introducing tasks not only indicates the creation of new organisational routines

understandings and technologies it also denotes the removal or the laying dormant of pre-existing competencies. This is a complex process because programmes occur alongside established organisational understandings. In other words, each study demonstrates how in different combinations the interests of participants are displaced according to different social processes.

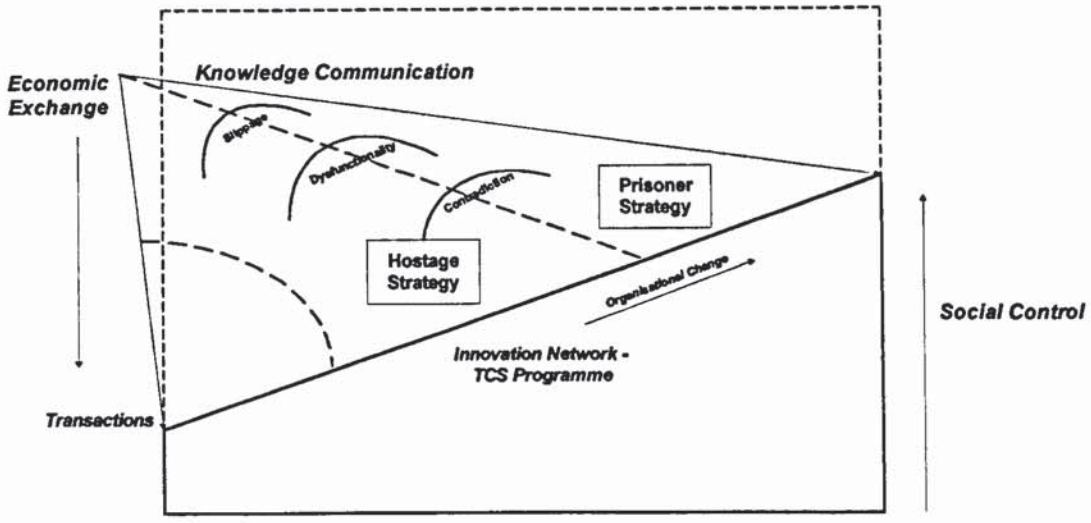
6.5 Coping Strategies

Juxtaposing process, context and content against contradiction, slippage, and dysfunctionality illustrates the situational reliance of translation. The notion of contradiction alludes to the different ways participants considered programme tasks and their respective roles, dysfunctionality relates to the exercise of control over the nature of these social alliances while slippage gives some indication of the extent to which translation was affected by displacements. The process, context and content issues provide an indication of the nature of these processes in terms of programme organisation, zones of manouevre and knowledge creation.

For the purpose of explication it might be assumed that at the start of each programme tasks were organised according to a *hostage strategy*. In such instances, social networks are established to communicate, construct and exchange knowledge according to pre-defined organisational norms and economic incentives. This relationship involves, as Scarbrough (1996:230) would have it, a kind of "mutual hostage-taking in which each side controlled assets that were more valuable to the other than to itself." In the case of TCS programmes *successful knowledge trading* is expected to reflect increased economic value *and* professional development including Associate training and academic deliverables like academic papers and new teaching material. The link between benefits is designed to preclude any kind of opportunism or unilateral benefit. However, as demonstrated the interplay of contradiction, dysfunctionality and slippage involves complex and varied processes that reflect institutional logic's associated with the locale of participants, their access and leverage over knowledge via the programmes social alliances and the nature of this knowledge. Without exception, but for different reasons and

implications each study moved toward a *prisoner strategy* where "translation" reflected the dominance of certain individuals and groups interpretations of organisational reproduction (Scarbrough, 1996).

Figure 6.4.3 - Translation and Strategies of Social Closure in Organising TCS Programmes



Adapted from Scarbrough, 1996:227.

Switching suggests innovation processes are not driven by "the ruthless pursuit of transactional efficiencies" (Scarbrough, 1996:234) alone but reflect much deeper economic and social-structural arrangements. In spite of the fact that TCS programmes embody defined notions of mutual value and benefit organised around the resolution of specific business problems and are agreed via a legal contract each case study demonstrates key contradictions during translation. To this end, there are some "empirical tendencies" that reflect the possibility of "generative mechanisms" mediating translation (Godard, 1993) and system penetration (Giddens, 1995). Though the manifestation of these dynamics may vary between studies (e.g., according to zone of manoeuvre or knowledge creation) it is likely such contradictions would not have come to pass if it were not for the means of system penetration or what Scarbrough (1996) has termed the complex simultaneous equation of interdependencies.

Alpha's coping strategy: It is assumed that alliances are built on trust and the transfer of knowledge between participants. Organisational arrangements are

put in place to facilitate such activities through, for example, the allocation of academic time (by indirect payment). Similarly, the Associate has access to contextual knowledge on a day-to-day basis by virtue of their being based at the company site and if necessary at the University. At Alpha, the means to knowledge was mediated by virtue of the *separations between participants.* Instead of the Associate gaining from being located in-between supervisors their status and power was radically undermined by the fact that the Associate's status was not defined by these arrangements rather it related to deeper properties regulating organisational reproduction. By virtue of the location of the Associate on the company site and their closeness to day-to-day operations the industrial supervisor was able to manipulate such access without having to offer explanations other than at LMC meetings. It is clear the "employment relationship" reflected considerable asymmetries of power. Such asymmetries indicate the continued relevance of flavours in defining Alpha's operations and as a consequence generating inequalities among programme members in terms of the discourses legitimising the leverage of knowledge for the purpose of organisational innovation.

Translation also relies on the *nature of the discourses* through which programmes are communicated. At Alpha, the language of programme tasks was undermined by existing discourses around flavour production which were inextricably linked to the *validity of belief chains taken as knowledge.* This alludes to the complexities of translation and the fact that tasks are enacted simultaneously alongside pre-existing organisational practices. At Alpha, removing flavours effectively displaced the "programme" because the rationale of the tasks no longer offered a credible discourse, in the context of the asymmetries of power, to communicate or legitimise these activities. The changing relations and rewards afforded through the programme also reflected issues linked to the *means of disseminating available knowledge.* Problems with developing the analytical protocols further undermined the logic's of action and the rationale to pursue certain tasks at a time when other concerns on the site were causing concerns for Alpha's management.

The industrial supervisor's switching from strategic co-operation to control and entrenchment is described as a *critical moment* in chapter seven and relates to the interconnection of economic and socio-structural arrangements through which organisational reproduction is articulated and enacted.

Beta's coping strategies: The social alliances were not readily based on trust or the transfer of knowledge. In fact, the *separations between participants* was in a constant state of flux (see chapter seven) during which issues of control and status fluctuated as the planned social alliances were subject to changes both within and without the programme. Here again, the basis of the social alliances was flawed in so far as the rules of organisational reproduction (as at Alpha although for different reasons) were uncertain. However, in this case the logic of the programme remained relatively fixed following the ejection of the purchasing manager. Although the industrial supervisor ensured the Associate understood her responsibilities were broadly defined asymmetries of power emerged with the academic supervisor's failure to respond to these new responsibilities. This resulted in new "separations" within the programme and coincided with new "separations" in the firm. In this sense, translation did not rely, as might have been expected, on the co-operation of the academic supervisor rather the social and technical ware embodied in the tasks were already familiar to Beta's management and were easily appropriated.

These separations coincided with the imposition of new *discourses* that would mediate practices. Conflict may have been an unintended consequence of the efforts to ensure purchasing was effectively managed yet these events still undermined the basis of the social relations among programme members. Concerns about the Associate's competence and the support of the academic continued to be the key *discourse* informing discussions during the programme. This was pervasive as it coincided with other major changes at Beta (e.g., the management buy-out) which had the effect of re-enforcing the newly defined separations. *The validity of belief chains* was also linked to the separations within the firm. The newly defined responsibilities of the Associate and academic reflect displacements at Beta (e.g., removing the purchasing manager and managing director) and coincide with attempts to modernise the

firm's management practices. Slippage was not a major problem because the *means of dissemination* (the programme tasks) was not, for the reasons given above (e.g., management involvement) unduly problematic.

The industrial supervisor's switch from strategic co-operation to control was not smooth. Here, the rules regulating organisational reproduction were negotiated at the same time the programme was translated into reality. Even though substantively different to the Alpha study the inferred shift from a "hostage" strategy to a "prisoner" strategy reflects key "empirical tendencies" governing the social relations including the separations among participants, the nature of the discourses, the validity of the belief chains taken as knowledge and the means of disseminating available knowledge.

Gamma's coping strategies: The *separations between participants* at Gamma reflect the relevance of social positioning in relation to knowledge and its leverage. Once again, the economic and social-structural arrangements that mediate translation and organisational reproduction are substantively distinct compared to the other studies yet here again organisational arrangements influenced innovation. In this case, the industrial supervisor and Associate were heavily dependent on the expertise of the academic. This became most apparent when with the re-synchronisation of the consultancy work they were unable to influence changes to the programme. The academic had leverage over the "monitoring" protocols because it represented an economic benefit and because through the Green Futures project pre-existing agreements and obligations bound the key protagonists. The exit cost from such arrangements was too high for the industrial supervisor not to capitulate to the demands of the academic. Here we see, once again, how the *means of disseminating available knowledge* is associated with the *separations between participants*.

The *discourses* informing translation were located around the development of a new competence and service. Although the emphasis shifted in this regard the logic and economic validity of these activities remained relevant for all the participants during the programme. Because of the close tie-in with the Green Futures project such changes represented common objectives between the

industrial and academic partners. Despite the locale problems the changes to the programme emerged from joint interest in ensuring income revenue for the Green Futures project.

The Gamma study demonstrates that the shift in strategy may only be partial or perhaps temporary. The efforts of the industrial supervisor to develop the consultancy service in new ways demonstrated that the leverage of certain resources could be compromised and that control is not synonymous with the industrial supervisor instead it reflects the convergence of multiple processes and interdependencies. Here, a "prisoner strategy" was attempted during the events surrounding the monitoring issue otherwise the participants broadly operated according to a "hostage strategy". The failure to change strategy is directly related to the pre-existing organisational arrangements and the legacy of Green Futures.

Delta's coping strategy: The *separations of participants* at Delta were similar to those experienced at Beta in so far as the Associate was not particularly reliant on the expertise of the academic to ensure translation (technical). In a similar way, commonalities are to be found with the Alpha study by virtue of the location of the Associate in the company (close integration) and the level of discretion practiced by the industrial supervisor as to their day-to-day work and conformity to the programme. Unlike at Gamma where the Associate was embroiled with the technical and practical detail of the programme the Delta study illustrates how the Associate was involved in activities sometimes only loosely related to the letter of the programme. These instances seem to reflect the industrial supervisor's preference to groom the Associate as the NPD manager as opposed to encouraging the deployment of an innovative culture. Here again, we see asymmetries of power through association and the locale of the Associate in relation to the *positioning of their supervisors* and the *nature of the discourses*. The language of the programme was undermined by existing discourses about the "role of employees" (based on Taylorist notions) and the most effective means to affect improvements to the "bottom-line". In the light of these dominant views and the lack of leverage both the Associate

and academic had over expertise it is perhaps unsurprising little progress was made to instantiate these practices.

This interpretation of management and the role of workers on the shopfloor reflected those social pressures molding both the interpretations of Delta's management team but also elements of the shopfloor. The organisation of the shopfloor around these Taylorist perspectives made it difficult to introduce an innovative culture. The NPD committee did not provide the means to change these perspectives precisely because it was made-up of the senior managers perhaps most hostile to the proposed change in culture. In this sense, the *means of disseminating available knowledge* was organised around the actors most resistant to change. The NPD committee provided the vehicle to identify and assess ideas for new products and in this sense it was the vehicle by which change was communicated. Given the committee's constituency it is perhaps not surprising that it mediated decisions about NPD and translation of associated tasks.

The strategic shift was subtle in so far as the Associate was increasingly pre-occupied with new product development and introduction. Neglecting the soft elements of the programme was masked by successful new introductions and the revenues generated from these activities. However, as with the other case studies though the content of translation may vary considerably the empirical tendencies reflect the existence of generative mechanisms in the innovation process.

Translation depends on the interplay of existing zones of manoeuvre, the location of participants in relation to the nature of the modes of articulation of knowledge the means of dissemination and the social pressures affecting the interpretations and beliefs of participants. Scarbrough (1996) has considered these same processes in terms of "expertise" and the interactions converging around social relations, economic exchange and communicability. In this way, the innovation process involves transactions relating to the positions of agents within these social networks or hierarchies, the creation of economic value and the application and or creation of knowledge. Before considering these

elements at a micro level in the next chapter it is perhaps useful to summarise the findings and propositions so far considered.

6.6 Conclusion

In this chapter the author has considered how programmes are established and maintained. By identifying the process through which firm representatives and academics negotiate programmes it has been possible to identify those organizing principles and operational mechanisms central to the articulation of translation. In the discussion of the four studies it has been possible to comment on the complexities of the innovation process. Translation reflects key interdependencies mediating the actions of members. Innovation involves connections between the level of action and the generative mechanisms that enable and constrain changes to the organisational repertoire. Interactivity encompasses a complex simultaneous equation involving *social control* and *economic exchange* or the means of access participants have to knowledge and the validity of belief chains taken as "knowledge" and *communicability* or the modes of articulation of knowledge and the means of dissemination.

Because translation occurs at the same time as organisational reproduction it is not easily divorced from broader issues affecting the host firm. Likewise, because translation involves individuals from outside the host firm issues influencing their daily activities can mediate translation. Social relations are as important as market forces in the innovation process. The implication of these findings is to suggest the innovation process is the terrain on which interests are played-out where collaborative relations are never fully crystallised and the mutual benefit linked to the process is never guaranteed. Translation is characterised by asymmetries of power where control depends on access to "knowledge" legitimising and communicating actions. Considering the process context and content issues juxtaposed against contradiction, slippage and dysfunctionality served to demonstrate the varied empirical findings of the four case studies and the seemingly incomparability of the findings. Only through a discussion of the coping strategies is it possible to extricate the key "empirical tendencies" across studies.

In this chapter attention is given to the implications of the interdependencies mediating the translation of programmes. In the next chapter an assessment of the generative mechanisms at a micro-level is offered drawing on analytical classifications provided by Scarbrough (1996). My aim is to shed specific light on the dynamics of translation and by implication interactivity.

Chapter Seven

The Innovation Process: Translation, Interactivity and Organisational Reproduction

7.1 Introduction

In this chapter I *detail* interactivity in the innovation process. This is necessary if the mediational characteristics of organisational reproduction proposed in the previous chapter are to be made transparent for the purposes of deeper analysis. Alpha and Beta illustrate the complexities of translating ideas into reality. In the former, the analysis considers the *mediational* characteristics of knowledge creation and the social shaping of programme tasks. In the later, knowledge creation is considered in terms of the social processes indirectly associated with but consequential for the translation of tasks. Instead of assessing knowledge creation at the micro-level of "conversion" this case is used to illustrate equally important processes affecting translation including the unintended consequences of organisational change.

Considering the micro-processes of knowledge creation at Alpha rather than in any other case is not a reflection of the quality of the available empirical data. Instead, the objective is to substantiate the claims made in the previous chapter by exploring the minutia of social interactions on a day-to-day and week-by-week basis. By demonstrating the chronology of the many decisions and events it is possible to build a picture of the social interactions shaping the innovation process and by implication the generative mechanisms that mediate these actions. Similarly, the Beta case is not a "better" example of innovation rather it demonstrates a different aspect of the innovation process. At Beta, the micro-processes of translation are set aside for an analysis of the unintended consequences of innovation. At Alpha, factors within and without the firm *combined* with problems of communicability to precipitate slippage. At Beta, translation was relatively trouble free rather contradictions reflected the emergence of new interpretations which resulted in certain displacements but not slippage.

7.2 Innovation at Alpha and Beta: setting the scene

In this section, I introduce each case study summarising the core elements of the innovation process. Although no direct comparisons are made I base each analysis on the same notions of interactivity and therefore propose that there are *methodological* commonalities and empirical tendencies across studies.

Both programmes specified a set of activities that were designed to radically change each firm's organisational repertoire. At Alpha, this involved re-modelling and upgrading the botanicals manufacturing process to produce dry and liquid extracts at greater volumes supported by a quality assurance system. As it was, translation was not realised by the end of the programme with the only changes being marginal improvements to a scaled-up facility without the intended quality assurance system[7]. At Beta, translation involved introducing professional buying systems and disciplines within the purchasing function. This would enable the management team to capitalise on recent

[7] Figures were not made available to show the value-added of the project at Alpha.

acquisitions improving sourcing efficiencies and reduce costs. By the end of the project most of the new systems and practices had been routinised while the new management information system was all but implemented. In total, £88,900 worth of cumulative tangible benefits had been associated with the programme with future savings likely due to the "lean" methods appropriated.

At the start of each project the Associate's (at Alpha hereinafter 'PM' and at Beta hereinafter 'PB') had to make sense of the set of tasks. In combination, tasks are the mechanisms that mediate translation incorporating chronological codes (Clark, 1995) organised around 'clock-time' *and* outputs from other tasks. Ensuring synchronization is not straightforward it begins with each Associate making sense of the interconnections between tasks and phases:

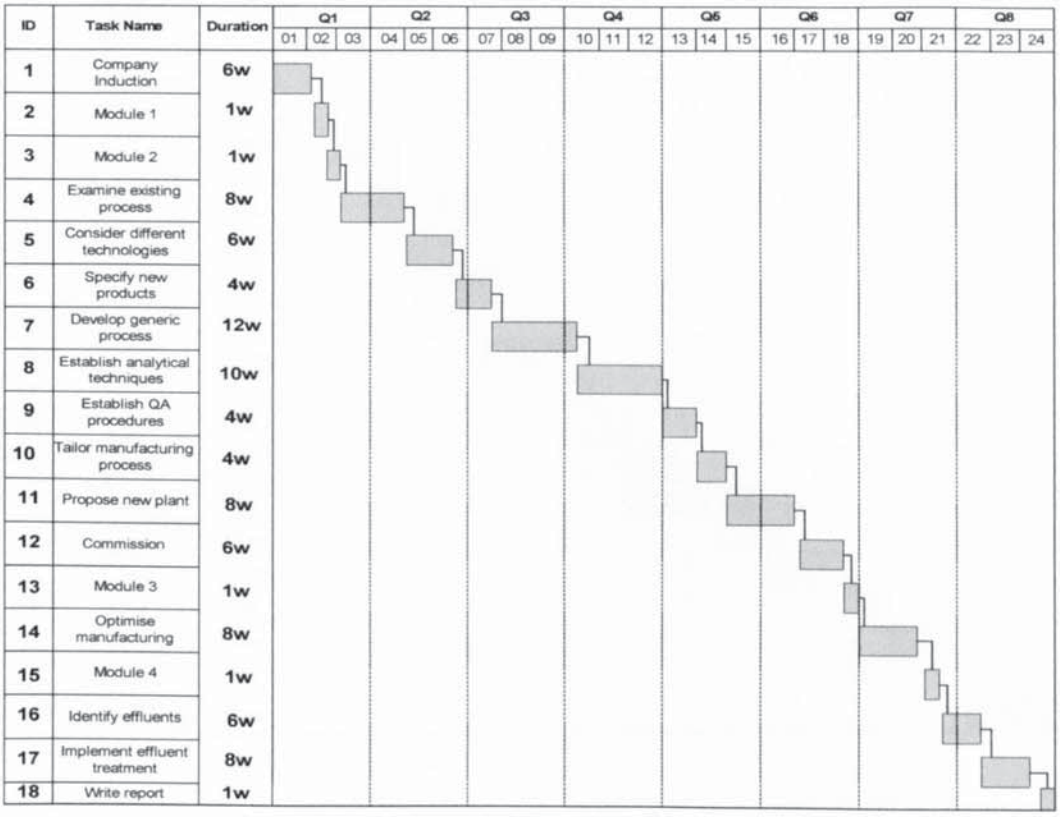
> "Like you would expect phase one to come before phase two...that is exactly what I thought. When I first looked at it phase 1, well obviously phase 1 is too basic. But when I looked at it in a bit more depth and I had spoken to [PA – industrial supervisor] and others, phase 1 is a group of similar tasks, phase 2 is a group of similar tasks and phase 3 is a group of similar tasks. But it is definitely written in a chronological order, I think, you can't do task 4 and 5 really until you have done task 8" (PM – Associate at Alpha).

Making sense of the "chronology" was key to the Associate's socialisation into the programme. Although the programme is represented as a linear sequence of tasks (see figure 7.2.1) it was more akin to a recursive set of practices enacted at differing periods and reliant on the progress or outcomes of each task in relation to the chronological codes (see below).

At Alpha, in phase 1 (i.e., tasks 4, 5, 6) PM had to familiarise himself with the existing manufacturing process (zones of manoeuvre), identify problems and to begin considering the new technologies and products. Phase 1 had two key objectives first it was to introduce PM to botanicals manufacture and secondly to establish the framework (physical – equipment and botanicals) around which translation would be replicated or institutionalised. In conjunction with a review of existing practices phase 2 involved research and development on a set of analytical protocols that would justify future changes and guarantee product quality. Developing a set of chemical analysis techniques was critical

for a rigorous scientific analysis of the production process. The analytical methods would provide data on the degenerative action of the production process on the products active compounds and they would enable Alpha's management to specify each products percentage of active compound (phase 2 – tasks 7,8,9). The recommendations and techniques made in phase 1 and 2 would inform the design and procurement decisions in phase 3. Each set of tasks or phase represents a chronological code a group of activities that constitute a key building block of the innovation process.

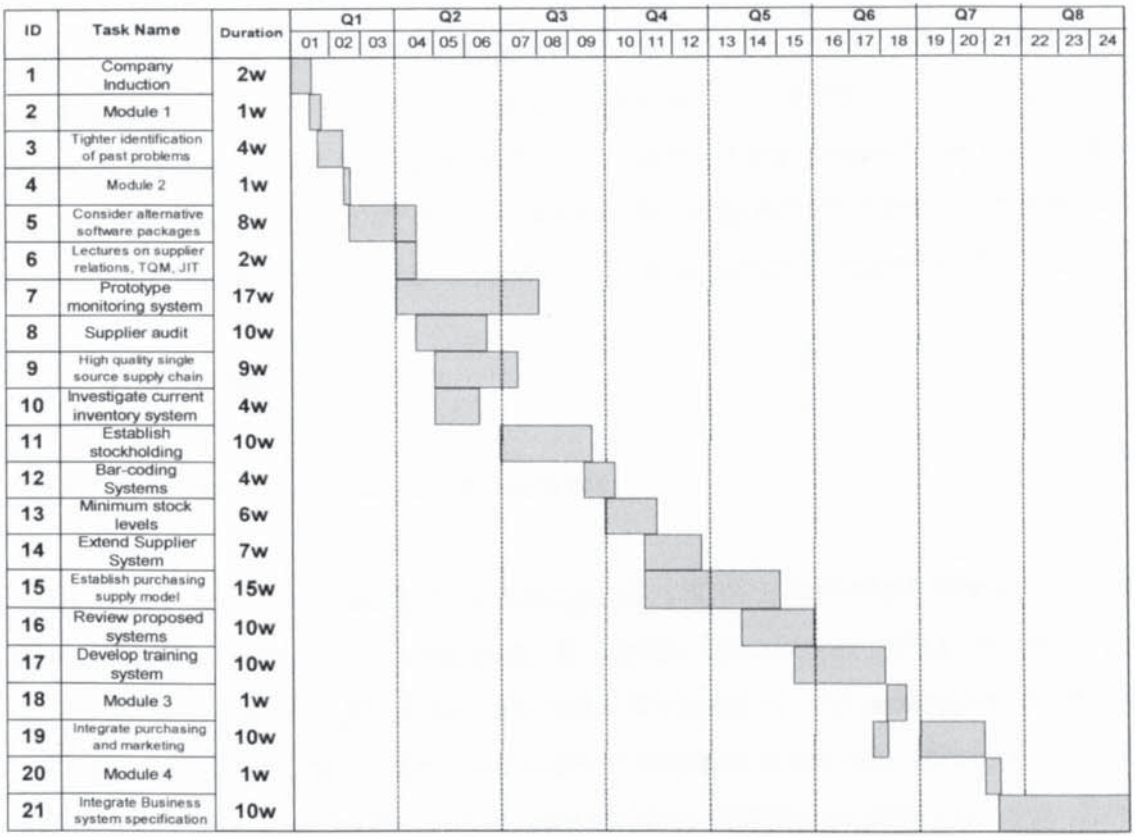
Figure 7.2.1 - Alpha's Programme



Progress was not smooth at Alpha partly because decisions made by senior management in the *Group* were to have significant implications for the project and partly because PM had difficulty in completing many of his tasks. In the first instance, Alpha Group decided a couple months into the project to move the core-operating pose (flavours) effectively stripping the Alpha site of its income generating activity. Work on botanicals took on a new significance as the site now relied on this work for its survival. In due course, Alpha Group's senior management decided to return flavours to the Alpha site reinstating the

core-operating pose at a time when efforts had begun to make botanicals the key activity. In conjunction with these changing circumstances PM failed to develop or implement the analytical techniques in phase 2. The mixture of uncertainty associated with the technical difficulties and strategic decisions made by Alpha Group quickly undermined the programme.

Figure 7.2.2 - Beta's Programme



The synchronisation of phases at Beta, as at Alpha, mediated the logic of the programme (figure 7.2.2). In phase 1 (tasks 3-9), PB investigated the pre-existing systems used to evaluate supplier performance, considered "off-the-shelf" purchasing software packages and begin monitoring Beta's suppliers. Phase 1 involved the Associate's induction, a review of current practices and an investigation into future developments. In phase 2 (tasks 10-13) the aim was to evaluate and implement lean methodologies. In conjunction with the output from phase 1 this work would inform decisions on making the system more efficient and cost effective. Both phases relied on exposing Beta's current operations. Work on phase 1 and 2 would be kept to high cost, high

volume components only in phase 3 would these systems be extended to all suppliers and all components. At which time purchasing would be integrated with accounting, production and sales using a management information system.

Beta's programme was introduced almost in full, which was remarkable given the contradictions emerging from translation. Many of these issues related to complexities associated with changes in the firm including new marketing, sales and production routines. The programme constituted one aspect of a range of changes. The changes within and without the programme effectively undermined the productive relations within the programme. What is of interest is why and how translation continued during this period of uncertainty.

7.3 The Alpha Case Study

7.3.1 Knowledge creation: a preamble

Translation occurs in relation to configurations of knowledge already in the firm's existing zones of manoeuvre. At Alpha, translation relied as much on the skills and knowledge of Alpha's scientific team as the academic team. At the time PM began the project the team included PA the site Director and TD the senior botanicals technologist (industrial supervisor's) who between them had about 60 years experience in direct or related areas:

> "I worked with [PA] in 1970 in Jamaica. I had been working for the British Government in the tropical products area, spices, essential oils, *plant extractives* that sought of thing...[PA] had a good background in plant extraction, his PhD was in hop chemistry and hop extraction...he always had an empathy with that type of work" (TD, *my italics*).

PM's exposure to them and the production operators and technicians on the shopfloor was essential in developing a 'shared language' (Burns and Stalker, 1961) necessary to appreciate the relevance of the knowledge embedded in the production facilities and operating procedures:

> "I really needed to look at every aspect of the process and every stage to just gain an understanding of what went on initially because I have never done this type of work before I needed to get to grips with the operators, work out what they did...I shadowed an operator for a week just to get an idea...and then there happened to be a time just after Christmas when two of the operators were away from work...so [TD] asked me to step in and look at the process, work out how to use it effectively" (PM).

To appreciate these aspects of the organisational repertoire it was essential to be a part of the *organisational context* – "there can be no understanding independent of a mutual set of experiences and interpretative practices" (Piore *et al*, 1994 cited in Cooke and Morgan, 1998:43). Working on phase 1 served PM well developing, as he did the necessary levels of understanding to begin instigating the programme tasks. At the same time as PM was being socialised he was also able to distinguish those aspects of manufacturing not necessarily applicable to the project. Alpha was the repository of knowledge not needed in the programme, which was embodied, for instance, in the skills and methods associated with flavours production:

> "[Flavours production]...is a lot less complicated it does not use the same equipment as botanicals. Flavours generally are located in a suitable vessel, to put the required quantity in, make sure they are clean and then adding particular components in a particular order, because of solubility, generally mixing them together and then packaging. It is very simple there is nothing technical about it. The most complicated process is going to be stirring it!" (PM).

Although flavours production was not technically relevant the fact it had been the key production activity was to have many implications. As will become apparent Knowledge is enduring and may only be temporarily dislocated. In the case of flavours production re-appropriation was relatively easy given the simplicity of the production process and given the problems with the translation of tasks in phase 2. As Scarbrough (1996:4) states knowledge "has emerged as a crucial modality of organisational life; that is, both the driver of change, but equally the biggest barrier to it".

7.3.2 Knowledge creation: mediations and social integration

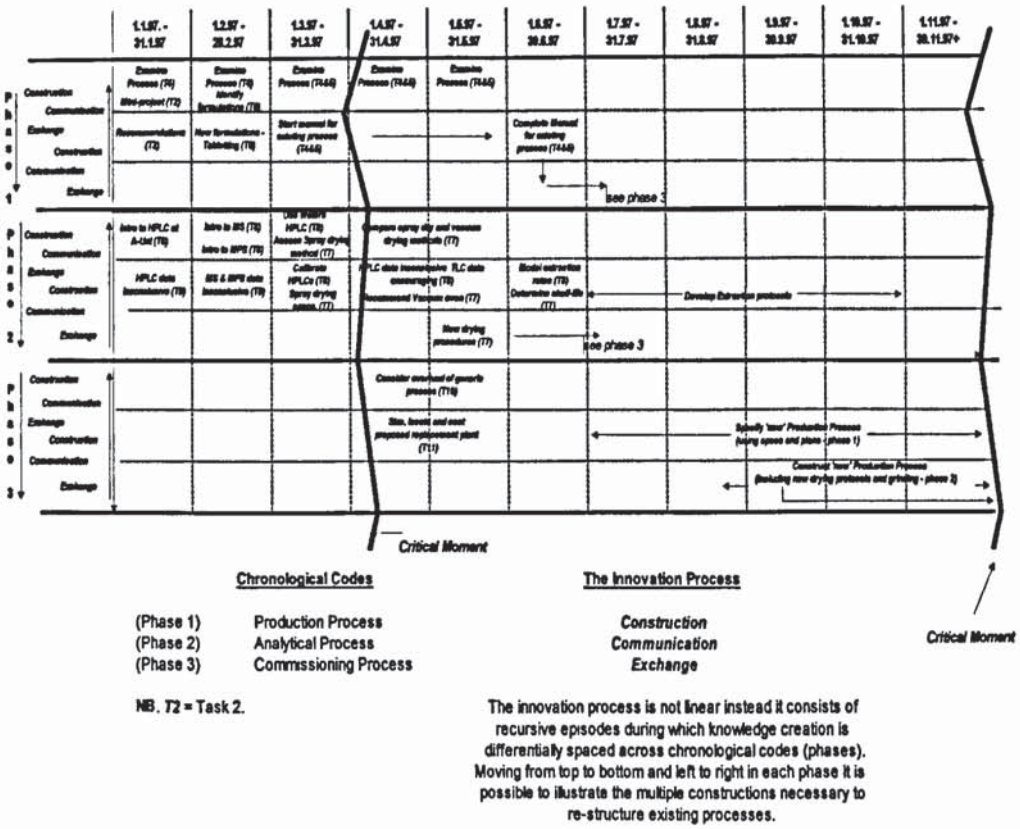
To understand the complexities of the construction, communication and exchange of knowledge one needs to consider the interplay of chronological codes during the innovation process. Creating knowledge depends on the synchronisation of different knowledge bundles. The mediating qualities of tasks are summarised in figure 7.3.1 while figure 7.3.2 captures the interplay of tasks and their actual synchronisation over time.

7.3.1 – The mediating properties of tasks

	Signification	Domination	Legitimation
Tasks	i) Specifies the content of the activity ii) Specifies the discourses used to interpret and justify actions iii) Defines actions in terms of a chronology of events.	i) Confirms knowledge (tacit/explicit) to be used or converted ii) Allocates the resource to be used in translation (numerical/physical) iii) Confirms separation among agents by virtue of the resources and discourses drawn upon during translation.	i) Informs agents of the rationale of the activity ii) Informs agents of the expected output(s) iii) Informs agents of their responsibilities iv) Confirms the media to be used when converting ideas into reality.

Tasks represent rules and resources or modalities (signification, domination and legitimation) that mediate the knowledge creation process (chapter four). They consist of ensembles of knowledge that have normative, interpretative and substantive properties: what ought to happen and how it should be achieved utilising a range of embodied knowledge – processes, techniques etc. Moving from top to bottom and left to right for each phase and set of tasks figure 7.3.2 illustrates the process by which knowledge is codified and then combined with other bundles in the construction of new formulations.

Figure - 7.3.2 The Innovation Process at Alpha



At such times when uncertainty develops the logic of tasks can be called into question. The mediating qualities of tasks are contingent on the process of instantiating the meanings and norms embedded in these activities. In turn, the outcomes of these activities mediate future activities. Uncertainty may not only arise by virtue of problems enacting tasks but it may also emanate from concurrent social processes. To illustrate these multiple processes it is worthwhile discussing the activities detailed in figure 7.3.2.

PM was responsible for multiple activities (task 2, 4, 5, 6, 7 and 8) including a mini-project (2), the examination of the existing process (4), the consideration of new technologies (5), the specification of new products (6) a review and development of the generic process (7) and the creation of analytical methods (8). In combination these tasks reflect the combination of social and technical ware across chronological codes.

As part of the preparation for the new botanical's facility PM undertook a mini-project forecasting the energy needs and costs of an up-graded production facility. This work had a number of benefits, it provided a useful introduction to the Alpha site and it codified the likely capital investment required for the new facility (data used in phase 3). In conjunction with these feasibility exercises PM began work on identifying the active ingredients in raw materials (task 8). This work was to be used to evaluate the existing process in terms of product quality. Developing these new methods was to be a radical improvement because the only data Alpha's scientists had on process performance was the volume of extract produced. The new data would specify the molecular composition (per cent of active compound) of product at any point during the production process. These methods would inform future decisions to improve the process and as such represented the basis of PM's *field of interaction* that would mediate future manufacturing:

> "In order to study how effective [the existing process is] you need some sought of measurement. Now what is currently the easiest way is to just look at the amount of soluble material extracted from the plant material and then knowing the solids content of the different parts of the process you are able to work out how the process works. But that solids content does not really mean much. There are lots of problems with this - raw materials come from all around the world, they are different quality and they have different ground conditions and storage conditions. It is difficult to quantify by volume because of contaminants. So in order to be able to examine the process instead of just looking at the soluble content it would be much better if we look at one specific component or one group of compounds" (PM).

Before testing could begin the analytical methods had to be developed which is an example of multi-layering where innovation involves building sub-archetypes (chemical methods) used to test products (chemical compounds) to create new archetypes (new and improved processes). The building of sub-archetypes relied on utilising and interpreting knowledge embodied in High Performance Liquid Chromatography (HPLC):

> "HPLC is relatively simple. Its solvent pumped through a column, which contains Silica gel or some sought of bead - glass beads or very fine beads of material, which absorb chemical compounds. And after the column there is usually an ultra violet spectrometer,

> which simply measures ultra violet absorbance and what you do is just inject your sample between the pump and the column and the column will absorb different compounds at different rates. Different compounds are passed through the column at different flow rates. You can't work out the compounds from the ultra violet spectrometer but by running, if say you put in some pure samples, then run it through the same conditions, the times for the compound to come through will be the same for each compound, the flow rate, roughly so that you can infer that one compound is the same as another" (PM).

Although HPLC was not new it had never been used to identify active compounds in botanical extracts:

> "As far as I am aware no one has ever used HPLC analysis to determine the compounds in Cascara, I have read papers for similar products that we produce but not Cascara" (PM).

Developing these methods was protracted as PM had a number of mechanical and chemical difficulties. At the start of the project (*1.1.97–28.2.97*, figure 7.3.2) PM tried to identify the active compound by passing a 'pure' sample of the active compound (Cascaroside) through a HPLC machine at A-Uni. Discovering the retention time (time for the compound to pass through HPLC) was equivalent to finding the compound's unique fingerprint. Having identified the fingerprint it would be possible to specify the percentage of active compound at different points in the production process thus making it possible to refine those stages that caused greatest compound degradation. As it was, PM was unable at this early stage to confirm the fingerprint due to problems with his sample:

> "I found that the sample was not actually pure Cascaroside. It [only] contained about 20% Cascaroside and because I could not get a pure sample I do not know the retention time of pure Cascaroside".

PM benefited from the involvement of the academic supervisor who was able to draw upon his experiences to furnish the knowledge creation process when the available resources (e.g., Cascaroside) did not meet expectations:

> "Now what you can do is as the different compounds come out of the [HPLC] column you can separate them, you can then use a

> Mass Spectrometer. What it does is it effectively blows the compound to pieces and then it measures using electromagnets the amount of positive and negative compounds and it will give you a likelihood of the compound being either X, Y or Z. So it is just an extra tool to try and help out to determine what the compounds are" (PM).

The information obtained using the Mass Spectrometer (*1.2.97 – 28.2.97*, figure 7.3.2) did not provide conclusive evidence because PM still did not know which reading was the Cascaroside. Difficulty with identifying its structure resulted in PM (once again with the advice of his academic supervisor) trying to identify the *location* of the active compound within the sample (the bark). If PM could determine this then he could remove unwanted compounds pre-analysis thereby improving his chances of finding the correct fingerprint. PM used a microscope and Malvern Particle Sizer (*1.2.97 – 28.2.97*, figure 7.3.2):

> "We wanted to determine where the active compounds were in the Cascara, whether they were part of the cell wall, inside the cellular part of the material or the extra cellular material, part of the dead material. So what we wanted to do is have a look at the detail of the particles to see if I could determine which bits were active. The other thing was that if I could determine the size of the particles and then extract them I could see which particles abstracted better. And then go back and see is it just because of the size of the particles or is it because the cell structures are being broken up" (PM).

These experiments provided insight into the development of the analytical methods while the work on particle size offered data that was used to improve other aspects of the production process (grinding). On this occasion work on task 8, although incomplete or partial, could be used (task 5) to transform the existing production process (reciprocation of chronological codes). PM not only considered grinding he also looked at extraction and drying protocols using this data to optimise the process:

> "What he is doing is look at three operations: the grinding operation, the extraction and the drying. Look at them individually and then combine them or re-combine them back into the production line and see if there is an improvement in the overall economics of that process?" (academic supervisor).

Any improvement in the economics of the process (including grinding, extraction and drying protocols) was viewed as a legitimate activity even though they were not supported by quality tests using chemical analysis. To this end HPLC was still key to optimising mechanical improvements. PM tried other experiments to measure retention times including monitoring the retention time of a related compound to try and 'guess' the Cascaorsides flow rate:

> "I was having problems with the Cascara because it contains at least 40 different compounds. So what I decided to do was go and do something simple to check it. So what I would have done was made up a standard solution and put in small amount of another compound that I knew the retention time of and just a general characteristic as long as it was similar to Cascaroside, then I could use it to work out the differences" (PM).

Although these results, obtained at A-Uni gave PM an *idea* of the retention time of the Cascaroside this work remained inconclusive. At the same time as working on task 8 PM also assessed (task 4) the production process:

> "In order to go forward in any area you need to know where you are now so the whole idea behind it was so that I could go and look at the process understand how it works why it works and its function" (PM).

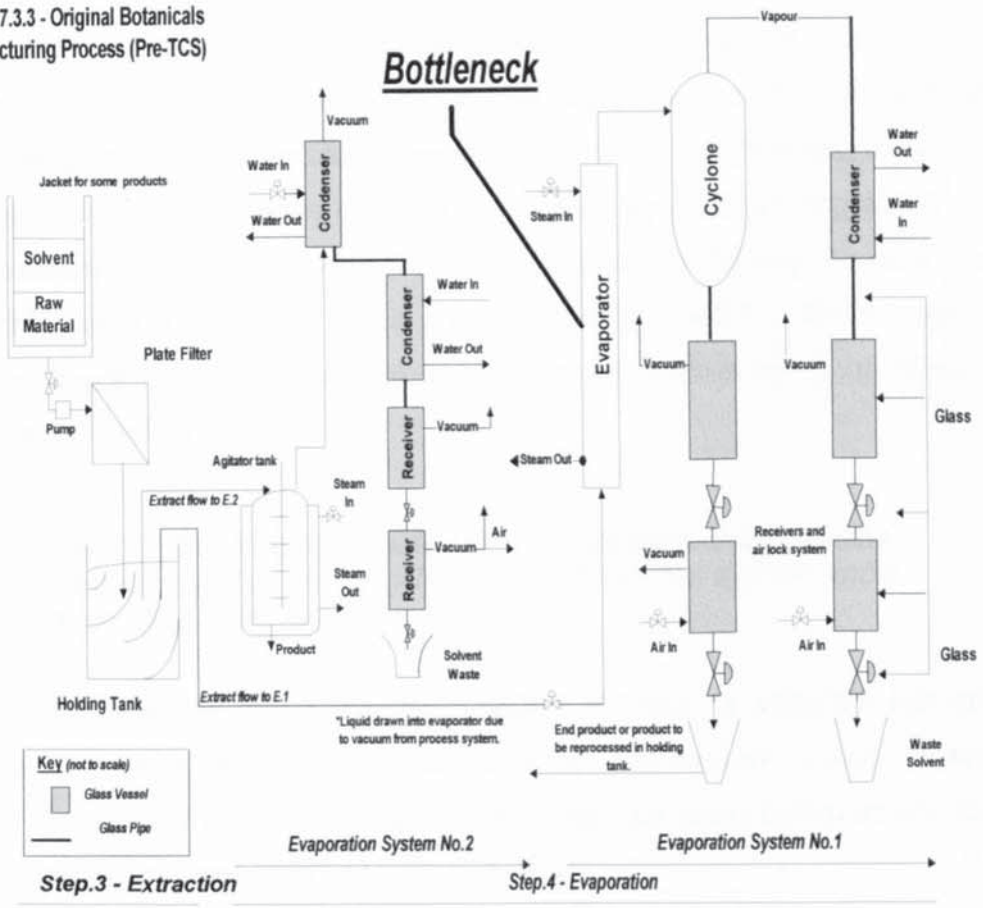
Operationally this task provided an opportunity for PM to identify any bottlenecks in the existing process, which could be designed out at a later stage (task 5):

> "It's like a motorway if you have got three lanes of traffic and they cut down to one lane you get a bottleneck because you can't process the cars quickly. So it's very much the same with any process in the chemical industry if you can produce a huge volume to start of with but the second stage is very slow there is no point producing the huge volume in the first place. You can only go as fast as the slowest part of the process" (PM).

For example, the evaporator was identified as a significant bottleneck (figure 7.3.3) a finding corroborated by TD the senior botanicals' technologist:

> "He recognised straight away...[there was]...a bottleneck...[in] ...the rate at which we can remove solvent from our extracts...it is the evaporators that hold up the botanicals at the moment."

Figure 7.3.3 - Original Botanicals Manufacturing Process (Pre-TCS)



The deliverables from these tasks included full design specifications of the *existing* processes and operating procedures (including safety standards) for extraction and evaporation. This confirmed the existing zones of manoeuvre and provided the technical details to identify the key parameters of the process including the chemical and physical characteristics of the botanicals (PM):

> "Because of the nature of the process it needs to be generic. A lot of the ideas are ruled out fairly quickly because they are very specific and you can see how they work for one product but then you can see how they would never work for another product."

Radical change was also anticipated in the formulation of new end products (task 6) – tablet making. Specifying the new formulations also influenced the evaluation of potentially new production processes (task 7):

> "In order to produce a product that falls into this specification you need to do particular parts of the process...so they go hand-in-hand you define what you want to produce before you define how you are going to produce it" (PM).

By the third month (*1.3.97 – 31.3.97* figure 7.3.2), Alpha took delivery of an old HPLC machine (Waters). Although it was useful for PM to have a machine on-site this advantage was tempered by its unreliability. As it was often inoperative and repair was difficult (PM was left to sought out any failures) PM was forced to use less sophisticated methods including TLC (thin layer chromatography)[8] to try and measure the retention times of active compounds. During the next two months PM used TLC estimate which drying methods (*1.4.97 – 30.6.97*, spray or vacuum - figure 7.3.2) were *more* likely to destroy the active compounds in an extract called Coltsfoot:

> "Thin layer chromatography was used to compare the products, their composition. So I knew what was in them *but did not know how much*" (PM – *my italics*).

As an interim measure these results provided PM with a valuable but still incomplete indication of the characteristics of compounds under certain conditions. To provide unequivocal results that could be used commercially still relied on the development of HPLC based methods:

> "The TLC method used provided a good indication that degradation in the spray drier did not occur, but this needs to be confirmed by liquid chromatography methods" (PhD qualifying report, p23).

By the fourth month of the project PM had been able to concentrate on these tasks without any interruption from events within or outside the firm. To this end, the work on phase 1 and 2 had begun to be used to inform decisions about the best drying methods. Further developments were needed if the work on phase 1 was to be properly evaluated using the analytical methods.

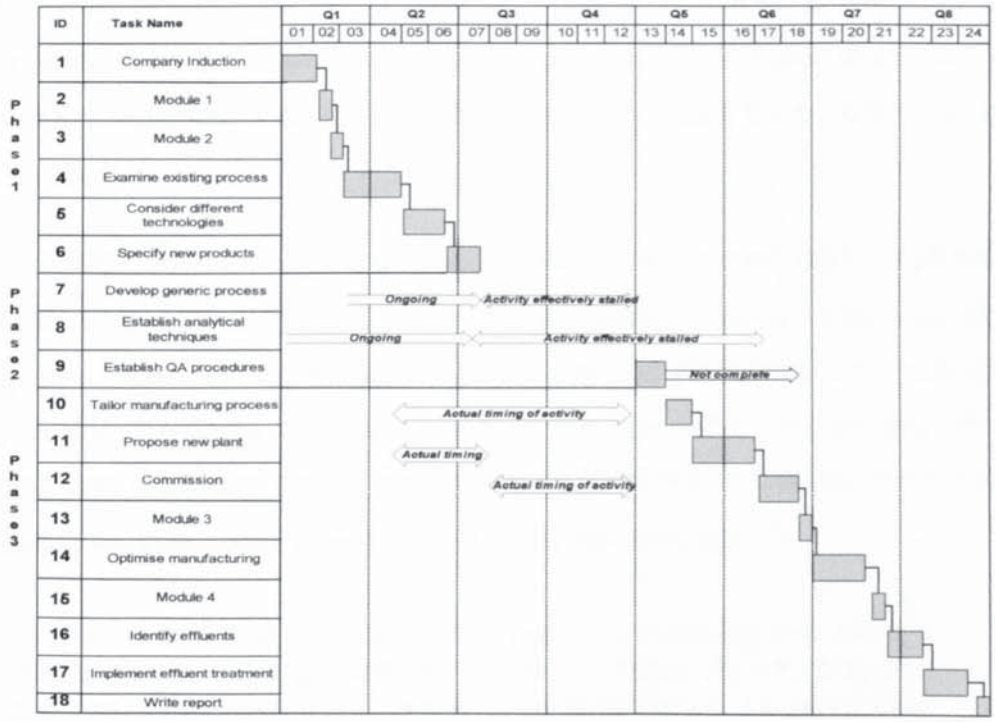
7.3.3 Slippage: suspension in the process

On the occasion when a task involves unanticipated difficulties synchronisation can become increasingly precarious. Control over the innovation process is not

[8] It is significant PM did not return to A-Uni to continue the experimentation but as this coincided with the decision to move flavours PM's ability to work on task 7 was increasingly curtailed.

only linked to the locale of the individual by virtue of the separations between participants it also relies on the means of disseminating available knowledge which includes translating tasks into activity systems. In this sense, turning an idea into reality, no matter how well defined, can be difficult if it relies on processes that have to be developed (e.g., HPLC methods for botanicals).

Figure 7.3.4 - The reconfiguration of Phase 3 of Alpha's Programme



Before the "critical moments" (figure 7.3.2) developing the analytical methods was a key programme objective. Certainly, PM with the aid of his academic and industrial supervisor's had been trying to ensure this at both A-Uni and the Alpha site:

> "The aim was to establish a quantitative method to have a very detailed specification of the product that one has obtained through the abstraction process. What they don't currently have is a detailed quantitative method to say we started with 80% of the total extract, we have gone from that to 50%; they can't do that now. The HPLC method would give them a very precise indication of how the processes are behaving and then one can change the process to optimise the extraction" (SG – academic supervisor).

At this time botanicals were a small-scale operation with Alpha's main income being generated through the production of flavours. However, in April 1997 this was to change as Alpha Group decided to move flavour production to its main site. This decision was to leave the Alpha site reliant on botanicals production for its survival thus radically re-structuring Alpha's organisational repertoire. It is no coincidence that as flavours moved from the Alpha site, PM began phase 3. Not only was phase 3 out of synchronisation with the other codes it was to be undertaken without the benefit of data provided in phase 2. Developing the HPLC method not only depended on operational equipment it also depended on the site being financially viable. When this was undermined the programme was placed in equal jeopardy (figure 7.3.4).

As of April 1997, PM had started all three phases which meant work on phase 3 was ahead of time and PM had been diverted away from his analytical work (task 8). The decision to bring phase 3 forward and to place task 8 on hold (i.e., coping strategy) reflects a convergence of interdependencies around which translation was organised and by implication undermined the validity of the belief chains taken as knowledge about certain tasks including task 8:

> "It is important that you have some basis for installing that plant, I mean what are the grounds on which you have chosen that and not that? Given that they have *already established the plant then obviously the analytical methods are not a high priority issue for them*" (*my italics*).

Deeper processes mediated the actions of programme members including the institutional logic's associated with the pre-existing balance of activities (flavour production). Once it became apparent that flavours production was being moved conducting research and development into botanicals was called into question. The validity of the belief chains were no longer judged on their intrinsic value or medium term economic return rather contradictions began to emerge around the tasks given the commercial state. Dysfunctionalities or asymmetries of power prevailed as the operational imperatives shifted toward the rapid scale-up of botanical's production. Hence, following this first critical moment, decisions about the programme reflected the discourses about Alpha's operational

integrity not the strategic intent of the programme. PM described the situation following the relocation of flavours as one of trying to match three themes:

1) Scale-up as quickly as possible,
2) Radically alter the existing production process and
3) Provide the means for him to submit sufficient results for a PhD.

What had been complementary objectives (business and academic) became confused. Having to scale-up the facility meant time and resources were taken from the developmental work (phase 2) not to mention his academic studies. The project was effectively compressed and although PM continued to work on phase 1 and 2 from April until the summer the majority of his efforts went into designing and procuring the scaled-up facility. By the end of September 97 PM had effectively installed the scaled-up facility after which it was envisaged he would again develop the HPLC methods and establish the necessary quality assurance systems. As it was, Alpha Group's management decided to return flavours production to the Alpha site following the failure to successfully integrate these activities at the main site:

> "The aim is to have full flavour production by the middle of March [1998] which is quite tough, and then consider ourselves operational by April, to start producing...*so the botanicals project has taken a serious back seat*" (PM – *my italics*).

Relocation was an arduous task, which occupied much of PM's time in the intervening period (November '97 – March '98):

> "In October 1997 we were told that flavour development, the flavour development lab would be moved down here and in November, December we were told to prepare for all the flavour production to be moved down here between January and March 1998. That, in fact was accomplished by moving about 200 pallets of raw materials, flavour compounding down here in the first two weeks of March... Paul was involved in whatever was going on" (TD – industrial supervisor).

PM's academic supervisor corroborated this view:

> "...that was the plan [look at HPLC] and that should have gone on until the end of December middle of January. But that is when he [PM] *got diverted across to the engineering work and really there was nothing he*...I don't think, I can't really give a concrete statement for him I think it had nothing directly to do with the Programme there were other related work" (*my italics*).

This second critical moment was to affect how the "new" botanicals facility, which had just been installed (June – September '97), would be used:

> "The newly purchased facilities were specifically designed for botanical production. This was the main thing that [Alpha] was going to produce [since flavours had been moved the first time]. Now with the reintroduction of flavours all flavour production is taking place in that new production facility. The one that was designed for the botanicals is now being used for botanicals *and* flavourings" (PM – *my italics*).

These events (*April, 1997; October 1997 - March 1998*) precipitated further strictures in the programme. With the decision to move flavours the organising principles of the programme continued to be supplanted by the immediate concerns of the site's survival. This had first resulted in the premature start to phase 3 it subsequently resulted in abandoning of botanical's production on a larger commercial scale and reflects a complex simultaneous equation of interdependencies associated with:

a) "Dislocation" of flavours from the Alpha site;
b) "Slow" progress towards developing HPLC methods;
c) "Premature" start to phase 3;
d) "Re-appropriation" of flavours production.

In relation to (a) the movement of flavours precipitated the industrial supervisors decision to re-define the chronology and nature of tasks. With the change in emphasis came a reduction in mutual benefit. The early commencement of (c) reinforced the commercially orientated perspective i.e., developing HPLC was not essential for scaling-up the botanicals process. The project was further undermined by decisions to re-appropriate flavours (d). Until the dislocation of flavours PM's main responsibility had been the project

but following this his actions were defined, in line with the re-appropriation of flavours, pre-existing institutional logic's informing organisational reproduction.

Figure 7.3.5 - The Organisational Repertoire at Alpha

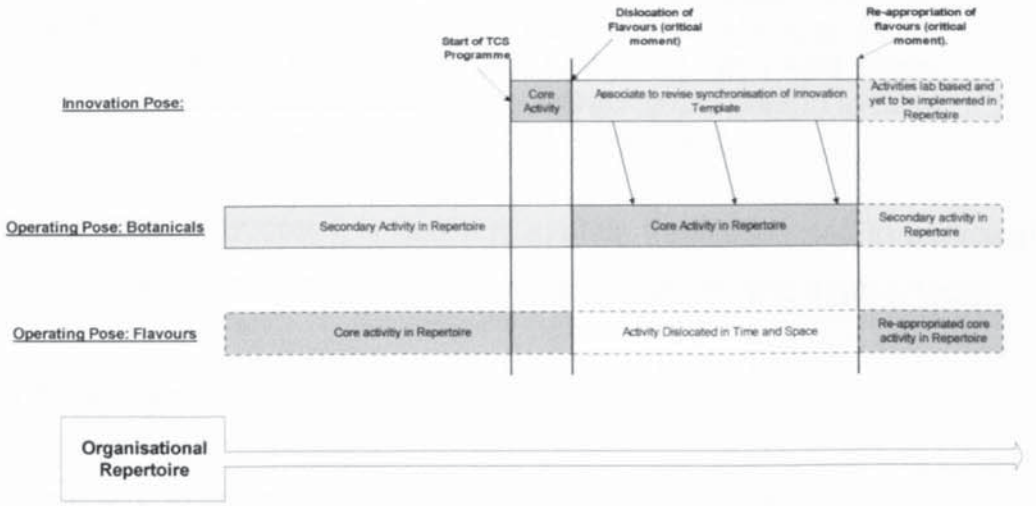


Figure 7.3.5 illustrates how re-structuring Alpha's organisational repertoire had been all but curtailed by the end of 1997 and pre-existing logics re-gained currency in the intervening period:

> "I think because [PA – industrial supervisor] now has [flavours] back on site, [botanicals] will pretty much cease to be produced or researched in anyway apart from what I do. Because HPLC is not essential for [flavour] work, and because I think [PA] sees 95% of products being [flavours], what is the point in developing a very expensive analytical process or even buying a new HPLC when you are not going to use it very much? But my perception of it is because [PA] sees the site as a [flavours] production site primarily it is not an essential piece of kit" (PM).

Following the return of flavours PM stopped his work on HPLC. Although, for PM the question was not *whether* but *when* HPLC would be available this decision had effectively been taken out of his control. The final eight months (May – December 98) were spent in the lab at A-Uni working on extraction protocols and developing percolation methods to replace the original maceration process (soaking extract). Knowledge creation is as much a political as a mechanical process, it is the terrain on which specific rules and rewards are negotiated.

As it was, this was not an equitable process in so far as certain interpretations dominated:

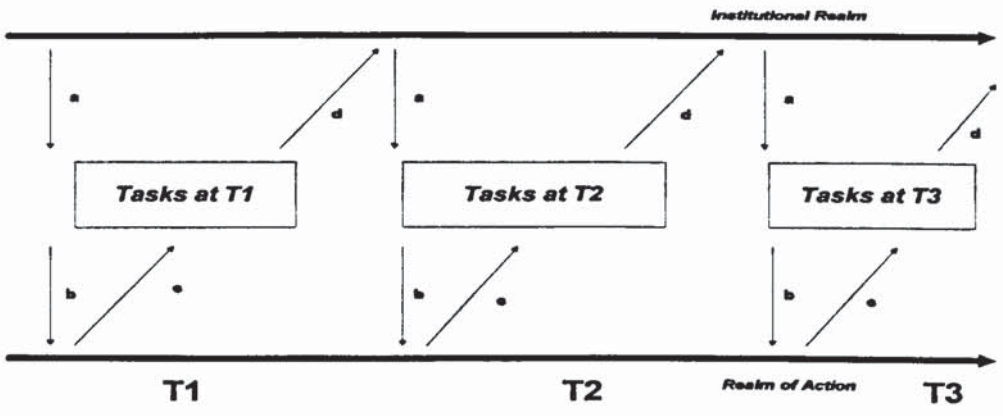
> "Where a weakness can be identified perhaps is if A-Uni was saying, and [NS – senior academic] was very keen for the HPLC. If we had been working properly as a team that should have been identified in the sense that okay you can't do it here [Alpha] we will do it there [A-Uni]. It was never that tightly knit...*as I said earlier [PM] would have had to been a very extraordinary person to have been able to come out above it all*" (TD – *my italics*).

To understand these events it is useful to explain translation and in particular the process through which tasks are interpreted, enacted and appropriated.

7.3.4 The process of translation

Figure 7.3.6 is a simplistic representation of translation. Arrow (a) represents the interpretation of a task before enactment. Here, the task represents a set of substantive codes of conduct that have yet to be enacted. Only at arrow (b) when the task is enacted will the various bundles of knowledge be brought together. Enactment is neither guaranteed nor necessarily continuous. Arrow (c) represents the moment when the task is completed and the subsequent embodiments are drawn upon. Only at (d) is appropriation achieved and even then it may only be partial or temporary.

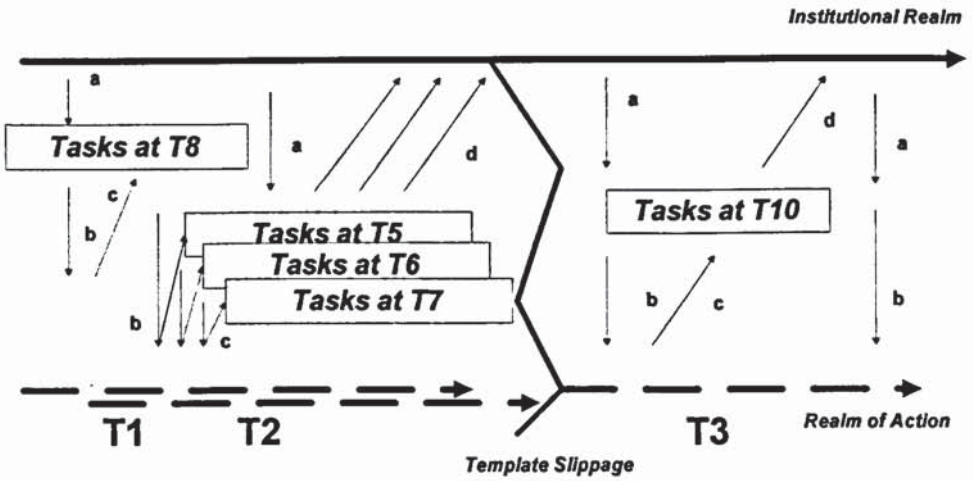
Figure 7.3.6 - A model of the instantiation



Adapted from Barley and Tolbert, (1997:101)

The temporality of tasks is shown as T1, T2 and T3. It is at such points that the existing zones of manoeuvre are revised or as at Alpha perhaps only made temporarily dormant. Translation may be temporary or partial because the validity of tasks is continually being scrutinised by programme members.

Figure 7.3.7 - Dislocation and translation at Alpha



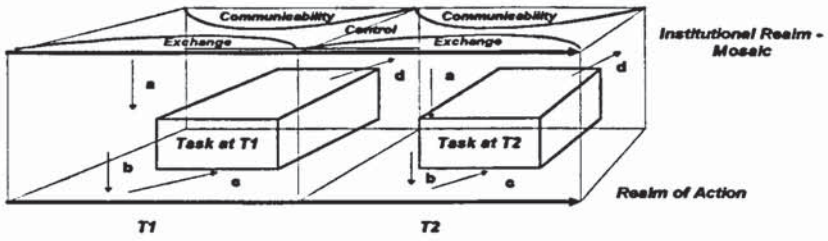
Adapted from Barley and Tolbert, (1997:101)

Translation is not a one-way process instead the enactment of tasks occurs alongside other operational activities. Put another way, the institutional realm "wraps" action so that actions are in context at all times. This perspective of the knowledge creation process is described in relation to task 8, *the creation of analytical methods*. This task embodied a key element of the programme yet it also specified how these competencies would be achieved (arrow a). In particular it confirmed that the new production process would be based on the chemical fingerprint of each compound. Finding the fingerprints was neither smooth nor continuous because of the problems with the HPLC machine and the limitations of TLC (arrow b). In addition, the discourse – *to deliver reliable and efficient chemical and analytical techniques which add value to marketing by enhancing quality assurance and customer confidence* – was undermined by issues in the institutional realm linked to existing practices. A characteristic

of slippage at Alpha was the premature start of associated tasks. In this instance, resources were diverted from completing task 8 and used (physical and intellectual – the Associate) to start task 10 in phase 3. That said, the information generated from task 8 was used in tasks 5, 6 and 7 (arrow c) which although reduced enabled the development of new competencies such as grinding (arrow d) (figure 7.3.7).

As illustrated in figure 7.3.7, programme members can work on a range of chronological codes at any one time during which time the results emerging from one code is used to inform activities in another code. At Alpha, slippage reflected in part the curtailment of outputs from specific tasks (e.g., task 8) in relation to other tasks (e.g., 5, 6, 7) in the same chronological code as well as commencement of other codes (e.g., task 10) ahead of time and without the anticipated level of knowledge to optimise decisions. In other words, task 10 completed ahead of time with little in the way of any substantive changes to the botanical's production process.

Figure 7.3.8 - Translation and programmes



For the purpose of explicating duality it is proposed that the enactment of tasks (realm of action) embodies properties emanating from the institutional realm. Tasks may be constructed for a specific purpose but translation cannot be separated from the repertoire of mediations simultaneously enabling and constraining social reproduction. Translation involves the establishment of specific social and economic relationships and the bestowing of social and

economic rewards that are defined and legitimised during such activities. In this way, slippage at Alpha involved the emergence of different meaning systems in relation to these social and economic rewards (contradictions) and in particular the redefinition of relations and rewards (dysfunctionality). In this case, slippage relates to the different ways knowledge can be distributed and valued in changing social contexts.

Using the terms developed by Scarbrough (1996) the translation of tasks depends on the convergence of processes linked to social control, economic exchange and communicability (figure 7.3.8). These processes reflect deeper mechanisms described earlier in terms of the nature of coping strategies (chapter six). The appropriation of tasks (moving from arrow a – d) is not simultaneous rather as described with reference to task 8 it involves multiple activities not simply linked to knowledge creation (i.e., communicability) but including social control and economic exchange. At Alpha, social control or the leading role of the industrial supervisor in ensuring the botanicals plant was scaled–up as quickly as possible and then reduced when flavours was returned demonstrates the significant separations between programme members. Although TCS programmes are premised on the idea of equitable relations the separations demonstrated at Alpha confirms that the exercise of control relies on pre-existing socio-economic arrangements. In this case, the viability of the site in relation to flavours production.

The shift from a hostage strategy too a prisoner strategy is a demonstration of the complex mediations in the institutional realm. Critical moments mark those situations when the social shaping of translation involved changes to existing interests, rewards and relationships within and without the programme. Such processes illustrate differences in the separations between participants by virtue of their location and the nature of the discourses associated with the institutional realm. The validity of the belief chains taken as knowledge is not only tied to these organisational understandings they are also entwined in the practical arrangements of converting knowledge. At Alpha, these issues were

played out in relation to slippage, dysfunctionality and contradictions among programme members.

7.4 The Beta Case Study

The construction, communication and exchange of knowledge at Beta relied on similar processes to those at Alpha. The enactment of tasks involved programme members unpacking tasks and then implementing new processes and technical knowledge. Although the outcomes of the interdependencies mediating change at Beta are different to those at Alpha they still constitute commonalities in terms of empirical tendencies. Instead of translation being curtailed by the dislocation of social relations, an unintended consequence of problems within the firm, such events proved a key event in the maintenance of the programme at which point new alliances were created.

7.4.1 Beta as context – zones of manoeuvre

As with the Associate at Alpha, Beta's Associate (hereinafter "PB") began by considering the pre-existing zones of manoeuvre. From this, it soon became apparent the organisational repertoire was a loose fusion of ad hoc practices:

> "Determine the sophistication of current system of evaluating supplier performance? There is not one - is that alright - there is not one" (PB).

The absence of any formal procedures or protocols was organisation-wide. To this end, Beta's Commercial Director, industrial supervisor and champion of the TCS programme (hereinafter "SR") saw the programme as one component of a broader attempt to re-configure Beta's operational practices:

> "I joined the company in November 1995. I brought my company into [Beta], which is the accessory side of the business and effectively the business doubled with the addition of my company. [Beta] didn't, if I'm blunt, know really any of the professional administrative routines and procedures, which you would expect to find in a business of that sort of size. It was run very much as that of a cottage industry...The Company had grown under the control of [JS] the Managing Director who started the company off.

> But he is not an administrator by (laughs) any stretch of the imagination and the company was run almost entirely on day-to-day decisions. Most of the sort of key commercial information was locked up in [JS's] head and as a consequence the company was operating with six or seven staff who were working in the driest isolated pockets. They couldn't make a decision without referring to [JS] and as a consequence, if he was not here nothing would happen. Couple that with the fact that there were no real systems for recording and regurgitating information efficiently – it meant the whole operation was inefficient, very low morale people had reached a stage where they would not accept responsibility and were not offered it."

He went onto say:

> "I mean it was a pretty awful mess, virtually everything done on the back of a fag packet with a computer system which had been staggering along, some Australian software. It was actually quite a sophisticated system but it had been ill managed over a period of time and regularly crashed and support was hopeless. That finally died in March 96. However we made the decision to move to a Pegasus system. There was nothing terribly scientific about it but we desperately needed a system and we knew it would work. Unfortunately, the original system was full of inaccuracies and old debts of outstanding invoices going back three or four years. So it was a fairly major exercise to get the system up and running"

For PB to change the way things had been run meant generating the data to drive the systems and a range of checks to ensure transparency in all that was done. At Beta, this had been conspicuous by its absence:

> "He [purchasing manager] was another person like [JS – the MD] who kept everything in his head and he kept all his purchase orders in a hand written book all of that sort of thing which you would have expected to have available on the computer system wasn't. If Brian wasn't here then you just couldn't find out what was going on" (SR – industrial supervisor).

As evidenced with the purchase of the Pegasus system SR had begun, prior to the start of the programme, to improve Beta's operations which included employing a new Marketing Director. By his actions, SR was building a critical mass around which change could be organised. Creating this critical mass was essential to the broad strategy as there was considerable resistance to change from within the firm:

> "It made a huge difference to have somebody of a like mind [the Marketing Director], all throughout that period, um I was effectively fighting against [JS – the MD] who couldn't really understand the need for change and didn't want to change. It made it very difficult, what I saw is from previous experience in business as this logical and sensible and straightforward um every time you try to do anything significant [the MD] would need to be convinced in the necessity of doing it, particularly if it was something that would cost" (SR – Industrial supervisor).

Implementing tasks involved minimal revisions to the existing practices, as they were albeit non-existent. Instead, changing Beta's management ethos such as the centralisation of management control around the MD was more likely to curtail the modernisation of Beta's operations. At Beta, the innovation process was embedded within a broad process where issues of control had unintended consequences for the programme and translation. These issues generated contradictions within the programme although they did not result in slippage. To explain why slippage did <u>not</u> happen means considering the coping strategies in relation to the contradictions that emerged from these broad processes.

7.4.2 Contradiction and fragmentation: coping strategies

At the time the programme was designed it was agreed the Associate should work with the purchasing manager. However, just before PB was recruited Beta's management decided to make the purchasing manager redundant:

> "The original idea was that they were looking for the project to go ahead with an Associate with all the benefits and hopefully someone they would get on with whom they would probably offer a post to as the purchasing manager. I think the original idea was it to be 18 months down the road. They then suddenly came in and said as we started the interviews, oh by the way, the purchasing manager is going. I don't think that is true I think he had gone and they did not have much intention of replacing him. Which then put this problem on that we had got a programme going which was going to be difficult really to keep on line and fill the requirements of the host company without being a big issue" (GB – academic supervisor).

Understanding why the purchasing manager was made redundant before the start gives an indication of the industrial supervisor's intent. The removal of

certain personnel was seen as essential if change was to be achieved:

> "He [the purchasing manager] was a creature that couldn't wouldn't, didn't want to change his spots and, it was incredibly frustrating" (SR – industrial supervisor).

A capable graduate would better serve the future of Beta's purchasing and inventory function. Unfortunately, removing the purchasing manager created unforeseen problems. Not only did it result in the gradual deterioration of the purchasing operation prior to the start of the programme it also meant the Associate was without a company-based mentor. Originally, the day-to-day purchasing decisions were to be the responsibility of the existing purchasing manager. As it was, these decisions and the programme were left to the Associate who was in her own words a "purchasing virgin".

Because purchasing had been unmanaged for such a long period PB's first task was to resolve the outstanding delivery and dispatch issues. Not only did she have to learn the job "on-the-hoof" it created tensions in the programme:

> "[SR - industrial supervisor] was aware that I was not getting enough time for [the project]. I spoke to [GB - academic supervisor] and said look I am not getting enough time for this - we came to the conclusion that two afternoons a week would be enough to start us off" (PB).

Tensions between the programme and purchasing were the key contradiction from the start of the programme. This meant the Associate's responsibilities were held in an uneasy state of tension:

> "From a small companies point of view she is there [PB] as an employee and I think inevitably because part of the buying side is so important our focus is on getting day-to-day things done. Great, we want these additional skills and routines brought into the business but it is very much secondary to having 100,000 wipes here for nine O' clock in the morning to meeting a customers order. And, I think fundamentally the twain will never meet in a small business like this. In a much larger company maybe so you can more easily designate periods of time for doing one part of the job as opposed to another. Here it is driven by fire station management quite often, I tried with [PB] early on to set-aside two afternoons a week and it just snowballed, she did not apply

> discipline to do it and as it eroded we just steamrolled over it" (SR – industrial supervisor).

Such comments provide important insight into the way the industrial supervisor saw the programme and the role and responsibilities of the Associate. Although the programme complimented his aim to improve the way purchasing had been conducted there were tensions between the implementation of tasks and the pressure of meeting orders. Ideally appropriation would enable management to improve scheduling and deliveries i.e., task 9 – *high quality single source supply chain*, yet with the Associate fire fighting she had little chance to devote the recommended time to these tasks. An *interpretative gap* or contradiction emerged as the Associate endeavoured to fulfil the industrial supervisor's expectations:

> "I feel that one party is swaying me off, if that makes sense [referring to the industrial supervisor]? It's working out who I answer to because at the end of the day I am employed to do this programme and I have got to do it within the two years" (PB - Associate).

I went onto ask her:

> "So who do you think you answer to?"

She replied:

> "You tell me, I am working in a company as their purchasing manager and being employed by the university to do this programme. At the end of the two years it's not going to be the university who is going to be giving me a job it could potentially be [Beta]. Do I carry on working in [Beta] as their purchasing manager and completely disregard the programme which I am actually employed to do or do I completely disregard the purchasing of the company who could potentially employ me and where I am based to do this programme? I mean theoretically the firm should have this programme as their number one priority and give me the support and time-off that I need. But that is not happening in the short term".

The Associate was aware her main responsibilities should have been with the programme. However, day-to-day purchasing issues displaced these concerns

as the industrial supervisor levered their position of authority and emphasised the Associate's obligations to the programme's host. This was accentuated as it became apparent the Associate was failing to meet the industrial supervisor's expectations. It also became apparent that the industrial supervisor also had concerns over the academic supervisor's involvement:

> "[SR – industrial supervisor] did feel that [Beta] were not receiving sufficient support from the University, as a visit had not been received from the Academic Supervisor for some weeks" (LMC1 – 7th Nov '97, minutes p4).

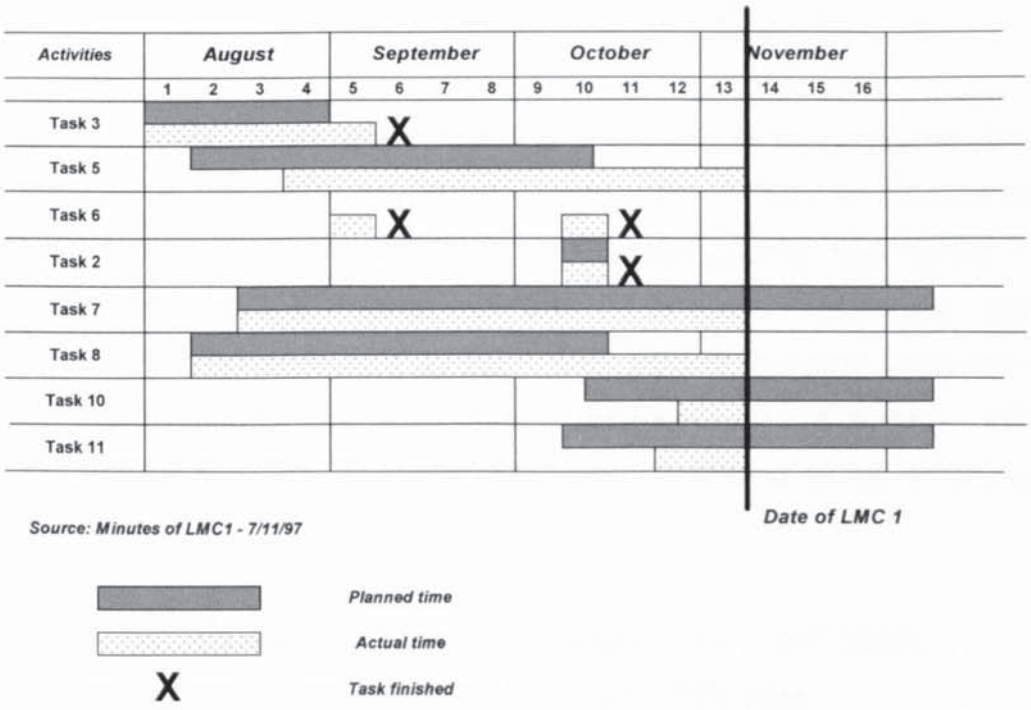
A link existed between the industrial supervisor's concern to increase the level of academic support and improve the Associate's lack of commercial awareness. This reflects a reinterpretation of objectives with the industrial supervisor expecting the academic not only to give assistance on *project* matters as defined in the programme but to *also* advice on day-to-day *purchasing* decisions. Issues arising from operational difficulties increasingly mediated the interpretation of the Associates day-to-day activities. Coinciding with these issues the industrial supervisor was met with increased resistance from within Beta. This became apparent as early as the first LMC meeting three months into the programme. At this meeting, the industrial supervisor with the support of the consultant and head of the Business School instructed to academic supervisor to provide greater assistance. It was agreed they should visit the Associate more frequently, code for involvement on day-to-day purchasing decisions and attend the monthly marketing and production meetings. As it turned out, not only was the academic reluctant to become more involved but the Managing Director proved resistance to their greater involvement:

> "I have been pushing [the academic] to come [to the marketing and production meetings] and [JS the MD] sat there and said I don't want him, I don't want him coming this week. I've said how about next week? No I don't want him to..." (PB - Associate).

This was typical of the Managing Director's skepticism of not only the role of the academic but also of the objectives of the commercial director (industrial supervisor) generally. The MD was particularly reluctant to change the way

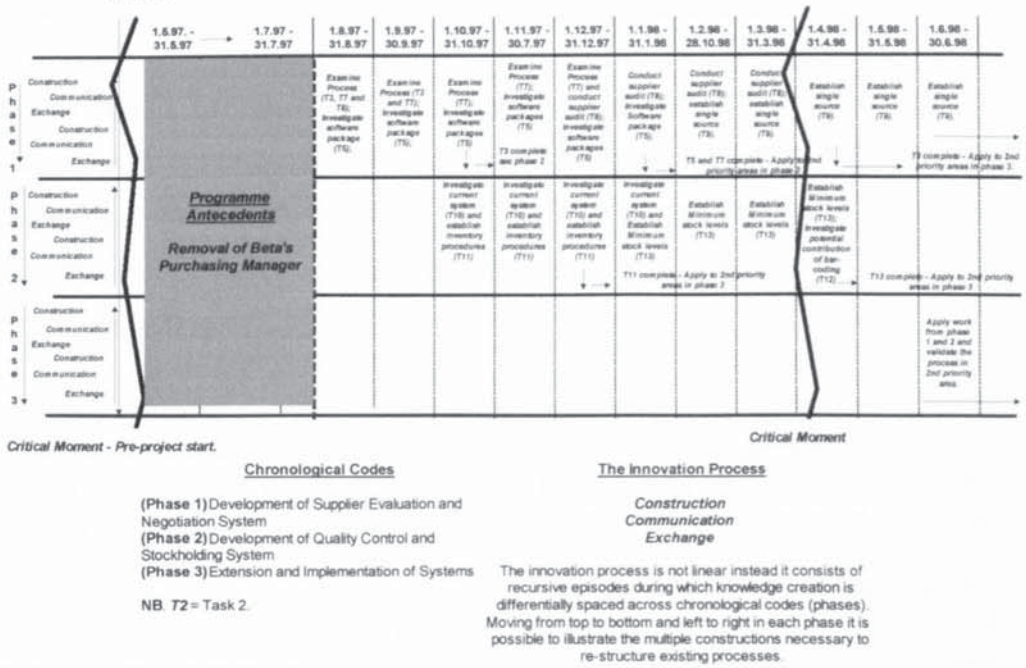
the firm had been run, as it would result in the devolving his authority to others in the firm. It is perhaps surprising then that in spite of these contradictions the Associate was able to report progress (figure 7.4.1). The Associate had been successful in attending to many of the early tasks not only because they were straightforward (e.g., documenting existing practices was easy because there were no formal systems) but also because the tasks complimented the firm's need to change purchasing and inventory control. Communicability was not only practically trouble free but for the industrial supervisor the programme remained key to the continued success of the firm.

Figure 7.4.1 - LMC 1 progress chart



In this respect, the tasks provided value added and strategic advantages, for example, tasks 3 and 10 confirmed there were no formal purchasing systems while task 7 – *prototype monitoring system*, task 8 – *supplier audit* and task 11 – *establish stockholding* enabled cost savings and better supplier relations. That said, translation was marked by critical moments and contradictions (see figure 7.4.2).

Figure - 7.4.2 The Innovation Process at Beta



Chronological Codes

(**Phase 1**) Development of Supplier Evaluation and Negotiation System
(**Phase 2**) Development of Quality Control and Stockholding System
(**Phase 3**) Extension and Implementation of Systems

NB. **T2** = Task 2.

The Innovation Process

Construction
Communication
Exchange

The innovation process is not linear instead it consists of recursive episodes during which knowledge creation is differentially spaced across chronological codes (phases). Moving from top to bottom and left to right in each phase it is possible to illustrate the multiple constructions necessary to re-structure existing processes.

Slippage was avoided because translation was trouble free and because day-to-day purchasing was eventually brought under control. Both achievements reflect the adoption of specific coping strategies (see chapter six) related to the changing role of Beta's management and the academic supervisor. This shift in opinion and activities was by no means smooth because translation occurred against a backdrop of considerable resistance and uncertainty both within and without the firm. The key contradictions related to the following issues:

(i) The Associate's lack of commercial experience in *purchasing*;
(ii) The academic's *role* given the Associate's difficulties;
(iii) Organisational *resistance* – epitomised by the Managing Director.

Responsibilities were no longer defined in terms of the programme instead they were linked to the institutional understandings associated with Beta's re-structuring. Dysfunctionality among programme members emerged as issues around the role and responsibilities of the Associate and academic became contentious which was complicated by the actions of the Managing Director. In the period between the first and second LMC meetings (November 1997 –

March 1998) the industrial supervisor intensified his efforts to resolve all three issues and in doing so precipitated the second critical moment (figure 7.4.2).

Mid-way between the two LMC meetings the programme members agreed to meet for their *inaugurary* monthly project meeting. This was significant not only because it had taken them six months to arrange, but it also highlighted the industrial supervisor's overriding priorities at this time. I refer to my notes taken at the meeting:

> *SR asked PB to leave the room at this point. On leaving SR mentioned that 3i were making a substantial investment - effectively buying out the MD. SR hoped that this would happen by the end of February '98. SR thought change at [Beta] would not be possible without this change in the running/ownership of the company. SR also stated that if the MD did not go then he would leave. SR went onto to discuss his unhappiness with PB in her current position. He felt that she needs to do the job to the best of her ability and currently this had not been the case (re: purchasing). PB had made mistakes and had not acted in a professional manner. To assist PB, SR was employing a purchasing clerk. He also said that PB had been given a memo which had been designed to "bruise her" stating that if she did not improve she could be out.*

This discussion was significant for two reasons. First, it indicated the resistance shown by the original MD was soon to be resolved as evidenced in the joint buy-out with the venture capitalists 3i and secondly it demonstrated that the industrial supervisor still had doubts about the Associate's abilities. It was against this back-drop that key displacements emerged and alternative strategies were adopted. This change in circumstance is perhaps best described using the Associate's own comments:

> "[JS – the head of the business school] came in and informed me that [Beta] was not happy with the way progress was going and were willing to pay me my months notice. Okay, so in effect the University would like to keep their good name with the Teaching Company Directorate and if I go quietly we will say no more about it. So in a way it could have been deemed blackmail. If you go quietly we will not go through the normal disciplinary procedures. [the head of the Business School] explained to me that I had one of two options, I could jump thereby getting out within the six months, I think it was the 31st January, and you know there would not be any bad feelings towards me. Or I could stay put and bury my head in the sand and receive formal disciplinary proceedings.

> It could take up to six weeks to get rid of me but if the University were asked for a reference it would be noted. I said get out, I have spoken two words to him since" (PB - Associate).

These actions were the more remarkable because they were instigated not because of problems with "programme" but because of circumstances beyond the control of the academics. Referring to the recollections of the academic supervisor their motivations lay in part with the concerns of Beta's management:

> "After that meeting I spoke to [JS – the head of the Business School] and we went back to speak to the two of them [SR and DS the Marketing Director] about [the Associate] because we were very concerned. One we were getting to six months, and after six months it is very difficult to replace the Associate you have gone over the period and in fact we were six months and ten days. We had a meeting with them and came out and saw [the Associate] and said we were probably going to have to let her go or if she really wanted she could hand her notice in. Then I saw her personally had a long talk and said what the problems were, because we got to the point that we asked whether is there any point, you clearly are not getting on with it...[the marketing director] said if he had his way if she had been working for them she would have been out two months ago" (GB – academic supervisor).

The decision to pull-the-plug may have had something to do with the academics concerns with jeopardising future participation in TCS yet by giving PB a clear ultimatum was to have unintended consequences. As it was, the academic was surprised to learn that the Associate had persuaded Beta's management to re-consider the ultimatum. The Associate's perception of these events is crucial. As far as she was concerned the industrial supervisor had no knowledge of the head of the Business School's intentions:

> "[SR] said he had spoken to [JS – head of the Business School] on the Monday and [JS] had given no indication that he was going to pull the plug. The first he knew about it was when Helen went up and said something to him. Basically he said he did not want me to go in that he felt that over the last six or seven months there had been progress. He understands that when I came into the company I had no experience but he feels that over the last six months I had shown to be capable of doing it, and basically would I go back to work this afternoon. This clouded my judgement of the University severely. I feel very let down in that I can't believe that it could be done so underhandedly" (PB).

For the Associate, the academics had shown themselves untrustworthy while the industrial supervisor had "clearly supported" her at a time of uncertainty. The impact of these events was not immediately apparent, for example at the second LMC (11/03/98) only three weeks after, nothing was said of what had happened. As far as the consultant was aware progress was being made and the project team were working together. However, in the weeks that followed there was a significant shift, not only was the Managing Directly successfully removed but the Associate began to develop a much closer working relationship with the industrial supervisor (now the new MD) and the Marketing Director (who had been her main critic). In the first instance, the MD's removal was quickly followed by significant investments at Beta:

> "There is so much change the business has taken off like you would not believe [there is a] much better atmosphere within the company. JS [the MD] was not interested in investing capital with regard to production he was quite willing to carry-on with the way things were and now I think in the last week they have signed off around £20,000 for new equipment so things like labelling machines, shrink rappers we are going through a process of redecorating the whole ware-house. I think a lot has come from 3i with regards to improvement it is just fantastic..." (PB - Associate).

What is more, Beta's management team began taking a more proactive role in assisting the Associate on day-to-day decision-making:

> "Within my purchasing role I have been given more responsibility in the people I am dealing with. I am spending a lot more time with [DS the Marketing Director] around new product development so I actually know what is happening before I am told about it..." (PB).

Unsurprisingly it is at this time the Associate expressed reservations about the state of the collaborative alliance and the role of the academic:

> "Although I am doing the work for the programme I am doing it less as an Associate less involved with the university which may be a downfall but then I have not had the motivation from the university, I have had it all from [Beta] and I have had all the input, the good feelings from the company..." (PB - Associate).

These events combined to change the dynamics of the programme with the academics becoming increasingly dislocated from translation. It was completely possible that the programme might have ceased at this point however due to the actions of the industrial supervisor the programme continued. The actions were radical with the academic being displaced from the decision-making process but this appears to have been seen as a calculated risk given the increasing role of other members of Beta's management team (e.g., the marketing director) as well as outside experts. For example, at the beginning of the programme the academic had made some recommendations about the type of management information system might use to support the new inventory and purchasing activities. These were subsequently ignored (following the critical moment) and fresh advice was sought from a further education college. It is telling that the architecture of the new purchasing system was acquired without direct dialogue with the academic especially as they had written a detailed report on the available systems. Where there was dialogue this had deteriorated to such an extent that the collaborative alliance had practically broken down. At the second and as it turned out last monthly meeting (summer 1998) evidence of the total breakdown in relations appeared. During a discussion on supplier relations the academic supervisor failed to respond to a question posed by the industrial supervisor. Without hesitation, the industrial supervisor enquired whether "we are keeping you awake?" Dislocation was not total as the Associate and academic continued to meet on a weekly basis throughout the remainder of the project. However, this had more to do with maintaining the project Gantt chart and providing the academic supervisor with data for academic papers than with "contributing" to the project.

7.4.3 Closing the Interpretative Gap: re-configuring the project team

Establishing and maintaining alliances relies on continued negotiation at which time individuals try to close the fields of interaction around their definitions. At Beta, the problems encountered by programme members did not originate from concerns with programme tasks rather they reflected broader issues of *organisational reproduction*. Translation occurred because management saw it as essential for the firm's future. This is not to say the academic supervisor saw

it any differently rather contradictions emerged from how this was to happen in the light of other uncertainties.

Slippage did not result from these contradictions because the validity of the belief systems taken as knowledge remained legitimate and because the means of disseminating knowledge was unproblematic. This is in contrast to the events and experiences at Alpha. However, the social and economic relationships and rewards emerging from translation were considerably more problematic and demonstrate in different ways the mediatory properties of the institutional realm during the innovation process. The separations between participants cannot be explained without reference to the decision to remove the purchasing manager or to treat the Associate as their replacement. Although these decisions did not constrain translation it was necessary to adopt coping strategies to ensure that the Associate was able to meet Beta's management's expectations.

The increasing involvement of the management team and outside experts gives a good indication that the means of disseminating available knowledge was not dependent on the academic. In this sense, the relative complexity of tasks at Beta was considerably less than at Alpha in as far as the success of tasks was not affected by uncertainty during communicability. In this respect, the nature of the discourses or the programme's logic was not compromised by uncertainties in the utility of certain tasks nor was it compromised by pre-existing institutional understandings as at Alpha. Instead, with the removal of the Managing Director the industrial supervisor was able to articulate the programme objectives without having to field objections from senior colleagues.

The Beta case study is valuable in showing how the generative mechanisms mediating strategic action can have differential outcomes to those reported at Alpha while still sharing common empirical tendencies.

7.5 The Innovation Process

This analysis has identified the core characteristics of the innovation process: communicability, social control and economic exchange. In both cases issues of communicability were discussed in terms of synchronising and translating tasks according to chronological and substantive codes. At the heart of this process is the re-configuration of existing zones of manoeuvre which is faithful with approaches that explore the social construction of knowledge:

> "To speak of the social construction of knowledge does not imply that particular social groups arbitrarily construct their own truths and beliefs. Knowledge is seen not as a choice but as a provisional accomplishment of social groups and social processes. It also involves attending to the wider social structures that shape these processes; the latter being a necessary corrective to the depiction of knowledge as free-floating facts or narratives. The social construction approach thus gives us a sense of the 'duality' of knowledge; that discrete bodies of knowledge are not defined simply in terms of their innate cause-effect propositions but are also related to, and validated by, a wider socially embedded structure of knowledge" (Scarbrough, 1996:32-33).

The translation of knowledge during the innovation process not only relates to the practicalities of creation it also relates to wider processes including the commodification and marketisation of academic expertise and work. The duality of knowledge is not only manifest in "market forces" it is embedded within the firm's zones of manoeuvre. If we consider the mediational affects of knowledge it is also necessary to assess how technological infrastructures and disciplinary knowledge mediate translation. Translation at Alpha was affected not only by the problem of communicability but also by commercial issues and concerns that lead to the programme no longer being judged on its intrinsic cause-effect propositions. This was exemplified with the return of flavours and the reinstatement of pre-defined configurations of embedded knowledge. At Beta, the situation was different because the pre-defined configurations were only loosely embedded within the organisational structure while resistance was removed following the management buy-out.

In this analysis the aim has been to develop and deploy an interactive process perspective of the innovation process. This depends on showing how translation depends on connections between social integration (practice) and system integration (structure). *Social integration* is reflected in the process of knowledge creation. In the case of *system integration* the same processes are tied to the structuring affects of the firms' zones of manoeuvre and its socio-economic context. The innovation configuration, constructed as it is of existing and newly associated bundles of knowledge (Clark and Staunton, 1989), is continually negotiated its trajectory always susceptible to change via what are sometimes unintended consequences. Slippage reflects disjunctures in social integration which is a measure of social accomplishment and the relations and rewards established during the innovation process. In this respect, knowledge creation was explored in terms of the rolling-out tasks where each set of tasks or chronological codes reflected a specific group of rules and resources that were instantiated in relation to existing social structures and relations.

The empirical tendencies constitute the rules and resources drawn upon by programme participants during the innovation process. As demonstrated, with the discussion of contradiction, dysfunctionlity and slippage the mediating properties of tasks are continually in flux according to the configuration of interdependencies through which social practice is negotiated. In different ways and in different combinations issues associated with communicability, social control and economic exchange impact the trajectory or organisational innovation. Given these findings it is perhaps worthwhile locating these issues in relation to the constituent elements of the innovation process - invention, diffusion and implementation.

According to Bijker (1987:182), a theory of *invention* should provide some order to the "chaos of artefacts, relevant social groups, technological frames, and variation, selection and stabilisation processes" accompanying the design of *technical artefacts.* It is apparent from the analysis that the invention phase was not easily closed while the innovation configuration included technical artefacts *and* social processes. The interpretation of tasks did not remain stable because of the empirical tendencies discussed above. To this end, the construction and

communication of knowledge was inextricably linked to the *closure mechanisms* adopted by agents to justify one "technical frame" at the expense of another. Here we see a shift of strategies from the original hostage strategy based on mutual value and benefit to prisoner type strategies as agents closed translation around a revised notion of change. Incumbent of such shifts were issues of communicability and the deployment of resources in ways that *enrolled* agents or *dislocated* them from the innovation process. It is because tasks are enacted alongside day-to-day activities within the firm that slippage is so closely linked to socio-economic interactions at the level of the firm.

These interdependencies not only reflected mediations within the firm they also demonstrated wider socially embedded structures that transform the bundles of knowledge of a particular work process (Whipp and Clark, 1986). In each of the studies, the tasks were to radically alter how each firm operated. At Gamma, the development of the simulation package showed how 'strategic innovations' radically changed the 'organisational repertoire' thereby establishing standards other housing associations would arguably have to follow. These decisions were not arbitrary rather they reflected societal discourses based on 'environmental impact' and 'sustainability'.

In the case of diffusion it is apparent that representatives of the firms were not passive rather they proved to be key players in the interpretation of tasks. None of the tasks remained static instead translation was a complex process whereby agents reflexively monitored progress. Control over, and the use of knowledge (access) was inextricably linked to the locale or positioning of agents in relation to that knowledge thereby reflecting the dialectical relationship between process and social structure:

> "Pre-existing and sedimented knowledge bases...constrain the production of new forms of knowledge and validate or qualify their claims. But equally, processes of innovation and diffusion transform the knowledges of a particular work process into widely held, structural forms that in turn provide the backcloth for other work processes" (Scarbrough, 1996:33).

We can see this process in each study with the transformation of embedded structures (zones of manoeuvre). However, appropriation is temporal as the longevity of new organisational poses (e.g., the new botanicals facility at Alpha) may be dislocated at any moment. In fact, none of the programees were totally appropriated instead members achieved something between 'partial imitation' and 'appropriation' (Clark, 1996). As described, this process was neither smooth nor continuous reflecting a dialectical relationship between process and social structure.

7.6 Conclusions

A deeper understanding of organisational innovation has been achieved by considering the process through which programme tasks are translated into reality. A key objective has been to outline how tasks, the modalities of the innovation process, reflect the dialectic with existing zones of manoeuvre. By remaining faithful to the basic assumptions encapsulated in Giddens theory of structuration it has been possible to tease-out the generative mechanisms mediating innovative activities thus showing how structure is the medium and outcome of social practice. Tasks embody the rules and resources agents draw upon in the resolution of the business problem. Explicating the dialectic between translation and the maintenance of existing configurations provides additional insight into re-structuration as reported by Barley (1986, 1990) and advancing our notion of complexity (see figure 7.3.6). The detailed description of task 8 at Alpha in relation to other tasks illustrates the connections between innovative activities and the institutional realm in ways that demonstrate the social shaping of innovative activities. This an important contribution with the testing and refinement of Barley's (1986, 1990) theoretical model of change and re-structuration.

This is an important advance because it has been possible to adapt existing methods and representations to illustrate the complex dynamics afflicting the translation of the innovation configuration (Clark and Staunton, 1989). This process involves combining new and existing knowledge according to a variety of chronological codes synchronised according to specific recipes.

Without considering how the strategic conduct of agents is mediated during translation it would not be possible to comment on the various levels of interaction encompassing the innovation process. If the analysis had limited itself to the collection of economic (output) data or even a simple quantitative analysis based on a questionnaire the complexities alluded to by previous authors (e.g., Callon, 1986, Clark, 1995) would or could not have been exposed. Considering the innovation process over a two-year period has meant it has been possible to "follow" events in an intensive fashion. In other words, the adoption of intensive research logics has allowed for a more considered analysis of organisational innovation.

The implications of this approach are considered in greater detail in the next chapter. Innovation is reconsidered in relation to a critical realist methodology and a philosophy of social science proposing the duality of social structure.

Chapter Eight

Discussion

8.1 Introduction

In this chapter I consider what the current study adds to our knowledge of the process of organisational innovation. A key theme of the study has been to address some of the conceptual and methodological issues in the existing literature. Here, the findings of the research are reviewed in relation to these issues so a clear indication of the explanatory value of the study is established.

The aim has been to address the following research problems:

- To what extent is agency or the strategic conduct of TCS programme members mediated by the programme tasks and the existing zones of manoeuvre in the organisational repertoire?

- How can the mediational characteristics of these tasks and the existing zones of manoeuvre be represented so to demonstrate the process of re-structuration and illustrate how knowledge (social and technical) can be both the medium and barrier to change?

For the purpose of explanation these issues are considered as part of the attempt to improve our understanding of organisational innovation. To explore

the relationship between agency and institutional structures it is necessary to demonstrate the linkages between these levels of analysis illustrating the complex and dynamic mechanisms mediating organisational reproduction.

8.2 Improving our Understanding of Organisational Innovation

When considering the explanatory utility of the existing literature criticism was made of studies proposing antecedent factors as key predictors of innovative behaviour. The main criticism focused on the failure of existing typologies and factor-based studies to make sense of how strategic decisions on technology and innovation were articulated and translated (section 2.2.3). Although such studies provide insight to the strategic positioning of companies and indicate the factors that seem to hinder or enable innovation they offer an essentially prescriptive interpretation of innovation. Knowledge of innovation continues to be partial and inconclusive despite the voluminous work on the phenomena and despite progress toward a better awareness evidenced in the adoption of process methods (Wolfe, 1994). There remain reservations about the conceptual viability or basis of many of these studies (sections 2.4.2 and 2.4.3) as many process models fail to resolve the enduring schism between studies focusing on either action or structure.

Although this study is not unique in its approach (see Slappendel, 1996) it is unusual in the approach taken to develop an *interactive process* perspective of organisational innovation (chapters 2-4). This has significant implications not only for theorising but also the research process itself. This is because the object of inquiry *and* the research process are theory-*laden* and should be scrutinised. Addressing these conceptual and methodological issues has been a key concern of the current study.

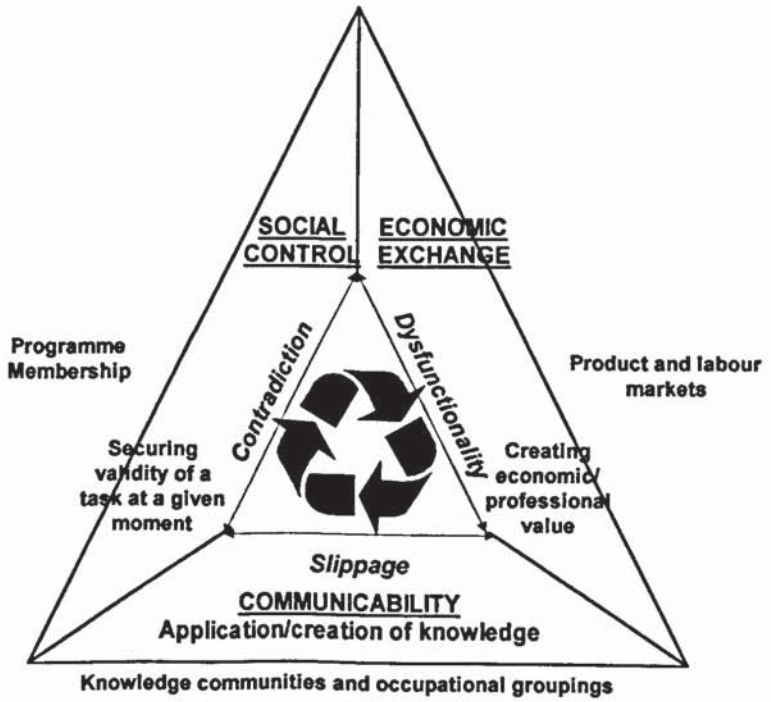
8.2.1 Considering Innovation and Complexity

To improve our understanding of innovation it is vital to explore the notion of complexity, which involves revisiting the assumptions grounding the orthodox literature. A core contribution of this research study is in rejecting the practice

of objectifying innovation. Innovation comprises bundles of knowledge that are embodied or encapsulated in programme tasks. It has been possible to show how tasks are constructed, communicated and exchanged demonstrating the unpredictable and often temporary nature of translation.

By concentrating on the innovation *process* this study demonstrates that the translation of tasks is not simply a "mechanical" process but constitutes an ongoing dialectic between the competing *worldviews* of programme members (Thomas, 1994; Clark and Staunton, 1989). This is significant, because it has been possible to comment on why innovations emerge, develop, grow and perhaps terminate. By exploring contradiction, slippage and dysfunctionality the study demonstrates how, in *different* combinations and with *different* implications, the institutional realm affects translation. Figure 8.1 alludes to this dynamic and the complexities of translation.

Figure 8.1 - A perspective of the complex simulataneous equation linking interdependencies in the innovation process



Adapted from Scarbrough (1996:27)

Translation is a negotiated process that relies on the continued legitimacy (perhaps partial) of tasks in terms of social control, communicability and economic exchange. The "critical moments" (that were identified) indicated changes to the complex simultaneous equation. At both Alpha and Beta these processes represented "sea changes", albeit substantively different, in the rules governing participation and the interactions between members. To this end, it is of note that dysfunctionality (the re-definition or curtailment of productive links) and the existence of different meaning systems lead to slippage and the reduction of radical changes at Alpha but not Beta. This alludes to the complexities of translation and suggests that successful programmes rely on the coping strategies of reflective individuals operating within institutional realms. For example, translation at Beta was achieved despite displacements within the social network. These displacements relate to the Associate's lack of experience and the role of the academic. Here, the absence of slippage reflects other processes tied to the institutional realm. Beta demonstrates how existing organisational understandings can be both enabling and constraining. Thus, to fully appreciate the innovation process it is necessary to consider the coping strategies adopted by members in an attempt, as in Beta, to overcome the barriers to innovation. Translation is somewhat paradoxical because it involves the establishment of new social orders at a time when the rules governing participation also reflect existing orders. Although programme members are not social dopes (Giddens, 1995) (they are reflective agents) their participation still occurs in an environment not all their own making.

This is aptly demonstrated at Alpha when the organisational understandings embedded in flavour production continued to exert influence over the actions of the industrial supervisor. These were not deterministic forces in so far as the rules mediating social practice reflect the intersection of varied processes including the nature of control, communicability and economic exchange. The movement of flavours production had implications for the programme but such decisions and their implications can only be fully understood when they are located in relation to problems with converting knowledge. Each set of issues

constitutes the institutional realm through which change processes are mediated.

This leads to a rejection of orthodox approaches and the failure to consider the "middle-ground" of the innovation process. Thus, the *before change* and *after change* approach has be replaced by longitudinal methods that illustrate how antecedents and existing zones of manoeuvre combine to mediate change. Instead of trying to identify the variables, which correlate with the adoption of an objectified innovation, this 'real-time' analysis provides a sociological explanation of translation which has led to the rejection of another assumption of the mainstream literature: the pro-innovation bias. It is a mistake to assume innovation is non-political. This study demonstrates how the translation of tasks is readily politicised so the basis of collaborations the matching of needs and means reflects deeper mechanisms or separations between participants, the nature of the discourses, the validity of belief chains taken as knowledge and the means of disseminating knowledge. As at Gamma, the notion of mutual value was not readily sustained especially after the academic was asked to participate in ways that compromised pre-existing interests. Not only does this illustrate the negotiated character of innovation it also shows such negotiations involve socio-economic interactions beyond the immediate domain or theatre of interaction.

Knowledge is both a barrier and enabler of change. In this sense, knowledge can operate simultaneously (barrier and enabler) at different levels and across social relations with social reproduction reflecting a dynamic feedback loop between unintended consequences and socio-economic contingencies. As illustrated at Alpha, it is not possible to consider the consequences of the practical difficulties linked to phase 2 without reference to the socio-economic interactions involving the Alpha Group. Knowledge of botanicals from within Alpha enabled the rapid scale-up of the production process yet the reliance and familiarity with flavours proved a major barrier to future developments.

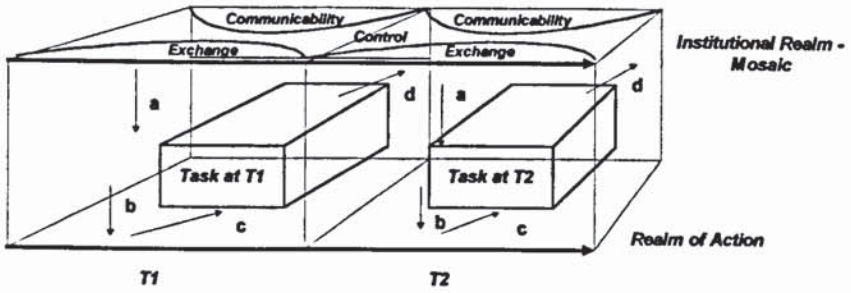
In the process of rejecting the longstanding assumptions found in much of the traditional literature it is necessary to consider how the current study attempts

to (i) conceptualise complexity, (ii) research innovation and (iii) link different levels of analysis.

8.2.2 Researching Innovation and Interactivity

In dealing with complexity the proposed conceptual framework coincides with recent attempts to make sense of interactivity (e.g., see Saren, 1990). In this sense, complexity and methodology are believed to be inextricable linked as the notion of complexity and its explication relies not only on processual accounts but also on exposing "the underlying theoretical assumptions about the role of individual action and structures" (Slappendel, 1996:108). Thus, *complexity*, *process* and *interactivity* are the key notions underpinning this study whereby innovative activities are inextricably linked to the *re*production of *organisational orders*. The nature of this process, discussed in detail using the Alpha and Beta studies demonstrated that translation was not only the skilled accomplishment of programme members it was also an expression of the mosaic of complex interdependencies in the institutional realm (figure 8.2).

Figure 8.2 - The mediating qualities of the Institutional realm



Translation is enabled and/or constrained not only by the deployment of resources around tasks but also by the mediating properties of the zones of manoeuvre, hierarchies of social and exchange relations. *Interactivity* involves

establishing the interpretative and normative foundations of tasks as well as deploying the relevant resources. *Slippage*, *dysfunctionality* and *contradiction* are terms used to demonstrate how the interdependencies operate differently across organisational contexts with different implications.

The complex simultaneous equation of interdependencies reflects in different combinations the structural properties mediating the actions of agents in each programme. Here again, slippage, dysfunctionality and contradiction illustrate the precarious and heterogeneous nature of these processes in so far as the relationship between translation and organisational reproduction relies on the construction, communication and exchange of knowledge across politicised and socialised domains:

> "Pre-existing and sedimented knowledge bases...constrain the production of new forms of knowledge and validate or qualify their claims. But equally, processes of innovation and diffusion transform the knowledges of a particular work process into widely held, structural forms that in turn provide the backcloth for other work processes" (Scarbrough, 1996:33).

Making the conceptual link between action and structure based on the notion of duality is a key development on previous "interactive" studies of innovation. For example, although Amabile (1988) describes the influences organisational factors have on individual creativity and visa-versa she fails to explicate *how* the two elements are linked. Despite Amabile inferring *interactivity* she omits to establish the mechanisms through which interactivity is experienced. This is a key requisite in developing an interactive process perspective because to establish a link it is necessary to show rather than infer the link or mediatory characteristics of social structure or knowledge. Not only does the current study show how interactivity might be conceptualised it also extends previous work using the notion of duality (e.g., Jones, *et al* 2000). Although the work of Jones *et al* (2000) considers the mediatory characteristics of the innovation process by discussing specific modalities they fail to demonstrate the *process* through which these properties are *re-structured*. On this occasion, the rules and resources mediating tasks relate to key mediations in relation to the locale of individuals within the social network and the nature and validity of the

belief chains taken as knowledge. Arguably, Jones *et al's* paper places too much emphasis on a cumbersome set of theoretical constructs without trying to demonstrate how these constructs are dynamically implicated in the innovation process.

The *dynamics* associated with communicability, social control and exchange relations are inextricably linked to the *interpretative schemes*, *facilities* and *norms* mobilised by agents in the process of interaction. Communicability for example, relies on the signification structure that underpins the way in which agents make sense of and organise their actions. This is precarious as both practical and socio-economic interactions can undermine the completion of tasks. In this sense, signification is closely linked to the exercise of control over the deployment of facilities and refers to the political process or the domination structure by which values, interests and goals are adopted. It also relates to the control over objects, goods and other material phenomena manipulated during translation. Likewise, communicability cannot be properly appreciated without reference to the normative foundation of such activities. Such conventions govern legitimate or 'appropriate' conduct in so far as the translation of tasks is set against socio-economic interactions at the level of the programme *and* the firm. At Alpha, translation was not only curtailed by 'technical difficulties' with the HPLC system but also by conflicting 'systems of interaction' (flavour production) embedded in the zones of manoeuvre. Thus, it has been possible to demonstrate a connection between the practicalities of innovation in the context of conflicting organisational understandings.

In demonstrating this link the aim has been to build on previous attempts to represent the processual aspects of organisational innovation. In particular the work of Barley (1986, 1990) and Barley and Tolbert (1997) has proven inspirational when considering translation and organisational reproduction. Although this work is somewhat different, Barley uses *scripts* while *tasks* are considered in this study, it is possible to demonstrate how the instantiation of tasks re-structures organisations. Where this study advances the work of Barley is in demonstrating how and why tasks can be precarious, cumulative and/or temporary. Thus, it is has been possible to comment and illustrate

when (critical moments) and why (using the concepts of contradiction, slippage and dysfunctionality) translation becomes problematic or is temporary.

Constructing an interactive perspective relies on mapping "emergent patterns of action". This is important because without analysing these processes it is difficult to comment on "how behaviors and interpretations stabilise over the course of the structuring process" or discern why they may discontinue (Barley, 1986:81). Like Barley, intensive longitudinal research logics are used to track, as far as possible, events as they happen. Such an approach can also be open to criticism in relation to the issue of generalisability. Here, I agree with Hamel *et al* (1993:35) when discussing the shift from micro to macro levels of analysis when they state that the objectives are more important than the number of confirmatory cases. This refers to the distinction made between statistical generalisations (Yin, 1994) in which inference is made about a specific population and analytical generalisations in which empirical data is compared with a theoretical 'template'. According to Giddens (1995:284) "all social research has a necessarily cultural, ethnographic or "anthropological" element to it". Universal laws, linked to causal statements, which can be found in the natural sciences, simply do not exist in the realm of human social conduct. In this study the aim has not been to study spectacular success or failure or to make generalised statements rather it has been to theorise about innovation and organisational reproduction:

> "A viable theory of the relation between action and institutions requires, at minimum, a heuristic definition of an institution that will allow researchers to examine the change and reproduction of institutions as general, ongoing, and historically embedded process" (Barley and Tolbert, 1996:96).

Drawing on the work of Giddens it has been possible to bridge not only the determinism of structural accounts but also the voluntarism of social action. Likewise, drawing on the work of Scarbrough (1996) and Clark (1995) and Clark and Staunton (1989) it has been possible to furnish the notion of

complexity with representations that demonstrate the political and socio-economic characteristics of organisational settings.

8.2.3 Understanding the Innovation Process

More generally, the study provides a detailed sociological analysis of the innovation process. It offers a critical overview of the establishment and ongoing negotiation of an obligatory passage point (Callon, 1986) through which programme members navigate. As such, it has been possible to comment on the conduct of agents regarding the apparent transition from *hostage strategies* based on mutuality toward *prisoner strategies* based on unilateral control. This has resonance with studies linked to constructionist interpretations of innovation and technical change (e.g., Bijker, 1987, Robertson *et al*, 1997; 2000) where the focus of analysis is the knowledge creation process. As in these studies this research opens the "black box" of innovation to both rigorous theorising and empirical analysis. Here the analysis comments on the antecedents of each programme (see sections 6.2-6.3) and demonstrates how the substantive aspects of tasks are differentially translated according to existing zones of manoeuvre (see section 7.3). The study comments on how the codes of conduct organising agents activities, based on economic, personnel and professional mutuality or value, are articulated. These links are not clear as criteria and processes that are embedded in the institutional realm mediate translation. Interpretative flexibility among members confirms the dynamic and contested nature of translation and *system penetration* (section 6.4). Most significantly the knowledge creation process involves a complex simultaneous equation of interdependencies reflecting the means of access agents have to knowledge, how knowledge is articulated, the circumstances relating to its validity and the factors linked with the means of dissemination.

In line with the criticisms of Rogers' (1962, 1983) work *on 'The Diffusion of Innovations'* (see section 3.2.4) this study demonstrates the difficulties with unpacking and appropriating innovations. As such, the innovation process represents heterogeneous elements (chronological codes) that are loosely

coupled and difficult to synchronise over time and space. If, as this suggests, innovation is an ongoing "process" then it calls into question the explanatory utility of *objectification*. This study concurs and supports the idea posited by Clark (1987:9) that:

> "The theory of structure and agency presumes that individuals learn a collective repertoire of cognitions normative frameworks and behavioural patterns. The repertoire consists of dormant aspects and active components rather in the same way an American football team possess a repertoire".

It seems that translation cannot be separated from contextual factors in so far as programmes may result in the entrenchment rather than the radically change in zones of manoeuvre. It might be assumed a relationship exists between radical-altering innovations and hostage strategies. Likewise, it might be assumed that with a shift to prisoner strategies the programme results in incremental-entrenching innovations. Such conclusions are not supported by the investigation, which suggests any deterioration in the social relations among members does not necessarily signal the degradation of the programme. In contrast, to the formulaic prescriptions of Nonaka and Takeuchi (1995) linking knowledge creation with seemingly "organised" *enabling conditions* this study suggests conversion may be more *messy* and reliant on contingencies that are not easily planned or managed (section 3.3).

Tasks are not simply ensembles of components or artefacts they are built on normative and interpretative foundations. When considering appropriation it is necessary to consider how the normative and interpretative foundations of tasks are played-out. Slippage, contradiction and dysfunctionality represent those moments when the substantive and organisational foundation of tasks (i.e., chronological codes) are problematised in relation to existing foundations embedded and embodied in existing zones of manoeuvre.

An advantage of conceptualizing innovation as an ensemble of tasks is the ability to demonstrate how these various chronological codes are differentially mobilized or synchronized over time. This supports the ideas of some writers (Robertson, *et al*, 1997) who posit invention, diffusion and implementation to

be recursively rather than sequentially organised. Demonstrating changes to the tasks indicates why the knowledge creation process is fluid and complex rather than linear and easily managed.

8.3 Linking Agency and Structure

This study develops a critical-dialectic perspective of organisational innovation based on the duality of structure. The aim has been to expose the assumptions or theoretical strategy adopted when considering innovation. This is in contrast to many orthodox studies that fail to explore their meta-theoretical underpinnings (Slappendel, 1996). Instead, this study comments on methodology in terms of empirical and normative theory. In the case of empirical theory, which relates to ideas of explication and analysis intensive research logics based on longitudinal research provide the most appropriate means to investigate "process". At the same time, it has been argued that to understand process it is necessary to view social practice in ways that account for both action and structure. In the case of normative theory, which relates to distinct research logics for constructing specific types of knowledge, it has been argued that variance-normative approaches are inadequate. Such approaches tend to reflect recommendations more closely akin to *social engineering* than *social theorising* (Morrow, 1994). Arguably, the relationship between the researcher and the object of inquiry is a significant dynamic in the process of reporting organisational innovation. This study is akin to critical analyses or the social theorising of the innovation process.

The advantage of this approach is in assuming that social practice and by implication translation and organisational reproduction are ground in the temporal pre-existing conditions of the institutional realm which reflect deep causal mechanisms that are enabling and constraining. Although these causal tendencies can only be represented indirectly by second-order concepts (i.e., slippage, contradiction and dysfunctionality) it remains for a 'post-empiricist' epistemology to "identify" those mechanisms mediating social practice. Taking a critical realist standpoint means asking how innovations are '*re*produced'

(Barley and Tolbert, 1997; Tolbert and Zucker, 1996; Powell and DiMaggio, 1991).

Case study research over a two-year period involving direct observation, the interrogation of written material and face-to-face interviews has proven useful to teasing-out the mediatory characteristics of each study (section 4.4). This study provides a specific "construct" of social phenomena whereby action and structure "are implicitly dependent on theoretical and empirical work focused on mediations, or what Giddens would call social practices" (Morrow, 1994: 222).

8.4 Conclusions

In recognising that innovation is a process rather than a single event many researchers have attempted to take into consideration the time and space implications of innovatory activity. Although, as Saren (1984) points out, many of these have tended to oversimplify the innovation process recently some writers (see Lewis & Seibold, 1993; Coopey, 1996) through empirical research have attempted to reconcile the agency-structure dualism. Adopting a critical realist approach represents an attempt to overcome one of the most intractable problems in social research. In structuration theory the relationship between agency and structure is similar to the association between grammar and speech. The rules of grammar are utilised by social actors in their patterns of communication, which in turn constantly recreate the structure of language. The same is assumed of the reproduction of institutional orders where the rules and resources mediating the actions of individuals are also recreated through such actions. In making a contribution to this debate a conceptual framework is advanced that utilises concepts taken from the school of critical realism and writers who theorise in complementary ways (Clark, 1995; Clark and Staunton, 1989; Scarbrough, 1996). As demonstrated, the innovation process includes social and technical-ware which is both a *process* and *product* of agency or social practice in organisational settings.

The empirical material is based on four TCS programmes in three small and medium sized manufacturing enterprises and a housing association. In each representatives, academics and graduates worked together to resolve a business problem through the application of skills and expertise in the development and implementation of new products and processes. By way of utilising concepts borrowed from among others Giddens, (1995) Clark, (1995) and Clark and Staunton (1989) and Scarbrough (1996) an analysis of the complexities, processes and interactivity linked to the innovation process and organisational reproduction is provided. In each study using concepts such as communicability, social control and exchange relations it has been possible to document how these interdependencies can affect in different combinations the integrity of innovations. For the purpose of explication the dynamics of these events have been described in relation to the following categories: slippage, contradictions and dysfunctionality. Not only has it been possible to comment on re-structuration (Beta) temporary re-structuration (Alpha) and partial re-structuration (e.g., Gamma and Delta) it has also been possible to analyse these processes in terms of the contradictions, dysfunctionalities and slippage's emerging over time and space.

This study is based on intensive research logics. While it may have been possible to construct a retrospective view of the changes, which occurred during the study such an approach could not have provided detailed accounts of the complex social interactions that typified each case study. Likewise, a sense of the relationship between action and structure could not have been achieved without being sensitive to the critical realist philosophy of social analysis. The implications and conclusions emerging from this approach are discussed in the final chapter below.

Chapter Nine

Conclusions, Evaluations and Implications

As the final chapter of the thesis it is necessary to formulate the contributions of the study, evaluate the methodological and empirical value of the research, discuss its limitations as well as implications for future research. As way of conclusion the author considers the overall recommendations of the thesis.

9.1 The Contributions of the Ph.D. Study

Following a detailed appraisal of literature covering organisational innovation, the innovation process including knowledge creation and methodology this work has focused on three research questions that are orientated around a core idea or proposition (see chapter 2, 3 and 4 for a discussion). The research questions are directed at the *process* and *content* of translating programme tasks in an organisational setting. On the process side, the aim has been to make sense of the strategic conduct of agents illustrating how they have translated ideas into reality. On the content side the aim has been to explain the issues and themes emerging from these practices by considering the *generative mechanisms* and the critical moments that indicate shifts in the mediations during the innovation process (i.e., contradiction, slippage and dysfunctionality). This exposes the idea that *institutional and behavioural contexts interactively influence organisational innovation* and as such the current analysis also provides a distinctly different assessment of TCS programmes.

9.1.1 Research questions and the thesis

It is useful to begin by considering where each of the research questions and basic propositions were considered in the thesis (figure 9.1). As will be apparent the basic premise, which has been based on "interactivity", provides the main organising principle of the research. In each of the chapters issues relating to interactivity in social reproduction has been considered and critically appraised. Both the theoretical issues and methodological implications of this perspective have been open to close scrutiny. The aim has been to reconsider the orthodox approach to organisational innovation by reconsidering the notion of "process" with the aim of placing *social practice* at the core of empirical analysis.

Figure 9.1 The treatment of propositions and research questions in the thesis.

Proposition	***Where in the thesis***
Institutional and behavioural contexts inter-actively influence organisational innovation.	• Chapter 2 for a discussion of the various methodological camps and theoretical schools found in the organisational innovation literature. • Chapter 4 for a discussion of the conceptual and philosophical character of an interactive process perspective. • Chapter 5 for a discussion of the methods adopted to tease-out the mediational character of the innovation process.
Questions/problems	***Where in the thesis***
How do company representatives and academics define the business problem and propose appropriate solutions?	• Chapter 3 for a discussion of how ideas are formed and then translated during the innovation and knowledge creation process. • Chapters 5 for a summary of each study the problems to be solved and by what means. • Chapter 6 for an analysis of how TCS programmes are established and then a summary (identify key themes) of these processes in each of the case studies.
To begin to develop an interactive process perspective of organisational innovation it is necessary to consider the strategic conduct of programme members during the knowledge creation process.	• Chapter 2 and 4 for an introduction to and development of an interactive process perspective – consider agency. • Chapter 3 for a discussion of the knowledge creation process. • Chapter 6 and 7 for an analysis of the strategic conduct of agents at each of the case studies.

To understand translation it is necessary to consider the mediational characteristics of the tasks and the zones of manoeuvre. To do so, depends on showing how knowledge can be both the medium and barrier to change.	• Chapter 2 and 4 for an introduction to and development of an interactive process perspective of innovation – consider structure. • Chapter 3 discusses knowledge as an enabler and constraint to change. • Chapter 6 and 7 for the final formulation of an interactive process perspective.

9.1.2 Contributions of the thesis

What contribution has this thesis made to the analysis and understanding of organisational innovation?

- **Establishing the logic of developing an interactive process perspective of organisational innovation.**

The logic of the study was established in chapter 2 when a number of the methodological (variance and process) and theoretical (individualist, structuralist and interactive) issues affecting the explanatory utility of existing studies were exposed. The aim has not only been to acknowledge the contributions of these studies it has been to provide a detailed critique. Studies based on agency or structure have advanced our understanding of organisational innovation while the current study adds, in contrast, new weight to the importance of interactivity and duality in the analysis of innovation (Slappendel, 1996).

- **Towards a sociological model of organisational innovation.**

Developing the idea of interactivity has relied on providing an overview of those studies considering the social shaping of innovation or the translation of ideas into reality. In combination chapters 2 and 3 provided the evidence and outline for developing a different perspective of organisational innovation. In chapter 4 these ideas were developed further with the formalisation of notions around Giddens (1995) structuration theory. The aim has been to theorise about innovation instead of providing a normative research model of the innovation process. Adopting an intensive research logic proposed in chapters 4 and 5 has involved combining aspects of Giddens 'sensitising devices' with

other concepts to develop a kind of toolbox of "representations" that can be utilised by researchers developing interactive perspectives. The thesis shows how innovation and technology can influence the mechanisms of organisational reproduction (see Barley, 1986, 1990).

The contributions of the study relate to the categories used to help explain the complexities and the uncertainties that are associated with translation. The idea of contradiction, slippage and dysfunctionality developed in chapter 6 specify the dynamic around which strategic decisions are made. For comparison these categories were juxtaposed against specific themes discussed in the study of previous TCS programmes (Peattie, 1993). This helped specify *difference* and *complexity* in terms of *process*, *context* and *content* issues and generated a story or narrative from which an assessment of the mediational properties could begin. From this, it has been possible to assess why changes to programmes resulted in the curtailment of objectives at Alpha and Delta but not Beta and Gamma (chapter six). The generation of categories has focused attention on the relationship between programme content and the social and economic relations within and without the TCS programmes:

1. *Contradiction* refers to the emergence of differing interpretations following the commencement of programmes. This category alludes to the likelihood of competing priorities so that translation entails dialogue among reflective agents. These competing interpretations can be task specific or relational such that issues of control are not always implicated in the translation of tasks but may relate to the organisation of social relations within and without programmes.

2. *Slippage* refers to the re-design of the original programme including the exclusion, reinterpretation, re-synchronisation or the failure to translate tasks. This category alludes to the difficulties (practical) of translating tasks and the associated displacements.

3. *Dysfunctionality* refers to the interpretative flexibility among members and the breakdown or curtailment of productive links. It relates to the relational issues linked with membership of the social network.

This typology of categories when considered in relation to process, context and content issues offer insight into difference and complexity. For the purpose of analysis concepts borrowed from Scarbrough (1996) and Giddens (1995) have been adopted to demonstrate in the first instance that although the nature of contradiction, slippage and dysfunctionality differs substantively between studies the basis of these tendencies reflect the complex intersection of the following interdependencies:

- Social Control
- Economic Exchange
- Communicability

In turn the exercise of control and by implication the establishment of rewards and relationships during the innovation process reflect the properties implicated in these interdependencies. These mechanisms are fundamental to the exercise of control (unintended consequences notwithstanding) that reflect common "empirical tendencies" that are apparent across studies:

- The separations between participants within and without the programme
- The nature of the discourses through which programmes are communicated
- The validity of the belief chains taken as knowledge
- The means of disseminating available knowledge

Each case study demonstrates certain basic commonalities associated with the mediation of action. The empirical tendencies reflect the mechanisms through which social control, economic exchange and communicability are articulated while the notions of contradiction, slippage and dysfunctionality represent loose categories to order the complex events around and locate the critical moments emerging from the innovation process.

- **Contributing to our understanding of the innovation process in the context of TCS programmes**

This study contributes to our understanding of TCS programmes in a number of ways. Drawing on categories used in previous TCS research (see Peattie, 1993) including process, context and content it has been possible to expand the links between issues by considering contradiction, slippage and dysfunctionality. In Peattie's (1993) original study no attempt was made to link these various issues. Here, it has been possible to make connections through the assessment of the interdependencies characterising contradiction, slippage and dysfunctionality. In doing so, greater emphasis has been placed on "content" issues (compared to the original study) and in particular the connection between communicability and the social and economic relations established during programmes. Arguably, the current research has highlighted in greater detail how innovations are shaped by different yet connected social processes.

The findings also demonstrate that those factors usually considered strengths of TCS programmes such as the role and positioning of the Associate are far more problematic than generally acknowledged (Senker and Senker, 1994, Tiler and Gibson, 1991). Peattie (1993) is not alone when alluding to problems with the role of the Associate and programme success. Senker and Senker (1994) also identify problems with internal ownership and support and organisational friction yet only in the current study are these themes tracked in the detail required to make sense of the dynamics of discord or dysfunctionality. A more critical approach has been achieved because innovation has been considered in terms of the re-structuration of the existing institutional realm.

Although Senker and Senker (1994:85) recognise the potential for "fragmented projects" they fail to explain how and why work on projects can be relegated at times of uncertainty (critical moment). Here it is suggested that fragmentation not only relate to issues of communicability (Alpha) but also the social dynamics of the social network (Beta). Greater sensitivity has been possible because the emergence of contradiction, slippage and dysfunctionality have been assessed against the interconnection of strategic and institutional factors (interactivity).

The TCS programmes studied within the current research project have been affected by a variety of issues that appear substantively different. That said, the research provides insights that potentially call into question the current practices for "managing" programmes. Ensuring sustainable or equitable alliances through TCS programmes may not depend on the close adherence to existing formal management practice (e.g., LMC). The coping strategies appear to show that control over the role of participants and resources is mediated by the institutional realm (i.e., Alpha, Beta and Delta) including related socio-economic issues associated with the status of the knowledge being transferred (i.e., Gamma). This calls into question the extent to which problems can be "designed-out" of programmes through, for example a tightening of the application process. If, as is suggested the rules and rewards governing participation emerge during the process then the establishment of rules of engagement prior to commencement is likely to have a limited impact on the accomplishment of the programmes aims and objectives. Such rules will also be mediated by existing organisational understandings so that the checks and balances available to ensure equitable involvement (e.g., LMC's) may only provide limited means to ensure mutuality.

- **Contributing to our understanding of the innovation studies literature**

Not only has this research study added to our understanding of the innovation process within the context of TCS it has also contributed to the innovation studies field more broadly. In this respect, the development of an interactive process perspective is closely related to the work of institutional theorists (e.g., Barley, 1986, 1990; Barley and Tolbert, 1997). The findings and establishment of "empirical tendencies" confirm many of the propositions posited in previous research in this field. In particular, a focus on the link between the institutional realm and strategic conduct conforms to the view held by Barley and Tolbert (1997:96, italics in original) that institutions are defined as '*shared rules and typifications that identify categories of social actors and their appropriate activities or relationships*'. These findings reinforce Powell and DiMaggio's (1991 :28) view that 'the creation and implementation of institutional arrangements [is] rife with conflict, contradiction, and ambiguity'. In this respect, the current study provides insights and categories to explore and understand these ambiguities in

ways that explore the social and technical dimensions of institutional processes and re-structuration (see Barley and Tolbert, 1997).

Drawing on the work of Clark (1987, 1995), Clark and Staunton (1989) and Scarbrough (1996) has facilitated the development of a critical analysis of the innovation process. This is not dissimilar from social constructionist approaches (Social Construction of Technical Systems) to knowledge creation (Bijker, 1987) and in particular "invention". Here the construction of dominant interpretations was assessed in terms of slippage and the changing social relations among programme members. Like Bijker's interpretation of technological frame the idea of "task" is based on the meanings attributed to these processes. It is because the meanings attributed to tasks represent a social accomplishment that it is possible to comment on the dynamics around changing interpretations. The Alpha and Beta cases demonstrate in substantively different ways how the meanings of tasks can change or can be sustained during periods of institutional flux and uncertainty. As described by Law (1986:15-16) such processes reflect how individuals struggle with one another to 'first determine their existence and then if that is secured define their characteristics...the outcomes of these struggles depend upon the particular combination of elements in play'. This reflects the complex simultaneous equation of interdependencies alluded to by Scarbrough (1996) in his study of the management of expertise and utilised here to account for contradiction, slippage and dysfunctionality.

The current approach follows the approach of Robertson *et al.* (1997, 2000) who describe innovation as a process of social activities organised around episodes of invention, diffusion and implementation. Although the analysis has not been couched in these specific terms it is possible to indicate the complexities of constructing, communicating and exchanging knowledge.

This thesis is one of a growing number of studies in innovation studies and organisational studies literature trying to make sense of the link between human agency and organisational structure in the innovation process. In particular, this study contributes to the development of innovative network methodologies (see Jones *et al.* 1998). In this respect, a critical realist perspective based on the

notion of the duality of structure provides a deeper understanding of the way in which social interaction shapes innovation. This follows the work of Rothwell and Zegveld (1985) and their move toward developing an interactive model of innovation which has replaced linear models emphasising either "science-pull" (Schumpeter, 1934, 1943) or "market-pull" (Schmooker, 1966). From a network perspective this study has demonstrated the complex nature of organising both internal and external relations during the innovation process. The emergence of contradictions, slippage and dysfunctionality seems to support the view that innovation is socially constructed and accomplished at the same time as specific individuals and groups pursue goals and interests (Scarbrough, 1996). It has also been shown that innovation emerges from a bundle or ensemble of ideas, information, technology, codified knowledge and know-how (Myers and Marquis, 1969; Utterbach, 1971; Allen, 1977; Conway, 1994). However, the translation of the ensembles of ideas remains precarious in relation to the pre-existing zones of manoeuvre or organisational understandings that mediate innovative activities (Clark and Staunton, 1989).

By commenting on the diverse nature of translation it has also been possible to demonstrate the importance of personal interaction on the innovation network, for example, the experiences of the Associate at Beta illustrate the key role the breakdown in relations with the academics played in changing the pattern of behaviour in the programme. Although not explicitly explored, the informal nature of the innovation process represents a significant dynamic in the translation of ideas into reality. As Jones *et al.* (1998:124) state: "It is important to acknowledge the fact that managerial decision-making takes place within networks of social relationships at both the personal and organisational levels" (also see Granovetter, 1985).

Finally, the current research study also conforms to recent trends in innovation research toward the use of relational approaches to explain both general and discrete innovative activities. Such trends reflect the increasing emphasis on networks and networking activity in the consideration of innovative organisations (Hakansson, 1989; Auster, 1990) and technological innovations (Conway, 1994; Steward and Conway, 1998).

- **The proposal of a methodology to identify and explain the interactivity of agency and structure in the innovation process.**

It has been possible to construct an analysis using concepts (chapter 2, 3 and 4) that make transparent the interdependencies mediating innovation (chapter 6 and 7). Each innovation is conceptualised as a set of "tasks" the vehicle of knowledge creation. The institutional realm has been viewed as a complex simultaneous equation whereby interdependencies are variously linked (Scarbrough, 1996). Although *duality* and *modality* provide the building blocks for developing an interactive process perspective it has been necessary to mobilise other concepts to adequately demonstrate the complexities of the innovation *process*. The research demonstrates that translation is mediated via a complex combination of interdependencies: communicability, social control and economic exchange that may result in sustaining the zones of manoeuvre and/or re-structuring the organisational repertoire.

9.2 Evaluation of the Value of the Research

The value of the research is to be found in developing a theory of organisational innovation via the combination of critical analysis and empirical research. Not only has this research been based on a rigorous appraisal of existing literature from many different bodies of thought it has involved a lengthy (two-years) case study investigation of four TCS programmes. A measure of the value of this research is to be found in the combination of elements for the purpose of theory development. In particular, through detailed analysis it has been possible to comment on the innovation process and the key themes affecting translation.

Based on participation in one international conference (EGOS 1997) and many UK based conferences (Labour Process, 1998, 2000; Constructing Tomorrow, 1999, ASEAT 1999) the ideas generated from this research study appear to have been well received. The number of publications made during the research (Edwards and Jones, 1998; Edwards, 1999; Edwards, 2000a; 2000b; 2000c and Jones, Edwards and Beckinsale, 2000) is also evidence of this assertion. But, it would be naïve to think the proposed methodology is fully crystallised or needs

no further work. Certainly, the combination of conceptual devices in conjunction with Giddens structuration theory needs further development. It remains to be seen whether the categories adopted and created (contradiction, slippage and dysfunctionality) are applicable elsewhere. This is important because the utility of such devices is not always transparent. For example, Barley's (1986, 1990) use of scripts seemed a viable device to illustrate the structuring effect of technology. However, with the nature of this study it was impossible to observe daily actions of members as he did at two Radiology Departments. As with Barley's use of *scripts* the utility of *tasks* depends on its generalisability that has still to be tested.

Because this study has been focused on theorising about rather than developing a "working model" of the innovation process the practical value of the research is perhaps less obvious than the claims made on the basis of theory and method. That said the consultant from the TCD has used the "process" model developed in chapter 6 as an aid for Centre manager training and thematic representation of programme start-up. Where it has been a little more difficult to generate practical value is on reporting the findings back to the participants. It has been necessary to maintain complete confidentiality. Although it would be interesting to reflect on the response of participants such an exercise has to be weighed against the implications of breaking participant confidentiality especially as in most cases the participants are in regular contact (May, 1993). That said, the research has implications for future participation in TCS programmes (see section 8.5).

9.3 Implications and Future Research Needs

The theoretical contributions and implications of this research study have been variously outlined above. Perhaps the most important theoretical contribution has been to apply a unique set of theoretical devices and intensive research logic to develop a better understanding of organisational innovation. This contributes to:

- Clarifying the focus of researching organisational innovation (i.e., social practice - process).
- Proposes sensitising devices that help us to theorise about the *complex simultaneous equation* mediating innovation processes.

The key contribution is in re-considering and advancing orthodox theoretical and methodological approaches. In terms of conceptualisation, innovation processes have to be located within the broader picture that reflects social and system integration. Only intensive research logics based on longitudinal in-depth analysis provides an opportunity to consider the complexities associated with reconfiguring existing zones of manoeuvre over extended periods of time. However, to appreciate how these multi-level events co-join it is necessary to develop theories that can account for the often complex and paradoxical relationship between agency and structure. This is achieved by considering action and structure simultaneously as outlined in Giddens (1995) theory of structuration (see chapter eight).

Of equal importance are what slippage dysfunctionality and contradiction tell us about innovation. "Innovation" is not an objective artefact instead they represent dynamic combinations of elements with both technological and organisational dimensions. Innovative activities depend on the interdependencies reflecting the contextual factors mediating the actions of agents. Problems with the shape and use of innovations may also be problematised by the unintended consequences of those actions linked to appropriation. As shown appropriation can be affected by struggles among individuals with the emergence of asymmetries of power.

From a practical perspective the research has some important contributions for the future organisation and participation in TCS. The intensive research logic adopted in this study has provided a unique appraisal of TCS:

- Provides a unique assessment of *process* as well as *outcome*.
- Indicates those areas where improvements in the organisation of TCS programmes seem in greatest need of attention.

From an organisational point of view the results suggest that programmes are unlikely to be transparent such that the consultant will find it very difficult to know if or when disputes among members are affecting programmes. This is not to argue that the programme failed to provide value-added or contribute to the development of those involved, rather achieving mutual benefit had very little to do with the consultant's participation. This is not a reflection or comment on the professionalism of the consultant instead it says something about the utility of the organising principles of programmes. LMCs were not widely utilised as a vehicle to articulate grievances. Although participants generally reported on progress and provided a measure of this work (usually as £s) it was extremely rare for Associates to voice concerns about personal development or progress. This was not because Associates did not have grievances rather this forum was not seen as the place to discuss negative aspects of programmes. In contrast, it was usual for company representatives to comment on problems or grievances. There does appear to be an asymmetry within programmes that needs to be addressed. In this case, the Associate might be given greater opportunity to talk informally with the consultant so they are given a forum to air concerns. This may not lead to improvements although it may start to address the grievances of Associates aired during the research study.

In addition, and related to these observations is a comment on the respective responsibilities of the industrial and academic supervisors. In each case study the key concern of the consultant was whether or not the industrial supervisor was satisfied with progress. Certainly, these views are important but it did appear there was a bias toward commercial concerns at the expense of the other measures of value. Obviously, the commercial future of the company is a key consideration but this was sometimes the only consideration. This issues links back to the tendency to report on "progress" rather than "slippage". Because it is in everyone's interest to show that public monies is being spent in a proper manner there was a tendency to ignore slippage especially if the company was able to demonstrate increased profits or improved margins associated directly or even indirectly with the programme. In this instance, there is an argument (within reason and resources) for the consultant to lead during LMCs so instead of being told what has happened they ask the respondents

about each task. This would focus the attention of participants on the whole programme rather than just those areas they feel most comfortable. The consultant would surely gain a better appreciation of the dynamics of programmes thereby making the process more transparent and securing better control over the use of public expenditure.

The current research has implications for academia, policy makers and those involved at a practical level on programmes. For academia, the argument has focused on questions of theory and method in the study of organisational innovation. It is proposed that academics need to consider how they want to represent "social reality" and what they want to be able to say about such phenomena. It is recommended that if commentators want to improve our knowledge of organisational innovation it is necessary to adopt a critical-dialectic approach to organisational analysis capable of extricating and explicating the complexities that have remained hidden from analysis. This study offers a conceptual framework including thematic devices to orientate future research.

For policy makers, there seems a strong argument to continue to support TCS programmes. In each programme it is apparent value-added was achieved even if the process through which this was achieved was troubled. However, if there are to be improvements made to the running of such programmes it is advised that future research be made into project management. There is evidence to suggest that an imbalance exist between the detailed evaluation of programme applications and subsequent tracking. More resources must be made available during programmes to enable consultants to track the detail of the programmes. Such observations should contribute to the improved monitoring of programmes whereby participants are made more aware of their responsibilities to each other. At a practical level the research has demonstrated the negotiated and often conflictual aspects to innovation. If transparency is to be achieved during these programmes then improved communications are necessary between participants so changes to templates are negotiated rather than imposed. This may be easier said than done but with the increased involvement of the consultant at programme meetings it might be individuals no longer feel gagged.

Further work is possible along a number of different lines. To begin, there is the question of whether this study could have been done differently? In answer to this, it is important to clarify my main aim was to contribute to our understanding of organisational innovation. I feel that my basic intentions remain sound although it is possible to address the relationship between agency and structure differently. Despite the work on structuration theory continuing other approaches need to be considered. It is appropriate to investigate the work of Archer (1995) on morphogenetics and consider the relative merit of this alternative theoretical perspective.

As with any research project there are questions as to its limitations, how it could have been done differently and what lies in the future? In the first instance, the proposed framework remains controversial and therefore limited because it is based on the notion of *duality*. This study has probably closed as many doors as it has opened to critical analysis. As with the work by Barley this study has a narrow focus whereby the discussion of templates and tasks may be difficult to apply in other less formal examples. Perhaps the current analysis provides an overly mechanical representation of innovation and therefore creates limitations for replication. In the collection of empirical data it would have perhaps been useful to look at TCS programmes involving a different consultant and manager. Concentrating on the West Midlands area has created its limitations because it has not been possible to gain an alternative perspective. This makes it difficult to generalise about the results because the actions and interpretations of TCD employees is likely to be different depending on their location. As it was, such opportunities were not readily available. Other limitations reflect the necessity to stop researching at the end of programmes. Clearly, the innovation process does not just end as funding ceases. Although the research provides a detailed overview for a prolonged period it still fails to consider appropriation beyond the end of programmes when arguably continued enactment is more difficult. There does seem to be scope to continue this research at firms after programmes have ended in order to monitor instantiation over these extended periods.

This is a limitation that is difficult to reconcile because as the author has experienced continuing longitudinal research requires both resource and time.

Future research into organisational innovation should accommodate the longevity of innovations in order to comment on the process of embedding and maintaining these ensembles of knowledge over time and space.

9.4 Conclusion

Over the past 30-40 years, it has become increasingly accepted that technology and innovation are essential to improving the competitiveness of firms thereby securing the economic prosperity of regions and nations. There has been growing interest in exploring and explaining *innovation*. One of the key contributions of this thesis has been a detailed review of the literature and accompanying commentaries to ascertain why there has been relatively little progress in moving our understandings forward. The established starting point for this PhD study has been to reconsider the theoretical and methodological underpinnings of the orthodox innovation literature. The research study has developed an interactive process perspective that is sensitive both theoretically and methodologically to the notion of duality. This has been achieved by drawing on Giddens (1995) structuration theory and many other concepts that have in turn acted as the lens through which the subsequent empirical research was interpreted.

Not only has this research contributed to the theoretical development of this field of study it has also contributed to the exploration of the dynamic, complex and often contingent characteristics of the innovation process in locations of distinct significance. TCS represents the flagship of government attempts to encourage technology transfer and innovation. The author can only urge others to consider similar venues and methods as a way of contributing to this dialogue and one hopes an improved understanding of the complexities alluded to above. This thesis should be considered as a single contribution to a vast area of interest and importance.

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