JAPANESE BY DESIGN

An Analysis of the UK Automotive Industry

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ABSTRACT

The UK automotive industry provides a focus where the recent Japanese transplants may be compared with the more established manufacturers in the UK, to see whether a cross-fertilisation of 'design methodology' has occurred. A tool advocated by the Japanese is 'Simultaneous Engineering' (SE), which demands flexibility of people, organisations and processes to maximise efficiency and reduce waste. Some argue however that the real innovation may be as simple as communication and trust.

Evidence exists that the OEM/supplier interface has also changed. Suppliers are now a trusted element of the 'wider organisation', carefully selected and nurtured as experts, with buyers participating and influencing the design process to a greater extent than has previously been seen.

In the UK automotive industry SE forms just one part of what may be termed the 'Japanese Model'. The conclusions from this study show that a perception of the 'Japanese Model' exists, and has been adapted to suit better the environment of the UK automotive assembler.

The research focus of this report is to investigate the importance of the engineer-supplier-buyer relationship, amongst others, within the framework of a simultaneously engineered project, concluding whether the relationship differs according to the level of design responsibility held by the supplier, and establishing the extent to which a Japanese influence may be seen in the application of SE in the UK.

The most prominent example of this within the UK, is the Honda-Rover Group partnership, which has slowly evolved and matured over the last decade. An ethnographical approach is taken when looking at the development of the Rover 600 / Honda Accord, and inferences are made as to supplier relations, in general, within the industry.

Key Words:
Automotive Industry, Rover Group, Simultaneous Engineering, Supplier relations

DEDICATION

- To my family -

for their love, support, and fellowship

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SECTION 1.0 INTRODUCTION

Mention World Class Manufacturing, and the Japanese instantly spring to mind. In Japan a supplier's relationship with a core firm appears to be one of trust and long term commitment. It is this relationship which the West is currently trying to emulate because it has seen its success in Japan. It is necessary therefore to understand what exactly makes the Japanese so successful, and to establish whether their approach is desirable and transferable between the Japanese and British cultures.

The study focuses on the methodologies adopted by the UK Automotive Industry and the extent to which these have been influenced by the Japanese.

The 'Japanese Model' is a term coined to collate the idealised views of the Japanese way of conducting business. Their apparent advantage is attributed to the way in which the Japanese utilise their cultural tendencies, and values of every day life, with application to the work place. An understanding of the 'Japanese Model' as seen within current literature, was investigated, with particular consideration given to its application within the automotive industry. Where appropriate, aspects of the model are supported by real-world observations which were collected during the data collection period of this work.

1.1 Japanese Culture

The 'Japanese model' has been intrinsically linked to the cultural tendencies of society within Japan. Culture was described by Tayeb (1988: p. 42) as:

> "... a set of historically evolved learned values and attitudes and meaning shared by the members of a given community that influences their material and non-material way of life."

Geert Hofstede (1984: p. 21) offered a similar definition, seeing culture as:

> "...the interactive aggregate of personal characteristics that influence the individual's response to the environment".

Culture is seen here to form a group's identity in much the same way as personality depicts the individual. Tayeb drew on Hofstede's work to compare English and Indian cultures. He concluded that colonial links affected attitudes in the work place, but not in the social context, indicating that people may adapt their responses to stimuli according to their social settings.

Hofstede derived 5 indices describing cultural characteristics based on his world-wide study on IBM employees. Comparisons of the relative rankings, of the UK with Japan, are shown in Table 1 and are discussed below in more detail.

Characteristic	Range (Average)	Japan (Ranking)	United Kingdom (Ranking)
Power Distance (low - high)	11 - 94 (51)	54 (21/41)	35 (30/41)
Uncertainty Avoidance (low - high)	8 - 112 (64)	92 (4/41)	35 (34/41)
Individualism - Collectivism	12 - 91 (51)	46 (22/41)	89 (3/41)
Femininity - Masculinity	5 - 95 (51)	95 (1/41)	66 (8/41)
Short-Termism - Long-Termism	0 - 118 (n/a)	80 (4/23)	25 (18/23)

Table 1 Hofstede's 'Culture's Consequences'

(a) Power Distance

Power distance is a measure of how an individual views the 'power status' of his boss in relation to that of the individual. A high score shows that there is an increased awareness of the difference in the levels of power between the manager and his subordinate. On average a Japanese worker is more likely to focus on this aspect than a British employee; evidence of this characteristic may be seen from the way that the Japanese alter their greeting bow, depending on the status of a dignitary.

(b) Uncertainty Avoidance & Individualism Vs. Collectivism

These two characteristics are complementary to each other. A high uncertainty avoidance score and a low individualism/collectivism score shows a dislike of risk taking, with the responsibility to the individual being lessened when decisions are made within the context of a group setting. This profile matches the scores of the Japanese and has been seen to exist within Rover-Honda meetings (Purchasing Interview, AL8) where Rover employees were far outnumbered by their Honda colleagues. In contrast the British score shows that the UK work culture exposes a preference for individualistic challenges.

(c) Masculinity - Femininity

Although the UK is only a few positions behind on the masculinity scale (provider, company motivator, high ego), it displays only 2/3 of the Japanese score for these traits, indicating that the British are more likely to portray a nurturing 'feminine', societal role, relative to the Japanese.

(d) Long-Termism / Short-Termism

The last and newest development of Hofstede's work was the application of the time-frame orientation. The Japanese were shown to adopt a longer term outlook in business whilst a shorter term orientation has been attributed to the British. Evidence of this Japanese characteristic may be found, for example, by looking at lifetime employment policies, where employees tend to work for a single company for the whole of their working life. Promotions are then given both in line with other employees of the same intake year, and as a reward for achievements. In contrast the British worker often moves companies as a means to gain promotion (Quinn *et al*, p. 356). Toyota's announcement in January 1994 shows that this element of the model is beginning to be eroded; Toyota assigned a limited number of designers to yearly contracts, with renewal being reliant on performance (Anon, Economist, January 29, 1994).

British companies are perceived to pay more attention to return on investment figures and short term paybacks (*i.e.* for shareholders). Japanese companies however, have stronger relationships with their banks due to their Keiretzu relationships, often having a 'friendly' bank manager sitting in on company board meetings. Because financial institutions take a more active interest in a company's business decisions, organisations are able to take a longer term perspective in their business outlook because the banks are supportive, confident in the security of the loan, and less concerned with a fast return on investment because any returns would be seen elsewhere within the Keiretzu group (Agenda, 1992).

Hofstede concluded that "organisations are culture bound" in as much that any national culture had more influence than a company culture, as he found little evidence for an

'IBM culture' existing across national boundaries. Implications for Japanese transplants in the UK are that any Nissan, Toyota and Honda company culture should be carefully nurtured to ensure that it becomes compatible with the cultural characteristics of people in the UK. Organisational success for the transplants will only become evident if their structures match the culturally derived expectations of their members, which in Japan are, according to De Bettignies, derived from history and family structures (Tayeb, 1988: p. 4,34). Although cultural differences were exposed, the two national cultures were never at extreme poles of Hofstede's scales; perhaps this is why the general business trends in favour of Japanese styles of management have been integrated well into some European and American organisations.

Ensuring that the people fitted the culture had much to do with the thorough 'head hunting' approach to employee recruitment undertaken by the transplants to employ those who would 'culturally' be able to work (and thrive) within such a work environment (See Wickens, 1988: p. 170). Hofstede's indexes are *averages* for each country, implying that people already exist within the UK who will respond more naturally to the Japanese style of management. Taking the thoughts of Ouchi (1981: p. 71) the transplants could be said to be a British version of a "Theory Z" organisation which is a hybrid of British and Japanese management styles.

The UK based Japanese car assemblers are Toyota (Derby), Nissan (Sunderland) and Honda (Swindon); these were encouraged by invitation from the UK Conservative Government, to locate in the UK in the 1980's. A European base for manufacturing was necessary to gain greater access to the European market, take advantage of lower wage costs and to enable a higher through-put into the market which did not exceed E.C. import restrictions. In reality however, the role of these Japanese transplants may be said to be to gain greater marketing knowledge and enjoy the benefits of local production whilst the major design/engineering responsibility remains within Japan, as will be shown later with the Honda Accord.

The Japanese transplants in the UK may be viewed as multi-national companies as they are dominated by the 'home' (Japanese) culture with only minor adaptations to 'UK-isms', although they are moving towards global strategies as devised by Ohmae (1992).

Jones (1991: p. 18) finds in favour of the need for the adaptation of Japanese company practices within the UK. She refutes 20 conceptions which have been built up around the Japanese. For example, a Japanese in a 3 year stint in the UK may actually put his short term personal agenda ahead of the company's longer term future as he has such a short time to make a success of his stay and must show results in this time (possibly the first time that he is viewed as an individual rather than a member of a group). Another claim she makes is that because there is a low percentage of Japanese in the UK transplants, consensus decision making is not practised. Personal views are that the British have adopted a greater use of the 'team' concept and use this to aid the individual decision maker. Ironically, it appears that the UK have also adapted the Japanese, for example in an appreciation of non-company dominated leisure time.

Ruigrok *et al* discuss a split in international policies throughout the world car industry. They state that where Honda enforces a 'globalised' strategy, gaining competitive advantages by integrating, on a world wide basis, its business activities (Ruigrok *et al*, 1991: p. 5), Toyota and Nissan are 'glocalised', that is, geographically concentrated with "decentralised but integrated production, R&D, distribution, *whilst* producing for local markets" (p. 2). Kidd & Teramoto (1992) would argue however that the Japanese transplants are Regional HQs acting as localised filters of complexity from Japan within a general globalist policy. In reality the new Honda Accord may be said to match the 'glocalisation' theory due to the fact that three vehicles were derived from one platform for the Honda Japanese and Rest of World markets and the R600 which maintains a British focus.

1.2 Characteristics of a Japanese Organisation

Strategy - 'Quality' is now perceived to be the minimum business qualifier for any organisation within a competitive market. The emphasis is towards having lean, flexible, decentralised organisations, and empowered, consensus seeking employees (Beddowes, The Independent, May 5, 1993: p. 25). Managers are forced to consider the longer term implications of decision-making, having to take a perspective on 'the global economy' within an environment of increasing levels of 'openness' and standardisation and quickly changing legislation. It is to the Japanese that the world turns to set the 'rules of engagement'; the danger is, however, that they may become victims of a self defeatist cycle of rationalisation, which may lead, in the future, to the return of price competition (Anon, The Economist, October 16, 1993: p. 89). As the level of rationalisation and commonisation increases, it will be more difficult for customers to differentiate between products, meaning that price to that customer will be the main focus of competition.

Organisations - Japanese organisations tend to be well disciplined, defined and methodical in their implementation of processes. Their attention to quality is well known and is aided by standardisation and the controlled manner in which they make changes and improvements.

People -The Concise Oxford Dictionary (1990) defines flexibility as being "...adaptable (to circumstances); manageable". It is now being realised that flexibility may also be applied to organisations, machinery, processes and work forces, and affects both the design and manufacture of products. The Japanese popularised the 'flexible work-force' by investing in their people, making them multi-skilled "super-operators" (Mueller, Industrial Relations Journal, 1992; Wickens, 1988) although cynics would say that this was by de-skilling the task (Garrahan & Stewart, 1992). As discussed in Section 1.1 there is an element of security for the worker, in terms of life-time employment. Other aspects are trust and empowerment of the worker(s) so that those closest to the task are able to make decisions affecting their work area. This is within the framework of consensus decision-making and will include all the relevant parties.

Process & Tools - The Japanese have created flexible machines which are able to process tasks for different models. In addition, by reducing the changeover times for tools, the same applies. However, Williams *et al* (Business History, 1993) show that Ford developed "multiple tooling" and minimised set up times dramatically during the manufacture of the Model T. They go on to state that many other attributed 'Japanese' techniques were being developed by Henry Ford and Walter Chrysler (Ziemke & McCollum, 1990) and Womack *et al* (1990).

Flexibility in work schedules is the product of another of the Japanese philosophies to eliminate waste (muda) and prevent excess (muri) or unevenness (mura). These values coincided with the literal need to conserve resources derived from the state of the Japanese economy post World War II, and during the oil crisis in particular.

Devised by Taiichi Ohno, Toyota's Vice President, Just-In-Time (JIT) in combination with a kanban system allows a reduction in costly inventory as goods are manufactured in response to a demand pull from the next 'customer', allowing early detection of problems (high-lighted by statistical process control (SPC) and ensuring that quality is maintained). JIT has been aided by 'kaizen', continuous process improvements; machine changeover times have been drastically reduced, allowing goods to be made in smaller quantities in response to demand (Schonberger, 1982; Monden, 1983). In addition, cellular arrangements of machinery are used so that they can be administered by fewer people, each of whom must be flexible in their ability to work with the machines.

The simultaneous engineering (SE) design methodology has been adopted to ensure that as the design develops, the ease of manufacture is also considered; this usually includes the involvement of suppliers and is covered in more detail in Section 2.2.

1.3 The Japanese Model

The Japanese model consists of elements which affect their culture, organisations, people, processes and tools. The progressive nature of their products is achieved through the engineering design cycle so that the next generation of products are of higher quality and lower cost than the previous generation. It is the evolution of the product, the involvement and management of the supplier within this process which forms the focus for the remainder of this thesis.

SECTION 2.0 JAPANESE BY DESIGN

The product development process in the automobile industry is said to consist of four separate units (although they now overlap via the simultaneous engineering approach); these are "... concept study, product planning, product engineering and process engineering" (Clark & Fujimoto, Journal of Engineering & Technology Management, 1989: p. 27).

2.1 Traditional Engineering Approach

In the US car industry in the 1950's the need to innovate was almost forgotten amidst the rush to compete "through style, advertising and price" (Abernathy *et al* in Ziemke & McCollum, 1990). This in turn facilitated the decline of inter-departmental co-operation between divisional managers and helped to build up the walls between functions. Gone were the benefits of 'talking' to all the major functions as pioneered by people such as Henry Ford, although Ford acted as a 'leader' as opposed to using the team concept (Ziemke & McCollum, 1990). Management texts state the need for 'gurus' to help drive the business, but unlike in Japan, the British train as 'specialists' rather than gain broad expertise in many areas, which would aid the Japanese-like addiction to teams.

Traditionally product life cycles were viewed as end-to-end, linear processes where-by product concepts were derived by marketing and passed to the design engineers who then 'threw' the design over the wall to production engineers to design the manufacturing process. Finally the product was built by manufacturing, sold by the sales people and the money was collected by finance (St. Charles, Automation, 1990). The whole process took longer because each 'step' had to be completed before the next could start, and when problems were found, much of the 'finished' previous step was influenced by the redesign (see (a) in Figure 1). The product engineer was very insular, with apparently little consideration as to the implications of their design on the manufacturability of the complete assembly. This was demonstrated when talking to one design engineer at Rover who told of problems which he'd encountered with one of his own designs when he was temporarily moved from product to manufacturing design (Engineering Interview, AL21; Agenda, 1992, 1993; St. Charles, Automation, 1990; Vasilash, Production, 1991).

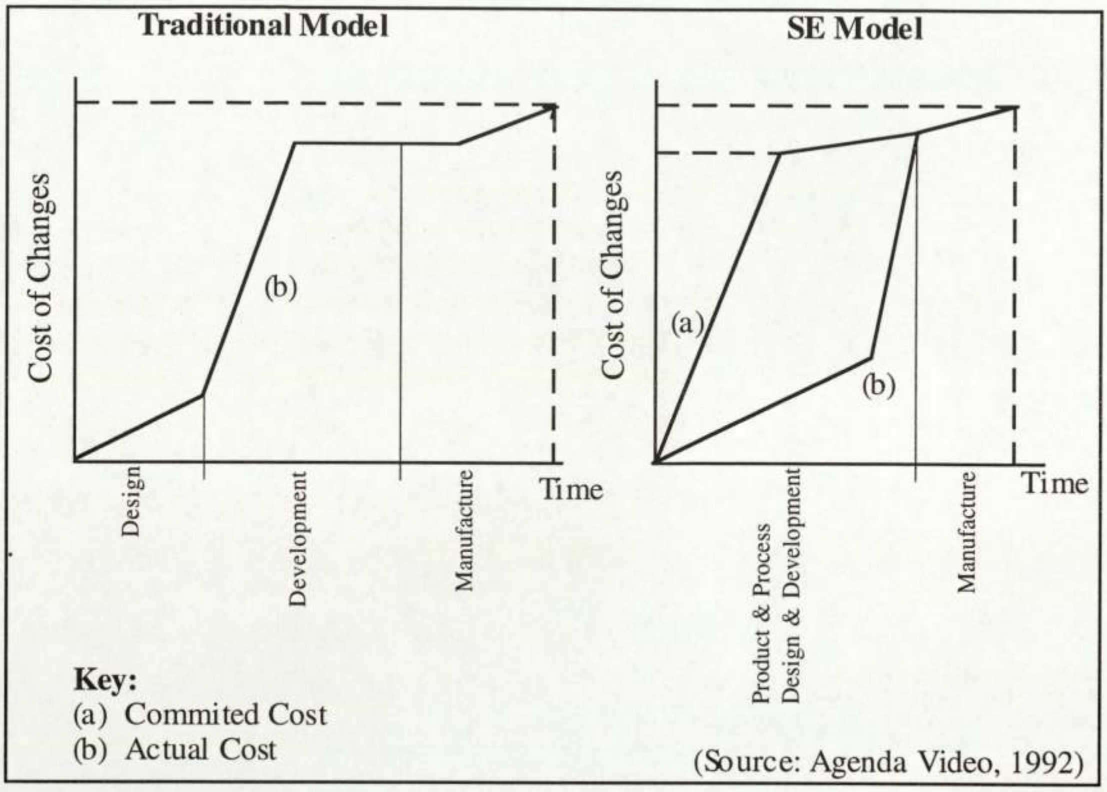

Figure 1 Cost of Development - Traditional and SE (*adapted*)

2.2 New Model - Simultaneous Engineering

Simultaneous Engineering (SE) [or concurrent engineering (CE)] "crosses functional boundaries and encourages the development of multi-functional teams to improve the speed and the response of the (design) process" and involves a 'step-change' approach to design (Agenda, 1993). Generally the 'core team' consists of representatives from purchasing, design and development, logistics, manufacturing, manufacturing engineering, sales, marketing and other 'guests' where appropriate, all working to a tightly defined plan. Because the relevant areas are involved and interact for the duration of the project it means that less change is required later in the development cycle after tooling has been commissioned. Relatively few commentators make the link between SE and its impact on the supply base *e.g.* Vasilash, Production, 1991. For automotive manufactures, suppliers are an integral part of the engineering process because the OEM may not chose (or have the ability) to undertake the engineering of one of their components.

By involving departments as early as the concept stage the designers are then able to accommodate the needs of the other functions, and use the continuous feedback provided by them, to produce more accurate designs within compressed time scales than was possible under the old method (St Charles, Automation, 1990).

SE allows flexibility to be incorporated at the design stage, and because the total design phase has been reduced, it is now possible to tailor design specifications closer to the date of product launch and actually start the design process later. Approximately Eighty-five percent of product cost is determined at the design stage and so it is advantageous to ensure that this money is being spent in the most cost effective manner (Agenda, 1993).

It is not difficult to appreciate the cost savings which materialise by being able to 'fix' a problem at the preventative 'paper' stage, rather than at the reactive 'full production' stage when expensive machinery has already been purchased; Non-quantifiable emergent properties are also seen to exist, such as employee satisfaction (Project Management Interview, AL14).

Figure 1 shows that in the traditional model engineering changes occurred later in the product development cycle, at a stage when costs had actually been realised. In the SE model however, there is a difference between the percentages of committed and actual cost, with most engineering changes being corrected at the committed cost stage.

One of the benefits of using suppliers to undertake a greater proportion of design for themselves is that it reduces the impact of time constraints on the core firm. This is because, as a dedicated component manufacturer, the supplier is able to devote resources to its one specific area of expertise rather than having to compete against other component areas within the core firm. Hence, designs are more likely to be cost effective and less likely to deliver poor quality due to project time constraints (Guy & Dale, International Journal of Purchasing & Materials Management, 1993).

The time differences associated with the traditional and new (SE) methods of product development are shown in Figure 2, although these vary according to the author and the case study. Engel (Manufacturing Systems, 1991: p.36) states a reduction from 24 to 14 months in developing an automation system for engineering. Within the automotive industry the reductions seen have been from 7 to 4 years (Stinson, Machine Design, 1990), with the '94 model year Honda Accord taking 4 years to take to market (Armstrong, Business week, 1993). Reasons for time savings from SE are discussed further in Section 2.2.2.

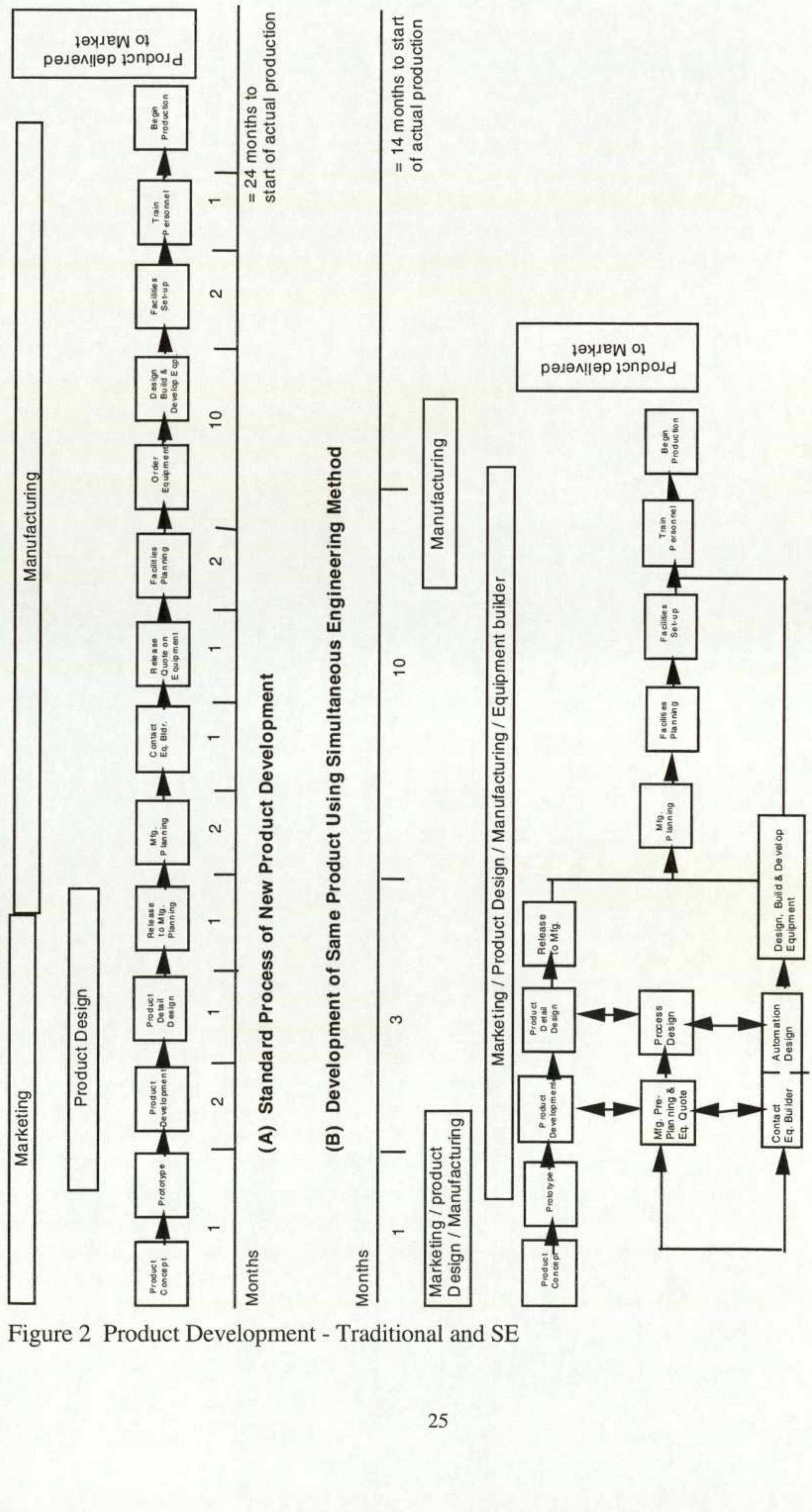

Figure 2 Product Development - Traditional and SE

Organisationally SE is aided by a business unit type formation of people who are then able to network both within their own group to other business functions, as well as with their contemporaries within other business units. It is possible (and has occurred) that projects succeed via SE regardless of organisation formation. SE is an evolving partner to the quality concept of 'every one in the value chain is your customer'. Customers are both upstream and down stream, which means that unless all members work together as a team, opportunities are missed. For example, the power train design unit is the supplier of an engine for the overall car, to meet the requirements identified by marketing and the whole team. Unless Marketing know of potential opportunities in design innovation (*i.e.* a customer of engineering R&D) they cannot gauge the response to any new ideas in the market place.

The mission statement of concurrent engineering could be derived from St. Charles as being:

> " ...To effectively and efficiently design a product via a route of integrating and crossing of functional boundaries so that people, knowledge and other resources, satisfy and exceed customer needs with respect to reduced lead times, cost and quality targets...."

Simultaneous engineering may be summarised as being the design of the manufacturing process simultaneously to the product design, including the integration of the supplier's engineering work into the wider engineering responsibility of the core firm. Discussion with Rover employees showed that although there is an appearance of simultaneous product and process design, in actual fact Honda concentrate on only one aspect at any time and quickly iterate any design loops to ensure that all core team members are happy with the engineering proposal (Director Interview, AL13). This is implied more fully in the following discussion.

2.2.1 Problem Solving

Clark and Fujimoto (Journal of Engineering & Technology Management, 1989) state that the Japanese advantage is derived twofold from the areas of planning and engineering lead-times.

At the planning stage each area of responsibility undertakes its own short problem solving cycles, which are integrated horizontally across the design programme to ensure that cohesion between the different commodity sections of the vehicle exists. Trade-offs then occur to ensure that the optimum solution for the whole vehicle is reached.

The horizontal links mean that when the engineering starts in earnest, problem solving takes on more of the form of 'doing' and therefore a greater inter-functional relationship is formed to integrate vertically each of the individual 'steps' in the design process. This ties in with interview material gained with a project manager who felt that the 'doing' started too early in some cases. It is vitally important to *talk* to suppliers as early as possible as resources are wasted if requirements are not exact before expensive tooling *etc.* is produced (Project Management Interview, AL14).

2.2.2 Aids to SE

Although pilot schemes of SE have successfully been implemented in isolation from the 'normal' business flows within organisations, there are several factors which would greatly enhance the effectiveness and ease of projects. Validation of project goals should be seen to be compatible within the organisation's strategy. For example, product line workers should feel that they will be listened to with respect to problems in manufacturing the product, even though this may have implications in redesigning certain aspects of the product and process. This feedback channel should be actively encouraged as suggestions for possible solutions are quite likely to come from the people who are the closest to the job. It is all part of being an 'empowered' employee; within Rover, ideas are captured by the means of the 'Bright I's' suggestion scheme.

In addition to the team approach to design, many tools and techniques are now available to aid the design process. Presently these include QFD[1], value analysis and value engineering, CAD/CAM[2], SPC, DFM, DFA *etc.* The 'new-age' of SE includes 'clever' "decision-support systems, advanced solid-modelling capabilities, expert-based manufacturing systems, parametric element processors, automated inspection and quality-assurance software" (St Charles, Automation, 1990).

Technology aids flexibility because it allows quick analysis of alternative scenarios, without the need to manually redraw and pass back and forwards design changes.

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1 QFD - Quality Function Deployment

2 CAD - Computer Aided Design; CAM - Computer Aided Manufacture; SPC - Statistical Process Control; DFM - Design For Manufacture; DFA - Design For Assembly

CAD/CAM will automatically update interconnecting parts and keep a record of those changes for future projects.

Cynics exist regarding the 'simultaneous breakthrough', not because they disagree with the concept, but because they see it as something which has been around for a long time and is "...nothing more than old-fashioned teamwork and common sense enhanced by modern technology" (Engel, Manufacturing Systems, 1991: p. 36).

The contribution of IT in reducing the burden of labour intensive activities (drawings, the ability to produce 3D models in short time scales and the use of simulation packages for component and vehicle testing) and as an aid to communication (e-mail) should be recognised as running concurrently to the implementation of SE across the world.

2.2.3 The Role of Purchasing

Previous references to buyer-supplier relationships have failed to indicate the importance of the role of the buyer (purchasing agent) in the design function. The Purchasing Department is responsible for the nurturing of the relationship between the various internal departments and suppliers and is the gatekeeper to much valuable information.

Buyers traditionally were the people who squeezed low prices from suppliers. Industry today sees a higher level of integration between the engineering and purchasing functions within organisations, ensuring that all aspects of a supplier's business are considered prior to the placement of new business with a supplier. Even when involved in a single sourcing strategy, buyers will be aware of the state of the industry as a whole. One issue that no-one quite agrees on is the level of engineering knowledge necessary for a buyer to have in order to understand some of the more technical issues. Some companies actively recruit engineers into purchasing whilst others maintain the business/technical balance by ensuring that open communications and team work, which should exist in the SE environment, are evident.

One hurdle to overcome is the 'paper pusher' view of purchasing which is held by (some) engineers (Burt & Soukup, Harvard Business Review, 1985; Guy & Dale, Journal of Purchasing & Materials Management, 1993). One way around this is to give engineers a stint in purchasing which would be a two way learning experience.

Supplier Development Teams are also part of the Purchasing department; they act as 'free consultants' to the supplying firms to ensure that the supplier is a viable option and high-light areas for improvement, which are then explored in more depth with the technical knowledge provided by engineers. It is also the purchasing/supplier interface which will influence the supplier's views of the costs and benefits of the SE effort, as many remain sceptical about the real benefits to themselves (Guy & Dale, Journal of Purchasing & Materials Management, 1993).

2.3 Supplier Environment

The working relationship between supplier and OEM has changed. In order to gain the maximum benefits from a SE philosophy it has been necessary for OEMs to review their relationships with their suppliers. SE demands high levels of communication and often includes the sharing of commercially sensitive information. Greater integration between the OEM and supplier also means that both sides need to commit to a level of resource which can support such an initiative. The following sections explain the policy options for supplier management available to the OEM and the reasons why this environment has evolved to one of greater co-operation and trust.

2.3.1 In-House Vs. Out-Sourcing

Within the automotive industry a high level of out-sourcing, as opposed to in-house manufacture of components exists. The reasons for this are because great cost savings may be realised because suppliers generally (are perceived to) have lower wage costs, and greater economies of scale than vehicle assemblers, and potentially greater expertise (Mahoney, Strategic Management Journal, 1992; McMillan, California Management Review, 1990).

For Rover the in-house/out-sourcing decision is very rarely made because it is not as vertically integrated as either Japanese, through Keiretzu, or American organisations. One of the exceptions, however, was a recent investigation into the possibility of out-sourcing seat manufacture in order to achieve the higher yield levels achieved by suppliers. In this particular instance, a Quality Action Team (QAT) was established, with the aid of suppliers, with yields at Rover being increased to such levels that the proportion of business historically made by Rover was maintained within-house (Purchasing Interview, AL6). Rover currently faces other out-sourcing decisions in the areas of software specification with a supplier verses writing software in-house. Currently Rover only has an active role with software code for engine management systems; BMW write most of their software in-house, with electronics suppliers being either a hardware designer or a build to print manufacturer, and will possibly influence Rover in any decisions.

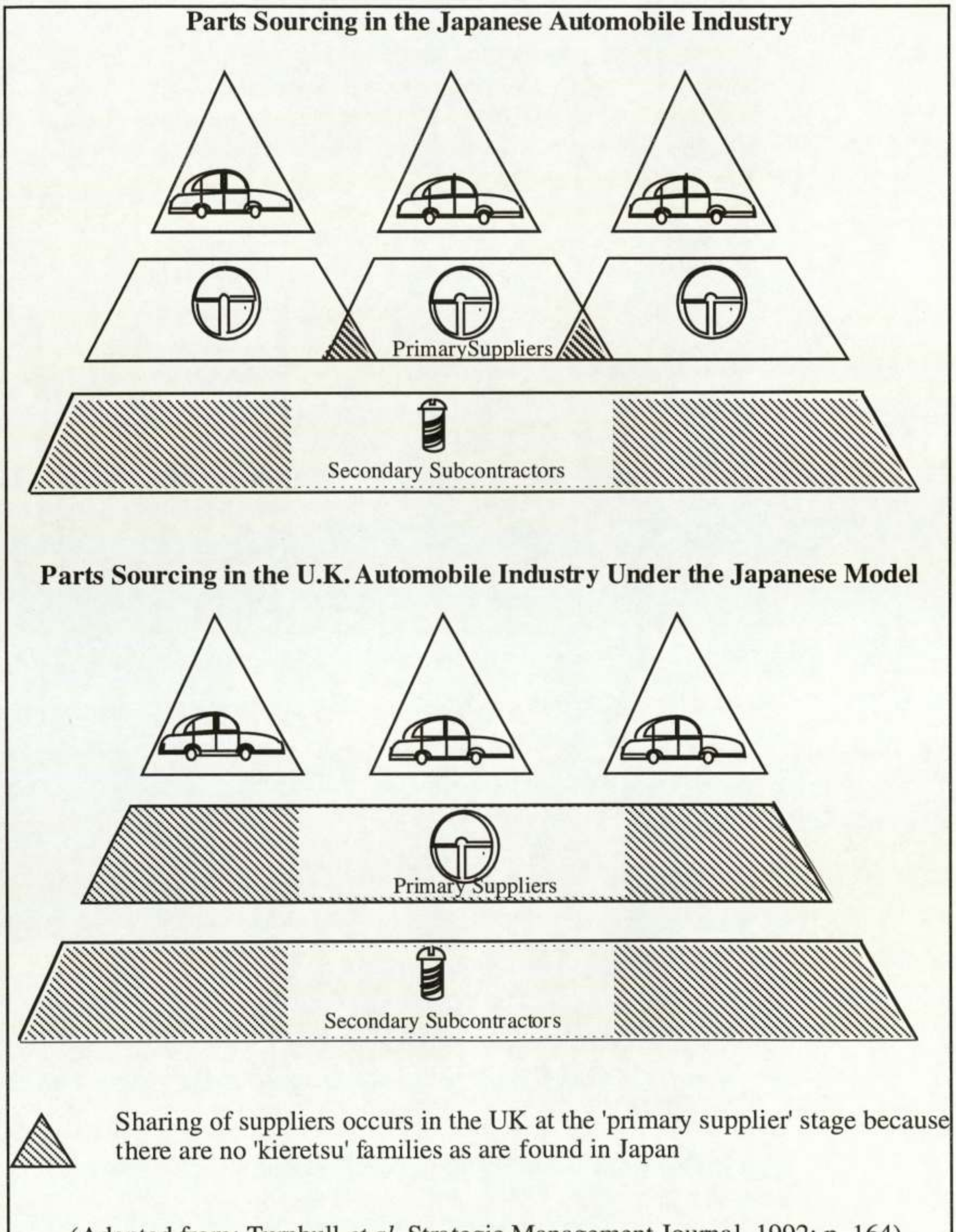
Regardless of the in-house, out-sourcing dichotomy the manufacturer is seen as head of a networked system of suppliers, with less contact at the lower levels and greater contact with an ever decreasing number of first tier suppliers; this has implications for supply chain management (see Figure 3). It is in fact ironic that in the same business environment as organisations are becoming leaner, reducing levels of management *etc.*, manufacturers are building up the formality of communication flows through to the second and lower tiers of their hierarchy. Some, such as Nissan, refuse to contact these suppliers directly and will not even help with their 'supplier development teams' unless there has been a specific request from the first tier supplier (Nissan Interview, AL17).

Hines (1994) introduces the 'interlocking network sourcing model' which builds on the 'alps structure' displayed in Figure 3. Hines observed that a supplier who is at the top of a peak in its own industry may be a first, or even a second tier supplier if an "inter-mediatory sub-assembler" is used to front the relationship with the automotive assembler.

Given that an out-sourcing decision has already been taken, the manufacturer is able to distinguish between several different types of relationships with the supplier. Many firms undertake gruelling analysis of the total 'business viability' of potential suppliers (such as Rover's RG 2000 explained in section 3.3.2) with the aim of being able to track the improvements made by suppliers over time. The out-sourcing decision does not totally eliminate the possibility of the core manufacturer also supplying the same components from 'in-house' capabilities.

2.3.2 Single, Parallel and Multiple Sourcing

The British car industry has traditionally relied on multiple sources for its supply of components. Historic reasons were poor industrial relations where a number of a manufacturer's suppliers could be out on strike at any one time. New and Myers (in Turnbull *et al*, 1992: p. 161) state that for the average UK manufacturing firm in the mid-1980's, out-sourcing accounted for over 50 per cent of total costs. It is remarkable that manufacturers allowed an area of such critical importance to fester amidst the adversarial relationships which existed between the manufacturer and supplier, as each aimed to gain at the disadvantage of the other.



(Adapted from: Turnbull *et al*, Strategic Management Journal, 1992: p. 164)

Figure 3 Hierarchy of Suppliers

2.3.3 Multiple Sourcing

Multiple sourcing meant that it was relatively easy for a manufacturer to carry out a threat of switching supplier and this was used as a means to ensure that the lowest price was obtained. Multiple sourcing is in fact a way of ensuring a technological spread across the industry as short term (often yearly) contracts allowed a continuous round of price bargaining to exist (McMillan, California Management Review, 1990: p. 46). There was a fear of becoming locked in to a supplier who could then enforce price rises on to the manufacturer *ad infinitum.*

It is not surprising then that variability between components supplied by different (and the same) organisations was high, and that it was necessary to inspect incoming parts and ensure that stock levels were maintained in the event of supplier failure to deliver usable parts. However, the total cost of ownership of maintaining relationships (Ellram, International Journal of Purchasing & Materials Management, 1993) with so many suppliers was either ignored, (as manufacturers were incurring many times the number of 'set up' costs of tooling, without the associated economies of scale from dealing with only one supplier) or the risks associated with using only one supplier were considered to be too high.

2.3.4 Single-Sourcing

It is generally assumed that the Japanese Manufacturing Model incorporates a single sourcing policy which is in line with Dr. W. Edward Deming's Fourteen Points (Deming, 1986) to reduce variation and maintain long term relationships (Richardson, Strategic Management Journal, 1993: p. 342). However, some would go further by saying that even if you are sourcing from only one supplier, if the product is being delivered from multiple locations, then this could be as costly as sourcing from more than one supplier because production would be via different processes (Anon, Total Quality Management, 1990).

Popular management writers (Porter, 1985) have, in the past, disagreed in favour of the competitive advantages realised from multiple sourcing. Burt & Soukup (Harvard Business Review, 1985: p. 93) actually go further and say that for each additional supplier submitting a price for a component, prices fall by about 4% for the core firm.

The ideal of single sourcing is that by nurturing the relationship with only one supplier per component you enable a high degree of trust between the buyer and supplier, who jointly can develop improved designs and processes. This also means that the buyer organisation feels that they can rely on the supplier for its quality, delivery and business viability, and that there will be no confidentiality risks from incorporating the supplier into the design process at an earlier stage.

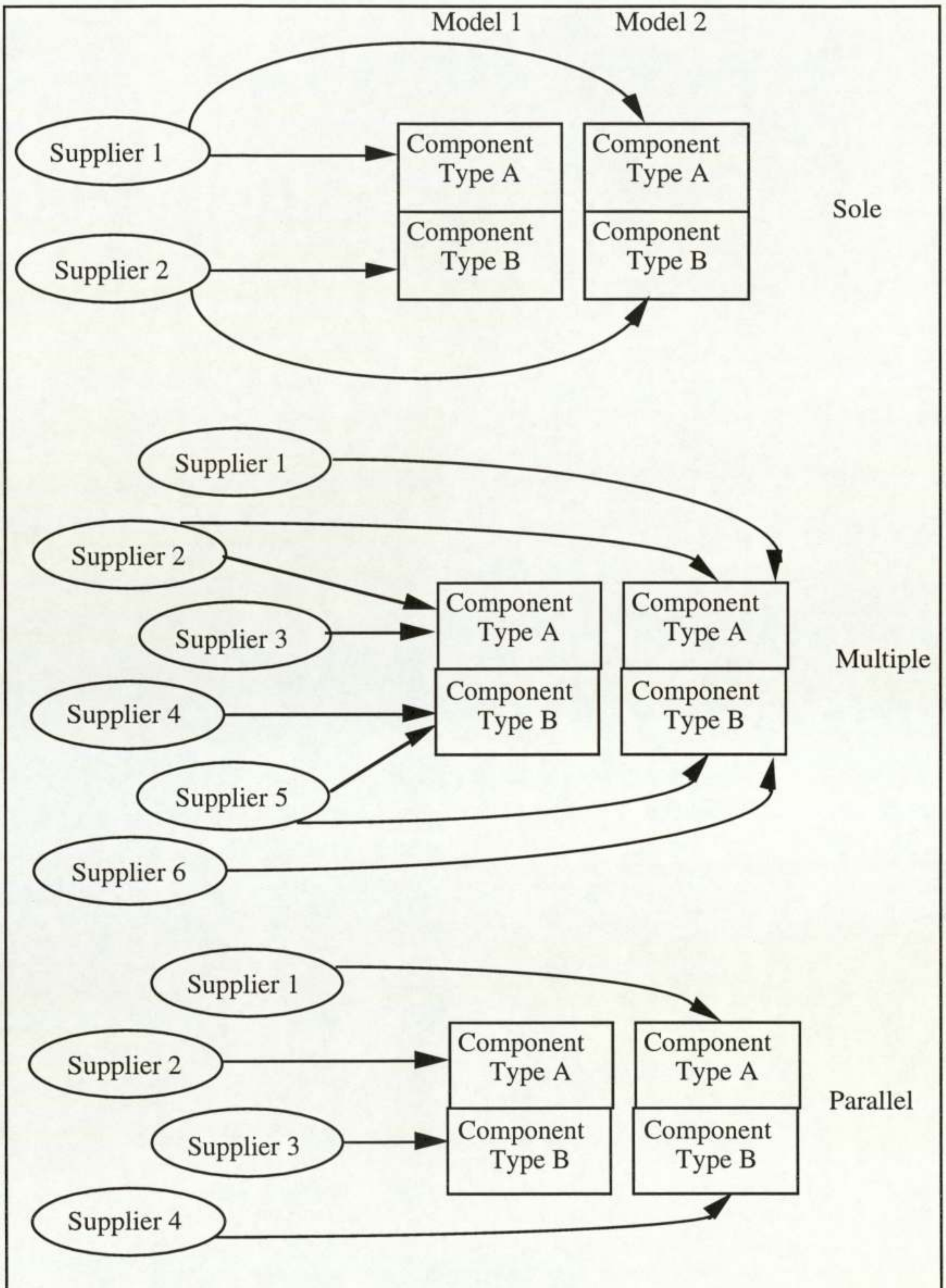
The relationship works both ways because the supplier is virtually guaranteed work on subsequent models and is thus more willing to invest in research and development for future models, becoming proactive to the purpose of design, rather than waiting to be switched on by a new project. Guy and Dale (International Journal of Purchasing & Materials Management, 1993: p. 28) argue that suppliers are more likely to be open about any problems that they may be facing because the core firm faces high switching costs, making it more cost effective to help the supplier with the problem, rather than change to a different supplier. Additional benefits mean that the supplier is more confidently able to plan for its work force and production capabilities although there is a loss of proprietary information (costs and expertise).

For both supplier and manufacturer there is an increase in the cost of maintaining each relationship simply through the higher levels of communication which are required (Cunningham & Homse, 1984), most of which seem to take place on a more personal face-to-face level. However, given that the manufacturer is dealing with a lower number of suppliers (low hundreds rather than thousands) the net effect is fewer, quality relationships (Mahoney, Strategic Management Journal, 1992: p. 559). As higher 'lock-in' occurs the manufacturer is persuaded by the now high transfer costs to ensure that the supplier is still competitive within the market place and often works with their 'preferred supplier' to reduce costs (such as through 'RG 2000') so that the supplier does not abuse its position of reduced supplier competition (Lyons *et al*, Sloan Management Review, 1990; Rogers, Modern Plastics, 1992).

2.3.5 Parallel-Sourcing

Parallel (or dual) sourcing is an alternative which is used by manufacturers such as Toyota. In its simplest form it means that two suppliers are contracted for each part (Rogers, Modern Plastics, 1992, p. 61). A deeper look however reveals that this 'hybrid' relationship offers the advantage of the close relationships which evolve from single sourcing as well as the security from multiple sourcing.

For each car model only one supplier is contracted, but a different supplier is used for a second (or third...) model. The two suppliers compete for shares of business from the manufacturer and this means that the desire to innovate is still present. Toyota insists



(Source: Richardson, Strategic Management Journal, 1993: p. 343)

Figure 4 Sourcing in the Car Industry

that the two suppliers share information with each other so that continuous improvement is maintained. Whilst this must be frustrating for the more efficient firm, it is a signal that if they were suddenly to become the worst of the two firms that Toyota would not abandon them, but would ensure that the other firm helped them to regain competitiveness and therefore survival (Richardson, Strategic Management Journal, 1993). The sourcing strategies are summarised in Figure 4.

2.4 Pricing

Regardless of the number of suppliers chosen, it is clear that there is an industry wide policy to rationalise the number of suppliers within the manufacturer's supply base and this affects the type of pricing policy used by a manufacturer.

Traditionally suppliers were able to increase their prices on an annual basis. There has been a shift of emphasis onto supplier costs (rather than prices) as OEMs try to understand where the cost of each component is derived. Buyers now expect to see cost down due to overhead reductions and increased efficiency within the supply base. A summary of different pricing strategies follows.

2.4.1 Cost-Track/Time Path

Manufacturers 'cost track' components through the development and production phases in a time-path of expected cost savings as expertise increases; Rover's version of this is using a Cost Down Tracking Sheet (CDTS). The idea is to allow the supplier to keep any excess cost savings above those agreed between the two companies so that they are encouraged to improve. This method obviously works best in the situation of good relations and long term contracts with preferred suppliers because a high degree of trust is shown by the suppliers who usually have to show an 'open-book' to the core firm so that areas for improvement may be high-lighted.

2.4.2 Deferred Fixed-Price

Deferred fixed pricing is similar to cost tracking but with a proviso that targets may not be achieved. A cited case regarding an original equipment manufacture described a Ford/ABB contract whereby ABB quoted well below Ford's committed cost reduction of 25-30%. In this case an agreement was made to share cost reductions from a joint value-engineering exercise, deferring a fixed-price, of 10% below the original ABB bid, which lasted for a 3 month period.

The final stage allowed the price to be fixed at a stage where both parties held greater information as to the feasibility of their targets, whether close to the appropriation price or Ford's initial target of 25%. In addition, the option remained for the relationship to be dissolved before higher costs were incurred. In the latter scenario, ABB would still have gained the engineering expertise from the project without committing themselves to an unachievable fixed cost from the outset (Frey and Schlosser, Sloan Management Review, 1993; p. 65).

Rover could be said to adopt a similar approach in their CDTS documentation. A supplier's quote for business may be higher than the Rover team's desired cost target; over the course of the project the supplier will aim to achieve the cost target and the progress is tracked using the CDTS.

2.4.3 Competitive Bidding

This was where contracts are renewed regularly and/or multiple suppliers existed; selection was based on best price, sometimes at the expense of poor quality because OEMs did not have the same level of disciplined focus on quality. This method encouraged variety and involved transfer costs from switching suppliers. Design undertaken by the supplier was associated with high risk because there was a possibility that payback for the work may not be achieved before the contract was terminated by the OEM.

2.4.4 Quotation Analysis

The use of competitive bidding is still fully utilised today when OEMs are undertaking a supplier selection process; cost analysis is just one area of a full 'business assessment' and 'project feasibility' investigation undertaken by multi-disciplined teams within the OEM.

Rover undergoes a cost investigation process when considering suppliers for a project, through the use of its Quotation Analysis Forms (QAFs). Ensuring that costs are interrogated and understood is critical to the success and profitability of a vehicle programme. Rather than being a 'lowest price' decision, as may have been seen in the past, by the time Rover has considered the cost element of a supplier's quotation package, they would have already investigated the wider commercial and engineering aspects of working with each supplier, based on past experiences.

Buyers, with aid from Engineers, Technical Support and Vendor Tooling, aim to understand each supplier's cost base and ensure that any cost comparisons between contenders involve a 'like-for-like' comparison. Cost may be the deciding factor in choosing one supplier over another, but by this stage there is a high level of confidence in the robustness of the supplier's proposal and overall business process capabilities.

2.5 Supplier Incorporation in Design

It makes sense for vehicle assemblers to tap into the supplier's 'dedicated' expertise to design components. The extent to which design is undertaken by the supplier varies, according to the component type, and these have been categorised by various authors as below:

'Black box' design is where the manufacturer provides very broad functional and dimensional specifications for suppliers undertaking component and production design (Cusumano & Takeishi, Strategic Management Journal, 1991: p. 565, Dyer & Ouchi, Sloan Management Review, 1993: p. 61), as "...the OEM can describe what is needed only from a functional standpoint" (Lyons *et al*, Sloan Management Review, 1990: p. 30). These are also termed 'design approved' suppliers by Richardson.

'Grey box' design is where the supplier produces to broad buyer specifications; the "... OEM has an idea of the physical attributes and function of the item, but does not know the details" (Lyons *et al*, Sloan Management Review, 1990: p. 30).

'Blueprint design' or 'design supplied' suppliers exist where the manufacturer provides exact component specifications which are merely manufactured by the supplier (Richardson, Strategic Management Journal, 1993: p. 342). This is termed 'detailed-controlled parts' in Cusumano & Takeishi (Strategic Management Journal, 1991: p. 565).

Where suppliers develop their own standard products Cusumano & Takeishi, term this 'supplier proprietary' which are, in effect, the marketed goods in group VII in Figure 5 Richardson's (Strategic Management Journal, 1993: p. 342) design approved (DA) and design supplied (DS) categories are expanded by Asanuma (Journal of the

	I	II	III	IV	V	VI	VII
	Parts manufactured according to specifications provided by the core firm ("ordered goods")						Parts offered by catalogue ("marketed goods")
	Parts manufactured according to drawings provided by the core firm			Parts manufactured according to drawings provided by the supplier			
CRITERION FOR CLASSIFICATION	Core firm provides minute instructions for the manufacturing process	Supplier designs the manufacturing process based on blueprints of products provided by the core firm	Core firm provides only rough drawings with completion entrusted to supplier	Core firm provides specifications & has substantial knowledge of manufacturing process	Intermediate region between IV and VI ?	Core firm issues specifications but has only limited process knowledge	Core firm selects from a catalogue offered by the supplier
	Design Supplied			Design Approved			
			Quasi Design Approved				
Other Literature	*Blue Print*		*Gray Box*	*Black Box* *			*
EXAMPLE	Small parts assembled by firms offering assembly service	Small outer parts manufactured by firms offering stamping service	Small plastic parts used in dashboard	Seat	Brakes, bearings tyres	Radios, electronic fuel injection systems, batteries	

* - Dichotomy of design approved and market supplied catalogue goods

? - Unsubstantiated by paper

Figure 5 Asanuma's Classification of Suppliers

Japanese & International Economies, 1989, p. 16) who distinguishes between 7 classes of parts and suppliers "... according to the degree of initiative in design of the product and the process."

Little difference is seen in the level of the manufacturer's input into the design of a 'black box' or 'marketed' component (depicted as '*' in Figure 5). A distinction can only be made as to the driver of the design process, whether a specific customer (black box) or the market in general (market good).

If we assume that the supplier serves a manufacturer as a large subset of its total business, at what point does the manufacturer stop becoming a unique customer of a supplier, with tailored design, and remain only the major influence in a supplier's analysis of the market's requirements in general? (*i.e.* the difference between being a market oriented market producer and a design approved supplier (Asanuma, Journal of the Japanese & International Economies, 1989: p. 15)) The distinction can only be made by looking at the type of design undertaken by the supplier **and** the relative level of the supplier's business placed by the core firm.

In the area of design approved supplier relationships a dichotomy exists because the nearer a supplier is to being dedicated to a manufacturer, the greater the likelihood that competitive advantage may be derived by using that supplier (given that their design is innovative) and more tailored towards that manufacturer's needs. However, the smaller the ratio of business compared to that of other manufacturers, the cheaper that innovation will be to a core firm as design costs will be diffused between many firms. The disadvantage of this is that a component will become closer to being more of an 'industry standard, market good', rather than one providing a competitive advantage. It is not surprising therefore that car manufacturers prefer to 'tweak' a supplier's market good to become tailored to their own specific needs.

As suppliers undertake an ever increasing level of design on behalf of the manufacturer, the importance of teamwork within the model of simultaneous engineering becomes evident.

2.6 Summary of Literature Review

The literature review showed that design is considered to be an area of competitive advantage to a manufacturer, particularly as a high degree of cost is determined at this stage. The Japanese appear to nurture their supplier relations through trust and incorporation into the 'wider manufacturing organisation'. This is made possible due to the interface with the supply base, consisting of mainly single or parallel sourcing policies, cost rather than price orientations, and long term relationships, each of which facilitate the SE and team approaches to design.

It is unclear from the literature however, as to the linkages of the various elements of the model. For example, is single sourcing a cause or effect of closer supplier integration in the design process?; is the type of design undertaken affected by (or does it affect) the number of suppliers sourced for a particular part? Asanuma's model suggested that different levels of supplier responsibility for design existed; this implies that a different 'type' of relationship between the supplier and OEM may exist.

SECTION 3.0 METHODOLOGY

3.1 Introduction

Flood and Carson (1988: p. 15-6) discuss methodologies as being concerned with either 'hard' (well-structured, quantifiable) or 'soft' (messy, typically humanistic) situations. They state that methodologies are mostly systematic, that is, concerned with procedural methods to aid problem management, although they may also heavily rely upon systemic, holistic thinking.

The problem area under investigation dealt with human intra- and inter-company interactions and as such a 'soft' approach was needed to aid understanding. As relationships occurred at both a company and individual level, care was taken to establish and maintain the level of resolution, and system of interest for the investigation.

Systems science provided an inter disciplinary framework within which to pursue understanding. As such, systems terms were used to describe the activities, relationships and boundaries of the research. One physical boundary focused upon engineering design methodology and assembly by UK based Automotive assemblers. This choice of industry was made due to the presence of the Japanese in the UK as both transplant and joint venture manufacturers. In addition, many commentaries exist which use the car industry as examples for exploring the Japanese model.

An ethnographical (case study) approach was adopted when considering Rover Group's relationship with Honda. Honda was the first of the Japanese automotive assemblers to locate within the UK. Access to all of the transplants was limited (although two Nissan interviews did take place) but the opportunity of talking to key Rover employees and their experiences with Honda was more readily available.

3.2 Rover Group

In 1877 the partnership between John Starley and William Sutton was formed to manufacture Penny farthings. Having been used as a name for one of their tricycles, in 1904 'Rover' was first associated with a car. This name has been miraculously preserved for use in the 1990's, having survived the many mergers which form the history of Rover Group.

3.2.1 The Honda Relationship

In 1978 a strategic alliance was signed between the then BL Limited and Honda for the limited licensing of what became the Triumph Acclaim, built from Honda Accord kits sent from Japan. This provided Rover with a quality vehicle to enhance their product range and Honda, who was still a relatively small player in the industry, an opportunity for a stronger foothold in the European market.

In 1984 the Rover 200/Honda Ballade were built at Longbridge. In this programme Rover was able to make limited changes to the design of the vehicle to ensure that European styling was achieved. The first joint development came in 1986, with the launch of the Rover 800/Honda Legend (Project XX) and this did much to enhance the working relationship between the two companies and Rover's understanding of Honda's stringent adherence to standards of quality due to the fact that each company built cars for the other partner. The Rover 200/400 project of 1989 (Honda Concerto) increased the levels of joint development and co-production and included the cross-sourcing of components. In 1990 the relationship was such that a 20% share exchange was made between the companies indicating the level of success and achievements made in the 10 years of the partnership.

3.2.2 Simultaneous Engineering Within Rover

Simultaneous Engineering within Rover is evident for both Honda led and Rover led projects. At Solihull the first SE programme for the Discovery was conceived, without any Honda intervention; the programme was delivered on time, to budget, and in a little under 3 years through the use of Simultaneous Engineering (Elsey, 1992).

The Rover 'D-Phase Philosophy' (adapted from Rover Group, 1992 in Figure 6) provides a summary of product and process quality maturation during the SE development of a vehicle. The milestones provide a consistent approach across the organisation as to the requirements at each stage of the development cycle. As a tool, the philosophy remains flexible, allowing each project to adapt to its individual requirements within the framework. For example, a completely new vehicle may have two D-02 builds, with several months in-between, to ensure that as much confidence as possible is gained early in the project before moving to the next stage.

Core teams are the forum by which functions are able to keep track of what is happening within the engineering sphere and comprise of the key players from engineering, suppliers, purchasing, manufacturing *etc.* for each project.

PHASE	PURPOSE	SIGNIFICANT ACTIVITIES	SUPPLIED ITEM MANUFACTURE	SUPPLIED ITEM STATUS
D0	Product feasibility	Style ratified product development specs produced Cost packs produced inc QAFs Simulator builds	Prototype	Function, material & dimensions to drawing Prototype submission reports
D-01	First prototype Functional test Design confirmation of long lead time items	Prototype component & vehicle testing Commence manf & logistics planning	Prototype	As above
D-02	Second prototypes Functional testing Design confirmation of remaining items	Prototype component & vehicle testing D-01 concerns addressed Review manf & logistics planning	Mainly prototype Long lead time items tooled	As above
D1	Final engineering stage Product validation off production tooling	Component & vehicle testing Function & reliability performance confirmation First product built on line D-02 concerns addressed Complete manf & logistics planning	Off production tools	Functional, material & dimensions to drawing Sample inspection of tooled features 100% inspection of any non-tooled features SCSR[1] D1 report complete
QP	Rover manf & assembly development Fit, finish & function Confirmation off tools & process	Cosmetic standards agreed Fit/finish programme complete Mould graining commenced RG process development Product off full RG facilities D1 concerns addressed Production packing/pallets used	Off full production tools & processes	Sample inspection of function material & dimensions to support SCSR QP completion Cp scope agreed/commence Off tool engineering Spec tests begun Control plan complete
M	RG manf & assembly development Fit, finish & function Complete off tools & process	RG facilities commissioned & capable Cosmetic standards achieved Grained moulding fit/finish complete Reliability targets achieved QP concerns addressed production cycle times used Production logistics used	Off production tools & processes & cycle times	Sample inspection to support SCSR M build completion Off tool engineering spec test complete Cp studies continuing
Adv Vol	RG manf & assembly infrastructure operational Continuous production & rate of climb begun	Volume build standards achieved production/maintenance training complete M build concerns addressed All concerns resolved	Off production tools, processes & cycle times Satisfactory Cp status	Sample inspection to support SCSR adv vol completion Cp studies complete status satisfactory
Vol Prod	Customer product build from full production system Production rate climbing to planned maximum	Continuous improvement activities underway	Off full production system	SCSR fully complete to vol stage Full volume process capability underway

Figure 6 Rover's D-Phase Philosophy (Rover Group, 1992)

[1] SCSR - Supplier Component Status Report; a record of supplier conformance (or deviations) to fitness to build requirements

After each build has taken place it is usual for the core team to meet at a 'Geba Kai' event. Gebas were introduced to Rover by Honda. The word, when literally translated, means 'meeting of minds'; In reality, the geba is an opportunity for suppliers and engineers to study their components fitted on vehicles, ensure that they are fully functional and learn of any problems associated with the fit of the part during Rover's assembly. As a formal event which is attended by most suppliers involved in the vehicle, it is an ideal opportunity for any issues to be discussed regarding the interface of one supplier's product with that of another supplier. As all the relevant parties are present, it is also an ideal opportunity for the SCSR document to be addressed and any other formal documents (CDTS, [1]PCRs *etc.*) to be signed off immediately.

3.2.3 The Rover 600

The 1990 Honda Accord became the platform for the new Rover 600 (Synchro). This was not a true collaborative project because Honda held most of the engineering responsibility. Three versions of the car were built, a Japanese Accord, a European Accord and the R600. Rover had responsibility for its own body style (addition of the grill) and chose to incorporate some of the familiar Rover features, such as wood and leather for the interior (Project Management Interview, AL12).

Rover were only involved in final 2 years of the 3 year project and more so when Honda decided suddenly that rather than build both (European) cars at Swindon, Rover would have to manufacture their own at Cowley. Rover sent a team of process and facility engineers to Japan who worked with Honda to study how the car was built and to develop their own manufacturing processes. The strategy was to watch Honda build a car, build the car with some help from Honda, and finally build the car on their own. Between D-1 (final engineering stage) and volume production only 30 manufacturing modifications were processed; this compared with the low 100's that would normally have been expected (Manufacturing Interview, AL15). Some reservations are felt within Rover as to whether Honda used SE by involving manufacturing in with the design of products. Instead, it was perceived that Honda had a very good knowledge of engineering processes and tended to adopt a carryover strategy so that parts looked similar and were fitted to the vehicle in the same way as the last model - evolution, rather than revolution!

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[1] PCR - Product Change Request; Rover's tracking and authorisation process for any changes

3.3 Rover Group's Suppliers

The use of project teams by Rover Group means that within its matrix style of organisation there is a requirement to ensure that the needs of individual projects are not met at the expense of the group as a whole. To this end commodity strategies are set within the purchase department and continuity is maintained by using purchasing personnel within the core teams. Rover's suppliers are grouped by two rationale which are by product group and RG 2000 category.

3.3.1 Product Groups

Although most suppliers will, by the nature of their products, belong to only one product group, there are occasions, due to a diversity of product range, or classification of a product and its second tier componentry, that suppliers may supply more than one product group.

The product groups form the boundaries for responsibility for both purchasing and engineering with teams looking after each defined area within the vehicle, namely Trim I, Trim II, Power Train, Chassis, Electrical, Body & Door and Steel Coils.

3.3.2 RG 2000 Supplier Categories

Rover is currently undertaking a rationalisation programme which aims to reduce its supply base to 350 suppliers. RG 2000 is a supplier support programme which aims to help suppliers understand their businesses so that continuous improvement may be directed into the areas where there can be most benefit derived.

Through its RG 2000 strategy Rover also groups its suppliers together into 4 categories, in order that it can define the minimum requirements needed by each supplier in its attainment of the quality accreditation BS 5750. Part 1 of BS 5750 looks at "specification for design/development, production, installation and servicing"; Part 2 looks at "specification for production and installation" whilst Part 3 is concerned only with "specifications for final inspection and test" of products.

The Rover supplier categories recognise the diversity in scale of business and type of product across the group's supply base. RG 2000 aims to define minimum requirements for suppliers in the areas of Project Management, Total Quality Improvement, Business Performance and Quality Systems Accreditation.

The four supplier categories are:

1) Proprietary, jointly designed products;
2) Major functional and selected non-functional components and assemblies;
3) Simpler components in normal or high volumes;
4) Less complex or special components in low volumes.

(Rover Group, 1991(b): p. 5)

3.4 Best Practice & Technical Support

Although 'technical buyers' exist (*i.e. those* buyers with engineering backgrounds) the core teams will also call upon the expertise of the Best Practice and Technical Support areas within the company. Currently both these functions are based within the Purchasing Department.

Best Practice tend to take less of a project focus, visiting suppliers to understand and encourage the sharing of best practice and continuous improvement within the supply base. Other responsibilities involve the supporting of supplier cost down initiatives and investigations into second tier componentry.

Technical Support are regular attendees at Core Team meetings and their presence benefits the team because, as they have a non-project responsibility, they are able to help the team 'step back' from any immediate problem, facilitate and discipline the team where necessary. Technical Support engineers own the RG 2000 process and undertake RG 2000 assessments of suppliers.

3.5 Wider System of Interest

The literature review looked at the cultural aspects associated with the Japanese and at some of the tools and techniques which are used by the Japanese. The automotive industry was seen to provide examples of some of these practices, the success of which was possible due to the close relationships which existed between Japanese automotive manufacturers and their suppliers.

3.6 System of Interest

Asanuma's model suggested that suppliers of components would be subject to different relationships between the supplier and OEM due to the differing levels of product and process design undertaken by the supplier. It also seemed evident that the OEM's relationship with a supplier depended on the commercial strategy adopted for a given component, with respect to pricing policies, sourcing strategies, length of contracts *etc.*.

The supplier relationship was therefore seen to be affected by the type of commodity being supplied, the level of design responsibility undertaken by the supplier and the tools (such as SE) being used, all of which influenced (and were being influenced by) the general business environment.

3.7 Conceptual Model

A Conceptual Model was constructed (Figure 7) which looked at the type of relationships which occurred, particularly between designers, suppliers and buyers, levels of supplier involvement in the design of a vehicle, and the strategies and policies which exist within the system-of-interest.

The conceptual model was a signed digraph of elements, each of which was linked to others by either an augmenting or inhibiting relationship. In essence, this meant that a positive, augmenting effect was seen between the elements 'level of communications & personal contact' and 'level of trust & openness'. As the level of the former rises, this results in a rise in the level of trust and openness between the supplier and the buying organisation. An inhibiting, negative effect is seen when the rise in the level of one element causes the fall in the element into which it feeds.

The model comprises of two types of elements. The boxed elements are influencing factors within the system which are not easily quantifiable. For example, the number of suppliers per component could vary according to a company's decision to change its sourcing policy from single to multiple suppliers, regardless of the level of supplier involvement in the design process and levels of trust which exist. These 'dummy' elements may also adapt to changes in the system's environment.

In contrast, the non-boxed elements were quantifiable variables. Some of these elements were measurements of 'soft' data (people's opinions) but which, when collated, could be translated via 'hard' data analysis techniques to extrapolate the flows and relationships within the model.

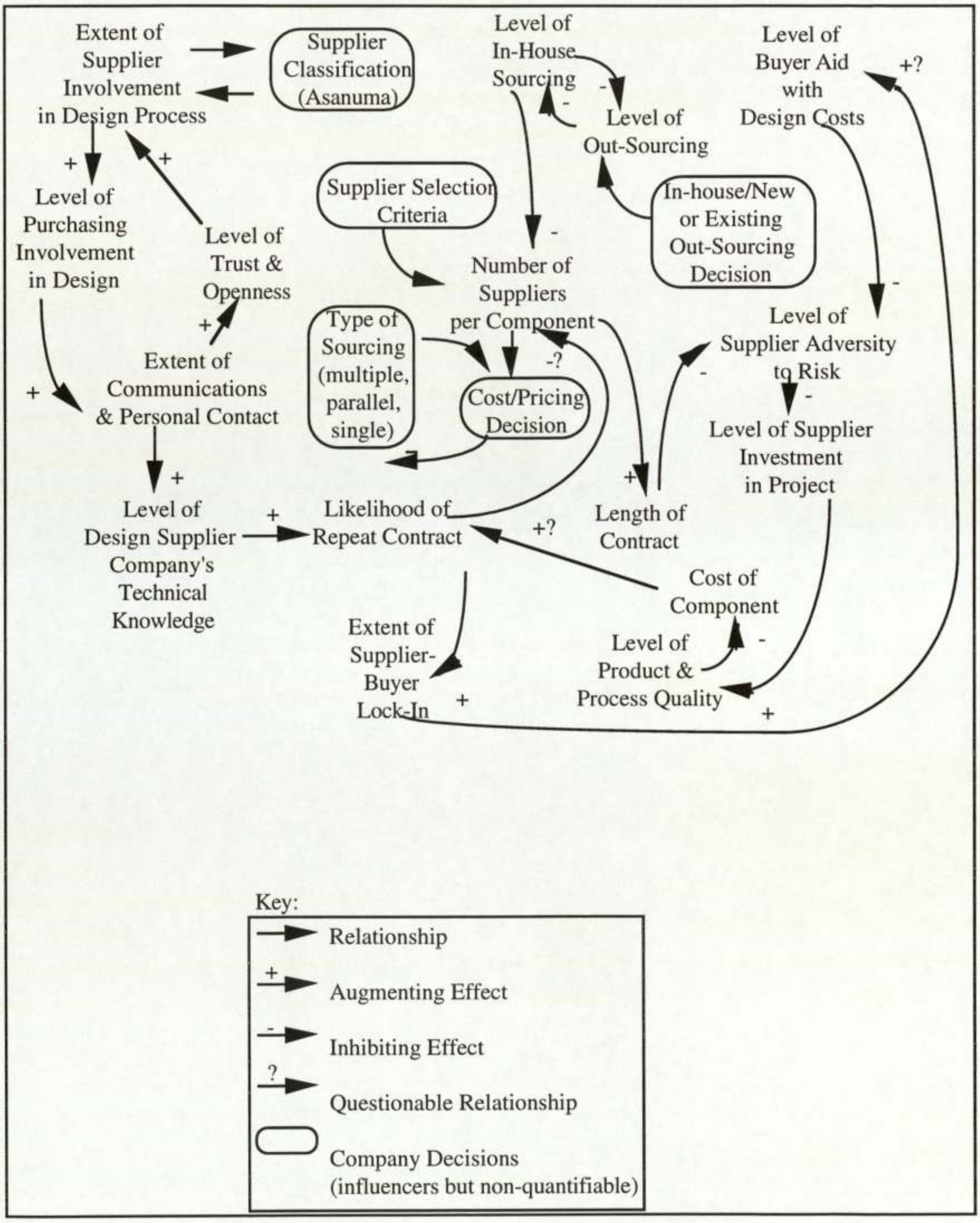

Figure 7 Conceptual Model

3.8 Research Hypotheses

The system of interest and conceptual model suggest that supplier relationships differ depending upon the environment and the extent to which the supplier undertakes design responsibility for a component; Asanuma's model attempted to classify these levels of design ownership. As with Asanuma's model, Rover categorises its suppliers depending on the type of product and the levels of design.

Hypothesis 1 *Differences in design ownership for product and process do exist;*

therefore

Hypothesis 2 *A correlation will be seen between Asanuma's model and the RG 2000 classifications;*

and

Hypothesis 3 *Soft and hard measures of a supplier's relationship with Rover will differ depending upon their RG 2000 and Asanuma classification.*

Given the level of influence by Honda in vehicle development

Hypothesis 4 *Supplier relationships will be different depending upon whether a project was Honda led or a unique Rover project.*

Controls were perceived to be a necessary part of any research to ensure that no other variables were affecting any results:

Control 1 *Rover conducts its relationships with its suppliers consistently across the product group areas;*

and

Control 2 *The supplier perception of the Rover/supplier relationship will be similar to that held by the buyer.*

SECTION 4.0 EMPIRICAL RESEARCH

4.1 Research Design

In order that triangulation of data sources might be effective, it was decided to collect both quantitative and qualitative data. Although relationships are essentially 'soft' issues, this did not necessarily exclude the use of quantitative analysis of the collective scores given by respondents in their perception of each factor.

The quantitative data collection took the form of postal questionnaires which were sent to buyers and suppliers. This method gave access to a wide range of suppliers and overcame any logistical constraints regarding capturing information from suppliers who were located outside of the UK. The questionnaires were used to gauge an overall perspective on Rover Group suppliers which was then compared with information gathered from suppliers on the R600 project. Finally a questionnaire to buyers helped to validate the scores given by suppliers.

The questionnaire was designed using input from Rover buyers, engineers and suppliers. In addition, it benefited from receiving feedback from researchers within the automotive industry field. A copy of the questionnaires may be found in Appendices 1 and 2.

Qualitative data collection took the form of semi-structured interviews with Rover associates and suppliers and added a richness of data, to complement the open-ended questions (see Appendix 3) within the questionnaires. Participative data collection was also possible through the writer's commencement of work at Rover as a buyer.

It was felt that the success of the questionnaire might be affected by the initial reaction of the receiver to the document. It was therefore crucial that the questionnaire should be well presented and contain the minimum number of open-ended questions. A conscious decision was also made to forego the use of any page numbering; this was to try and prevent a 'look and ignore' response being received. A major concern was that the presence of 3 communication grids might have affected the response rate, and as such, a risk was attached to having 3 rather than just 1, or no gridded questions. In some cases, however, questionnaires were returned without the detail in this one question, showing that even if respondents were not prepared to answer the question in such detail, they felt that it was still worthwhile to complete the rest of the questionnaire.

Likert scales were used in the questionnaire in order to help quantify people's opinions. The aim behind this was to try to gain a range of scores rather than scores which were multiples of 10s. The scores were derived by measuring the length of the lines, which were of a precise length.

4.2 Sampling

A copy of a questionnaire was sent to all Rover suppliers (apart from those which were considered to be non-strategic), taking advantage of access to the Rover supplier data-base. This allowed a comprehensive sample to be undertaken. Secondly a cross-section of supplier questionnaires was chosen to provide the *criteria* for the sample of purchasing questionnaires. Finally, the *opportunistic* route was taken for access to persons willing to be interviewed, and these then led to a *chain* of further secondary interviews from those which had been previously identified. Definitions in italics are adapted from Miles and Huberman's (1984) descriptions of qualitative enquiries.

Control hypothesis 4 was investigated by looking at the Rover 600 programme. This was run to a Honda design and was the latest vehicle project to have been released at the time of the questionnaire. The assumption to use this vehicle as a control was to establish whether any differences were visible to the supplier between a Honda and Rover led vehicle programme.

To this end two questionnaires were constructed, but only one was sent to each Rover supplier. The first questionnaire was sent to all suppliers who were involved on the Rover 600 / Honda Accord programme, and the second questionnaire was sent to all other suppliers who were involved with any other Rover Group vehicle programme.

As per control hypothesis 2, the questionnaires were also split according to whether the respondent was a supplier or Rover buyer. The two supplier questionnaires differed by their emphasis on the 'R600', as opposed to 'the most recently released vehicle'. The buyer questionnaires differed from the R600 questionnaires through the addition of two questions relating to the potential ease associated with resourcing the business, and opinions relating to the quality of the working relationship.

4.3 Questionnaire Pilot

A pilot of 5 questionnaires was sent out to suppliers to clarify whether the questions were answered in the way intended, so that meaningful inferences could be made from the data. Unfortunately no responses were received before it became necessary to send out the bulk of the questionnaires so that timing constraints could be met. It was felt that as the questionnaire had already received some supplier feedback, that the risk should be taken. Several flaws, however, were discovered with the questionnaire and these are discussed in more detail in the 'Analysis of Questionnaire' section.

4.4 Purchasing Questionnaires

Rather than send out a random sample of questionnaires to buyers it was decided that it would be more meaningful to send out a questionnaire to a buyer whose supplier had already responded to the questionnaire. The advantage of this was that a direct comparison could be made between responses relating to exactly the same vehicle since buyers were directed as to the model on which they should base their responses. The disadvantage of this was that some buyers felt that the suppliers chosen were mis-representative of a 'typical' supplier within their section, especially if they were a R600 supplier chosen by Honda. It was felt, however, that the purchasing questionnaire was a means to test the 'honesty' and perceptions between the two sides of a buying/selling relationship rather than as a means to gain further statistical inferences.

4.5 Questionnaire Constraints and Incentives

A constraint was attached to the help from Rover because questionnaires were sent to category A (strategic) and category C (specialist) suppliers only and not to category B (non-strategic) suppliers, because it was deemed insensitive to send a questionnaire to suppliers who were likely to lose Rover Group business in the immediate future. The category B suppliers are those left over from the days when Rover Group had significantly more suppliers on its books. In retrospect, although there was a loss in the richness of data, the analysis was intended to high-light areas which Rover needs to concentrate its efforts on to improve relationships with its suppliers and to capture the feelings of ongoing working relationships, rather than of suppliers who may have felt bitter about losing Rover business. The advantage of this was that any negative comments coming from suppliers were from those who had a vested interest in maintaining a good relationship with the group: and in addition that any concerns and criticisms, regarding the business relationship, needed to be discussed so that improvements, on both sides, could be made.

4.6 Data Sources & Collection

Suppliers were identified as such via access to Rover Group's own supplier database. In fact some of the 'non-R600' suppliers said that they also supplied parts for the R600 which shows that the database requires a more efficient means of capturing data from the supply base.

4.7 Questionnaire Presentation

It was originally intended that the questionnaire should appear in a booklet format but this would have been extremely expensive to achieve. Help was received from Rover Group in the form of providing all of the photocopied and stapled questionnaires and in the printing of the introductionary letter and address labels straight from the Rover database. A considerable time benefit was derived by using the Rover systems database to address the letters: one interesting outcome of this was that the database was sometimes out of date as to the name of a company's Managing Director. In one case the MD had left the company well over a year previously!

The letter (a copy of which may be found in Appendix 4) was printed, with permission, on Aston Business School letter headed paper. Although the link with Rover Group was stated as being one of a student who was soon to be employed within the purchasing department, it was necessary to state both that the questionnaire was sent out with the full knowledge and help from Rover but at the same time that a distance would be maintained so that confidentiality of replies would be maintained.

Several suppliers felt (quite rightly) that it was necessary to check with their buyers regarding the authenticity of the questionnaire. Unfortunately, this happened in some cases before the official circulation of information occurred within the department, and as some buyers and team leaders had not at that stage heard anything about the questionnaire, the suppliers were dissuaded from completing them. Other suppliers chose instead to contact the Aston Business School, through the number given on the covering letter, and discuss any concerns. In the cases where suppliers were looking for confirmation regarding the backing of Rover Group for the questionnaire, a contact name was given within Purchasing, who was then able to confirm the legitimacy of the claims in the letter.

Rather than buy stamps for reply envelopes it was decided that it would be advantageous to use *freepost* as this would reduce the cost of postage for returns. As such a facility did not exist at the Business School it was necessary to use the private *freepost* address for a literary organisation affiliated to the Christadelphian Church. It is not known how many people were put off from replying due to this apparently strange and roundabout means of returning questionnaires.

A major constraint on the responses to the questionnaire was that it was released at a time when many people were on summer vacation. No final reply date was given because it was felt that even if replies were received which were too late to be used in the analysis for the MSc., that the information would still be valid for any future research work. In reality responses were still being received up to 5 months after the questionnaire had been sent out to suppliers.

As an incentive to return the questionnaire suppliers were offered the opportunity to receive a copy of the report feeding back from the questions. In all, 92% of respondents were interested in receiving the report, also showing that they were prepared to offer their names as a reference point within their organisation as the respondent to the questionnaire.

4.8 Response Rates

The ratio for the number of questionnaires returned with respect to the number sent out is shown in Table 2 below. In total 95 usable replies were received from suppliers which equates to a 18% response rate. This is not a particularly high response rate but it was felt that this gave a sufficient number of responses from which it would be possible to extrapolate some meaningful inferences. No follow up telephone calls were made to try to increase the yield of returns, except during the pilot stage where the response rate was still zero even after respondents had agreed to complete the questionnaire.

Questionnaire Type	No of Questionnaires Sent	Percentage of Replies	Usable Questionnaires
Total Supplier Questionnaires	**528**	**22%**	**18%**
R600 Questionnaire	**112**	**24%**	**21%**
Non-R600 Questionnaire	**416**	**19%**	**17%**
Purchasing Questionnaire	**28**	**32%**	**29%**

Table 2 Questionnaire Response Rates

In itself the response rate indicates that there was some genuine interest in the area of research, with the questionnaire being considered, in some cases, a worthwhile exercise to undertake. It is not known how many suppliers did not respond because they were sceptical that confidentiality of answers from Rover Group would be maintained, given the close links of the researcher with the company. Alternatively, suppliers who thought that they would be identified to Rover may have been more inclined to respond to the questionnaire, but bias their answers in favour of Rover.

4.9 Statistical Analysis of Data

Information gained via questionnaires was loaded on the statistical package SPSS. Answers were coded (for example, vehicle models became '1' for the R600, '2' for the 38A *etc.* No interpretation of the data was made at this stage as answers to open-ended questions did not undergo a data-reduction exercise through being translated into codes.

The emphasis of the statistical analysis was placed on the use of one way analysis of variance (ANOVA) tests under three different independent variables, namely, product group, RG 2000 category and Asanuma classification. The assumptions of ANOVA, as seen in Walsh, 1990: pp. 118-143, are:

1) Independent random samples - satisfied as no researcher bias was introduced in selecting sample groups;
2) Interval or ratio level of measurement;

3) Independent subjects in each group - all questionnaire responses were mutually exclusive from all other responses;
4) Homogeneity of variance - expectation of only random difference in variance values;
5) Normal sampling distribution - ideally groups should have been greater than 50 members to allow the Central Limit Theorem rules to apply.

The tests were chosen as a means to establish whether the answers, given by the respondents in the different independent variables, could be statistically proved to be a characteristic of the relationship of one specific category.

4.9.1 Analysis of Variance

The analysis of variance test looks at samples and determines whether they originate from the same population or that a significant difference exists. Even within a population it is unlikely that the variance from one sample will be identical to the variance of a second sample. The F-ratio looks at the ratio between the sum of variation within the groups against the variations between the groups, *i.e.* that on average the variances between groups is x times as large as the variance within each group.

The F value is a figure which, having taken into account the degrees of freedom for the numerator and denominator, determines that sampling errors will be less than 5% (if using the 0.05 tables). In each case data is used to test whether the null hypothesis has been violated at the 5% level of significance for H_0: means of all groups are equal and H_1: mean of at least one group is different. Hence if the F ratio is greater than the F value found in the tables, H_0 is rejected and the conclusion is made that there is a significant difference in the variance of at least one group.

For ease of computation, the SPSS output combines the F-tables with a level of significance for the null hypothesis. Hence, if the 'F Prob' is shown as 0.38, there is a 38% level of confidence that the classes under observation are from the same population. If F Prob = 0.04, there is only a 4% level of confidence that the classes come from the same population; hence it is possible to conclude that, at the 95% limit the between class variance are significantly different from the within class variances. This means that at least one class is showing a different spread of data than all other classes.

4.9.2 Levene Test for Homogeneity of Variance

This test verifies whether it is statistically correct to undertake an analysis of variance test on given data, as it tests the assumption made that the populations are of the same size ($n_1=n_2$). It is essential to ensure that this assumption is validated for each data set because the population sizes are such that the central limit theorem approximation to the normal distribution is not satisfied (*i.e.* sample size was less than 50 per group).

The absolute differences between each group's variance and mean are taken and a one way ANOVA is performed. If the figure stated under '2-tail Sig' is greater than 0.05 then we are 95% certain that the groups show equal variances. Given that assumption 4 of ANOVA has not been violated, we are able to make inferences from the ANOVA tests with a relatively high level of confidence. If the '2-tail Sig' is less than 0.05, we are still able to use the ANOVA output to extrapolate meaningful inferences if the data classes are of similar sizes, although with not such a high level of confidence. If Levene's test is violated and the data class sizes are dissimilar we are not able to use inferential statistical tests. In this case a manual comparison of the means, variances, ranges *etc.* must suffice.

In the case of product groups it was found that because product group 7 (R) contained only 2 members, tests violated the 95% confidence limits. All comparisons of product groups thus excluded product group R. In reality product group R is very insular within the 'Approved Production Material Suppliers and Production Commodities' manual as it concerns steel coils.

4.9.3 Post-Hoc Tests

Post-hoc tests provide some of the detail behind any significant differences which the analysis of variance may have shown. The tests chosen for this analysis were the Student-Newman-Keuls (SNK) Test and Tukey's Honestly Significantly Difference (HSD) Test.

The SNK test makes comparisons between means which are ordered from highest to lowest with the extreme differences being tested first. Results significant at the 5% level are marked with an asterisk within the matrix which should be read down the column. Tukey's HSD test makes comparisons between groups. The test takes the error rate from all pair-wise comparisons and uses this for the experiment-wise error rate. This test was used in conjunction with the SNK test to see whether the results yielded similar statements regarding significant differences between two groups (SPSS for Windows, Help Facility, Version 6).

4.9.4 T-Test

For the R600 Vs. 38A comparison the T-Test was used instead of the F-Test. The T-Test compared the two classes of data to see if they were significantly different. Levene's test for homogeneity of variance was again used to determine whether the pooled-variance (equal variances) or separate-variance (unequal variances) method was most appropriate. Where Levene's test gave a probability of greater than 0.05 the pooled-variance test was used; the single-variance test was therefore used for significance levels of less than 0.05 (*i.e.* where class variances were significantly different from each other that they exceeded the 95% confidence limit).

The T-Test differs from the F-test in as much as it is concerned with means rather than variances between classes. If the two classes were shown to be significantly different from each other the '2-tail sig' column returned a figure of less than 0.05. Conversely, if a value of greater than 0.05 was shown, this meant that there was no significant difference between responses from R600 and 38A suppliers for that element.

4.10 Presentation of Results

Results were primarily presented in a summary format with the complete SPSS output being shown in Appendix 5; a copy of the full questionnaire responses may be found in Appendix 6. The element under consideration was shown in the top left hand corner of the table, with columns representing analysis by RG 2000 category and Asanuma classification.

The question mean and standard deviation were shown to allow some basis descriptive analysis to be discussed. The F-Ratio was shown with its degrees of freedom (in subscript) and F-Ratio figure which would normally be looked up within statistical tables. SPSS, however, gave a level of statistical confidence regarding any differences in the within and between class variances. Where a statistical difference was shown the result was entered in bold within the table. Additionally, where Levene's test showed that homogeneity of variances existed, the '2-Sig' was also shown in bold.

Results from the post-hoc tests were described, so that, for the Asanuma classifications shown in Table 3 below, classification II was seen to be most significantly different from classification III, and slightly less significantly different from classification VII.

Variable Name	RG 2000 Category		Asanuma
Group Mean		56%	
Std Dev		33.97%	
F Ratio	$F_{3,80} = 12.86$ F Prob = **0.00**		$F_{5,77} = 2.34$ F Prob = **0.05**
Levene	Stat = 3.32 2-Sig = 0.02		Stat = 2.97 2-Sig = 0.02
SNK	2-3, 2-1, 2-4 3-1, 3-4		2-3, 2-7
HSD	2-1, 2-4		2-7

Table 3 Example of Result Table

SECTION 5.0 QUESTIONNAIRE ANALYSIS

5.1 Supplier Information

5.1.1 Company Name

Analysis of the supplier questionnaire respects the confidentiality of all the participating companies. Suppliers were given numbers as an identity code to enable the linking of answers between the database and written answers. Questionnaire numbers of less than 200 refer to questionnaires completed by R600 suppliers: these suppliers were identified directly from the Rover database on suppliers. Questionnaires numbered at 200 or above refer to those suppliers who were sent the non-R600 'Rover Group' questionnaire (even though in some cases these suppliers chose to answer questions on the R600).

5.1.2 Component Types

Suppliers were asked to identify all the components which they supplied to Rover Group. The aim of the question was to identify the diversity of interest for the supplier within the make-up of the car (for example: whether they supplied a range of products which appeared to be non-related within the context of a vehicle and the technologies and skills employed to manufacture those parts) which may have affected the data given in their replies. In reality this was a time consuming question for respondents to answer and extremely difficult to evaluate with limited automotive knowledge.

Classification of components was given by defining the buyer codes, found within the 'Approved Production material suppliers and Production Commodities' manual[1] (March 1994) kept by Rover. In many cases it was found that suppliers had interfaces with more than one buyer and sometimes in different commodity sections. The information was classified as shown below.

Buyer codes were identified by two logics. Firstly, a list of products was available in the 'Production Commodities Directory' (a section from the above manual), which links buyers to product commodities. The second way was to look up the supplier's details in the directory which includes buyer codes.

[1] It should be noted that this brochure has now been superseded and the buyer codes rearranged since the questionnaire was sent out.

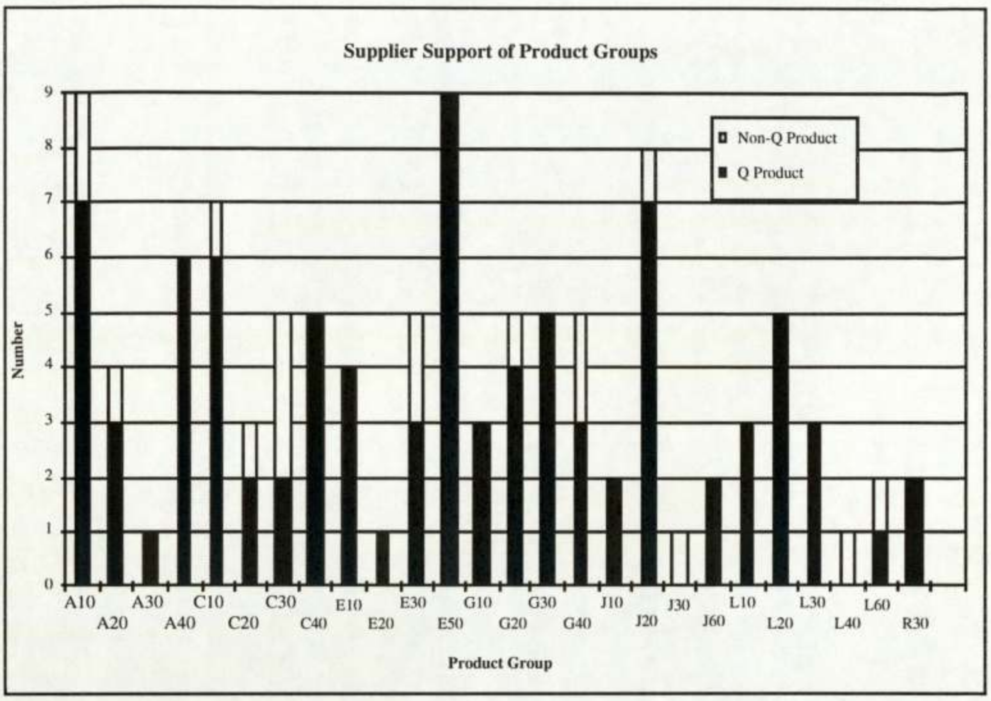

Figure 8.1 Supplier Support of Product Groups

Under the 'Component Information' section of the questionnaire suppliers were asked to select a major component (the one with the highest cost contribution to their selected vehicle model) upon which to base their answers for the remainder of the questionnaire. One supplier may deal with up to 5 different buyers over their product range; those products that were easily linked to a specific buyer code were unidentified as 'Q Product' on the graph in Figure 8.1. The graph shows the number of times each buyer's products were mentioned within the questionnaires. Figure 8.2 shows the questionnaire responses at the macro level for each product section.

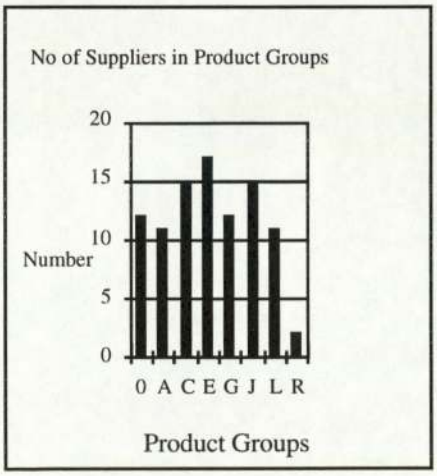

Figure 8.2 Number of Suppliers in Product Groups

5.1.3 Supplier RG 2000 Classifications

Suppliers were asked to state which of the four RG 2000 categories they believed applied to their company. This was compared to the categories as shown in the supplier details section of the supplier directory. Out of the 95 questionnaire responses only 73 suppliers were able to state (or in many cases guess) which of the four classifications applied to their company.

5.1.4 Perceived Category 1 Suppliers

Seventy percent of the 35 respondents who perceived themselves as category 1 suppliers correctly identified their status, whilst the remaining 30% were actually category 2 suppliers. Some anomalies exist in the classifications of suppliers; consider the following 2 suppliers:

1) Supplier of ABS, wiper motors, lambda sensors, head lamps & front signal lamps, fuel injection, diesel fuel injection (category 1 sites) and petrol and diesel starter motors (category 2 sites), with a category 1 UK administration and warehouse supplying all product directly to Rover (supplier 263 with various manufacturing sites for each of its Business Units).

2) Supplier of In-Car Entertainment (ICE) (category 1 site) with a category 2 UK sales office (supplier 476).

It is difficult to understand the reasoning behind why, for supplier 1, head lamps and front signal lamps should be category 1 components and starter motors should be category 2, with all products being managed through a category 1 UK interface, whilst ICE products (radios) are sold through a category 2 UK interface, even though the products themselves are seen as category 1.

It appears that some confusion exists as to the definitions and implications of these categories when considering the classification of the two UK interface offices from above. If the categories determine which of the parts of RG 2000 and external quality accreditations are applicable to each supplier, there is an inconsistency as to why one sales office has to achieve higher standards than the other, when both are selling category 1 products to Rover.

5.1.5 Perceived Category 2 Suppliers

Twenty-three suppliers saw themselves as belonging to category 2 and over half of these (65%) were correct in their assertions. Of the remaining 35%, 13% were actually in category 3 and 22% in category 1. An expansion of Rover's definitions here may be helpful in understanding why suppliers think that they are in a different class. A 'functional' component is one which does something, for example a window lift or radio, as compared to a 'non-functional' component which doesn't, such as a bracket.

In the case of a 'simple' component (category 3), it would be expected that Rover would design the product and the supplier (such as a press work supplier) would then suggest any changes (Purchasing Interview, AL4). Supplier 600 however provides presswork and assembly and wire manipulations and is a category 2 supplier, whilst supplier 103 is a category 3 supplier of weld studs, associated plastic clips and fasteners. These latter products are simple, off the shelf items which are required in high quantities by Rover.

5.1.6 Perceived Category 3 Suppliers

Of the Category 3 suppliers, 59% were correct, while 27% were in category 2 and 7% in both categories 1 and 4. Category 3 appears to be the most ambiguous of the classification because over 40% of suppliers believed that they were in one of the other categories. According to one purchasing interview (AL3) "... 'simple' is a definition for a proprietary part such as a washer or weld nut which is essentially 'off the shelf' or a 'catalogue good'".

5.1.7 Perceived Category 4 Suppliers

Only 2 suppliers considered themselves to be category 4 suppliers and both were correct in their assumptions. Supplier 576 (who did not return a questionnaire) is a category 4 supplier of North American Specification (NAS) proprietary lighting components, coming under the 'special components in low volumes' section of the classification description. What is worrying in this case is that Rover is sending mixed messages to its suppliers because if this supplier were supplying something in high volume it would be expected to achieve higher accreditations. Rover could be misconstrued as saying that the North American market is less important to them as a company. However, it is simply the case that special parts in low volumes command less resources to manage them within Rover, than proprietary parts in high volumes.

It would appear that Rover has classified its suppliers, using a combination of volume of business and product, process and technology complexities. As such it may be possible to compare these definitions with those of Asanuma's model which was explained in Section 2.5 and upon which questions are asked later in the questionnaire.

This question demonstrated that there is a lack of feedback and understanding between Rover and its suppliers as to the type of information and classifications which Rover makes of its suppliers. Each category determines the number of elements of the RG 2000 survey which are relevant to each supplier. If suppliers are unaware of their general Rover classifications it is extremely difficult for them to focus on the areas where they are measured by Rover. This lack of feedback could be attributed to either a lack of transfer of information within and between Rover or the supplier, for example when new purchase or sales people arrive.

Where analysis by RG 2000 category was undertaken, the Rover stated rather than the supplier perceived ratings were used as it is the Rover understanding of the relationship which determines the level of resource available to each supplier.

Suppliers were additionally asked when they had been classified by Rover but so few of them actually knew this that analysis was impossible. It was found that 11.25% of suppliers believed that a change to this classification would be likely within the next 2 years.

5.1.8 Supplier Reliance on Rover for Business

Suppliers were asked to give the percentage of their company's turnover which could be attributed to their reliance on Rover for survival. A company's reliance on Rover may affect other attitudes as answers ranged from 0.03% to 80%, with an average of 20%, and standard deviation of 16.04%.

At the 5% level of significance it was found that the percentage of business attributed to suppliers did not differ significantly according to their product group ($F_{5,71} = 0.13$) or Asanuma classification ($F_{5,72} = 0.86$). Levene's test was violated when considering a comparison against RG 2000 category.

In an interview with a supplier (Supplier Interview, AL22) it was stated that the company under discussion relied on Land Rover for between 80 and 90% of its turnover. The problem with this is because as a small company (220) they are unable to afford the luxury of many engineers and therefore any time spent putting together a quotation package for Rover, if unsuccessful, is time away from being able to win business elsewhere (which is something which is actually desirable for Rover anyway - Purchase Interviews, AL4 & AL6). The company is caught in a dilemma because it cannot afford to bring in new personnel unless they know that they have new business but it becomes increasingly difficult to win future business because of their current lack of engineering resource.

This is a company which appears to 'jump' if Rover tells them to and is generally eager to enter into the new Rover initiatives (although they were very unimpressed by their first Best Practice visit where it was felt that Rover lost some credibility).

5.1.9 Length of Relationship

Of the 94 suppliers who answered this question, 4% were new suppliers to Rover Group when they started working on the R600 programme. The majority of suppliers, 76%, have been part of a relationship with Rover for longer than 5 years whilst the remaining 20% have been involved with the group for less than 5 years. This question is ambiguous because it does not emphasis whether 'new for R600' refers to the first (SK1) programme, started in 1990 or the SK2, 1993 model which focused on replacing the Honda engine with one made by Rover. The aim was to establish the extent to which Honda influenced the choice of suppliers in addition to Rover's ongoing business needs to either resource or use new technologies. It must also be remembered that Honda would have been influencing sourcing decisions outside of the R600 vehicle programme through the Rover 200/400 / Honda Concerto models *etc.*. According to one purchasing interview (AL3) approximately 14 of the suppliers chosen by Honda were new to Rover for the R600.

Without ignoring the above comments, the data shows that there has been some movement in selecting new suppliers during a period in which Rover has sought to rationalise its supply base.

The level of common suppliers across the vehicle range is relatively high (see Figure 9). The lowest commonality figures come from the Mini and other older models, where sourcing decisions have remained in place over many years. During the period of data collection the Discovery was the latest Rover vehicle to be released which was derived from an older model (the Range Rover Classic). This contrasts, ironically, with the launch of the new Range Rover, the 38A, which is essentially a new vehicle, carrying over little else from the Classic, apart from the name and image.

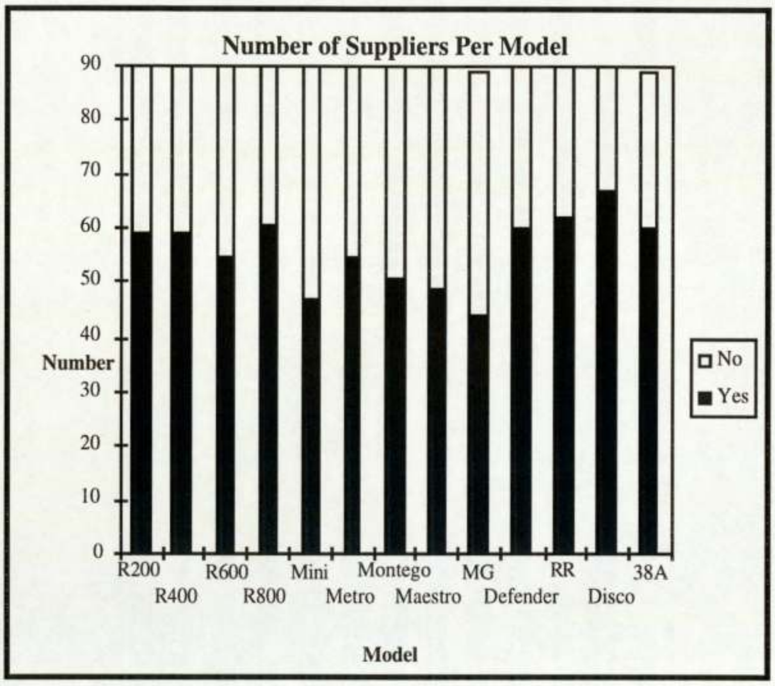

Figure 9 Number of Suppliers Per Vehicle Model

Additional factors to observe are that just as the older models will affect some of the supplier choices (due to the fact that they were designed in an era where a supplier rationalisation strategy did not exist), so will those for the 4x4 vehicles, particularly when vehicles are made to low volume specifications such as for the Police or army. In addition, strategy is affected by outside elements, such as the level of technical innovations and differing 'standard' items (airbags) which are now being fitted due to needs changing within the market place.

The implication for Rover Group is that they are currently carrying some suppliers that have business on only a few models and that there may be very good commercial reasons for keeping those suppliers *i.e.* because no other supplier wants to supply for low volume, specialist parts; hence, any supplier initiatives and the daily cost of running the business will be more expensive for Rover than for many other vehicle assemblers.

A measure of the potential supply base on offer for use by Rover Group may be seen in Figure 10 by looking at the percentage use of Rover Group suppliers by competitive car manufacturers. The highest commonality of suppliers between Rover and another car manufacturer is with Ford (and not with Honda); this is because both have been established in the UK (as has Vauxhall) for a long period of time and are using suppliers from their local area in the form of the UK supply base. Additional reasons for a lower commonality with Honda stem from Rover's wide product range and Honda's links with existing Honda Manufacturing's Japanese suppliers.

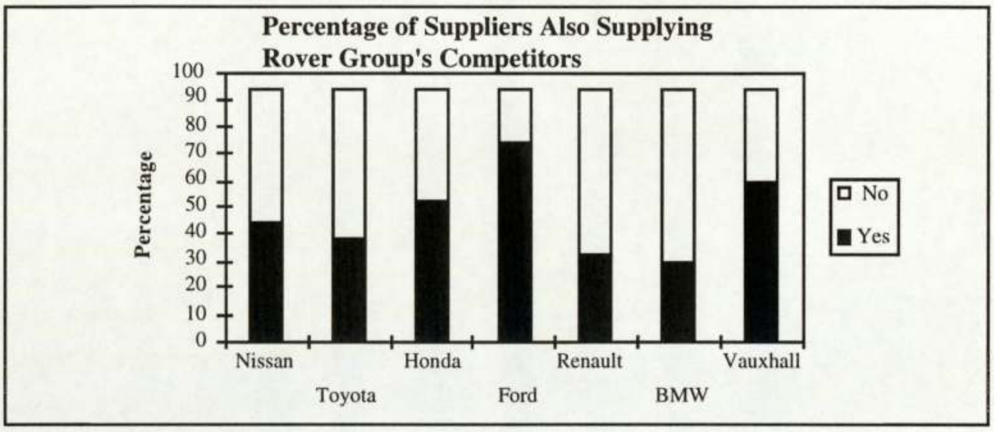

Figure 10 Common Suppliers with Competitors

If the quality of Japanese cars is considered to be the general benchmark, then it follows that the quality of the Japanese car manufacturer's suppliers is also probably higher. It is with Honda out of all the Japanese transplants that Rover Group has the greatest number of common suppliers (55.4%) which, given their partnership relationship, is to be expected. However, it is generally assumed that Toyota is *the* benchmark for quality.

In order to improve upon its own levels of quality, Rover could seek out the 59% of 'non-common' suppliers which Toyota uses in the hope of achieving a higher level of 'bought-in' quality from suppliers. The quality of the supplier's components is only one element of quality levels of Rover vehicles as there is also the need to consider the quality standard of the value-added work which is actually undertaken at the Rover sites.

Due to the process by which transplants are established in a foreign country, there is a large number of UK based Japanese manufacturers' components which are still sourced from Japan. It is therefore extremely likely that these components will be excluded from commonality with Rover Group. Ironically, it is with BMW that Rover has the least commonality in its suppliers. It will be interesting to note how this changes as their relationship develops.

5.1.10 Supplier Reliance on Automotive Industry

Respondents were asked to state for which other industries their company supplied components. The aim of the question was to understand the level of commitment to the automotive industry of each of the suppliers in the sample. A more informative question, however, would have been to ask for the percentage of turnover within the car industry. Answers to the question were varied but included electronics, engineering, bicycles, hardware, carpets and other automotive related industries.

5.1.11 Chosen Vehicle

In order to reduce levels of generalisation it was important to get respondents to focus upon one model. For R600 questionnaires the R600 was mandatory; However, for the other supplier questionnaire, answers were meant to look at the 'most recently launched vehicle' on which the supplier had worked. Of these 27 chose the 38A, the new Range Rover, which at the time had not officially been launched although it was at the end of the development programme.

As Richard Elsey (1992) commented, Land Rover was not involved with Honda in a collaborative relationship and so, its use of development tools is more indicative of where Rover would have been in terms of project management and design procedures without the Honda influence. Figure 11 shows the number of each vehicle chosen by suppliers for analysis.

Some criticism was levelled at the questionnaire because it was biased towards the vehicle models. Those suppliers who are part of the Power Train side of the business are totally focused on these projects (such as the 'K' Series engine) and have little or no knowledge as to the consumable end product - the car. Perhaps this is evidence that the supply chain is working because suppliers are totally focused upon the demands of the Power Train Business Unit, which is then itself an element of the vehicle design process.

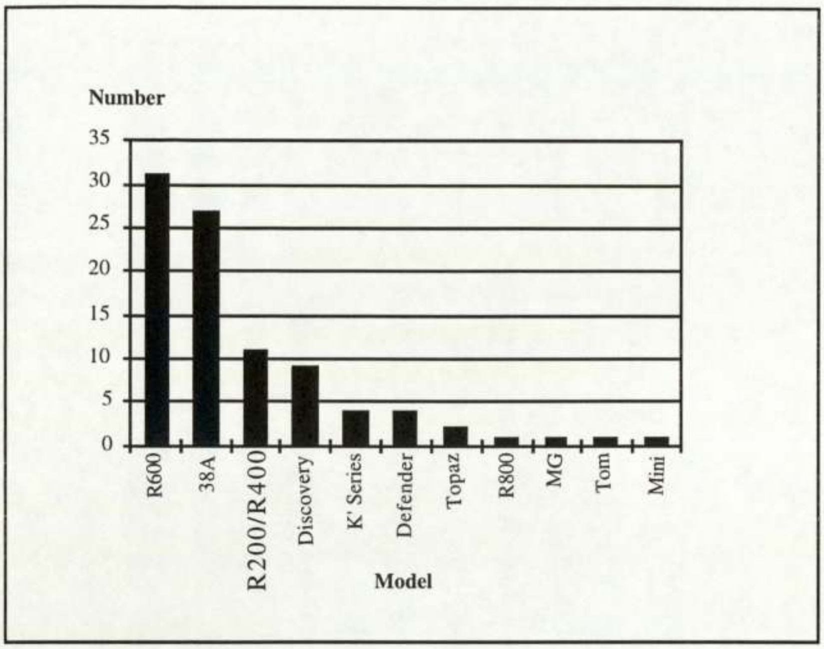

Figure 11 Questionnaire Based Models

5.1.12 Vehicle Sets

The level of attention which a supplier receives from Rover Group may be proportional to the total cost contribution of all a supplier's products within each vehicle (vehicle set), as shown in Figure 12.

Answers ranged from £0.40 to £600 for an item on the MG, with the mean cost being £57, and a standard deviation of £66. This gives an indication of the differing levels of a vehicle's cost base being split between suppliers and shows that either there were a few high cost items, or that there were a large number of low cost products. Following Pareto's 80:20 theory it can be seen that approximately 20% of the parts account for 80% of the vehicle's cost.

There was low correlation between how much cost a supplier owns within a vehicle and the product group, Asanuma classification or RG 2000 category. For example, a category 1 supplier could charge as little as £2 or as much as over £400 for a vehicle set of its products.

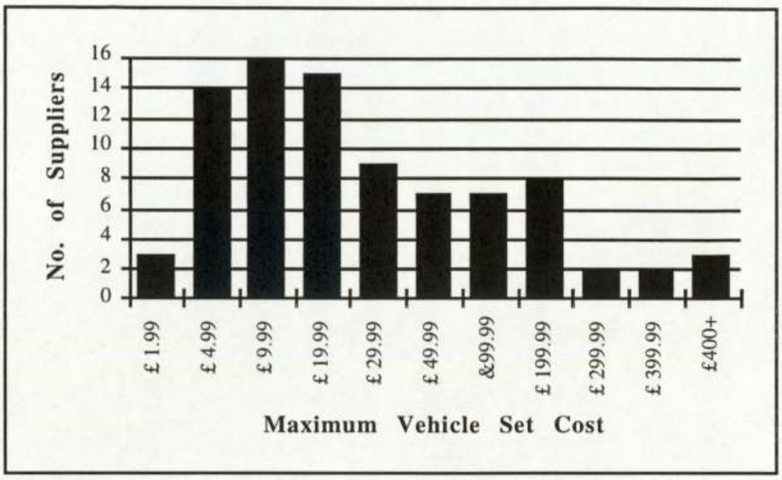

Figure 12 Range of Vehicle Set Costs

5.2 Component Information

5.2.1 Major Component

In order to increase the level of resolution it was necessary to ask suppliers to look at one specific component. Consistency was maintained by asking that the chosen component was the one which had the highest cost contribution from the selected vehicle in the preceding question.

In order to retain confidentiality the components were converted into buyer codes. Further analysis was conducted on some of the questionnaire sections using SPSS to establish whether there was any significant difference in responses between suppliers of different commodity groups. Comments will be covered at the relevant sections.

5.2.2 Supplier Nomination

Rover do not have a formal contract for the supply of components with their suppliers; instead they issue a letter of nomination which should be used consistently across the Purchase department. Sometimes there is only a verbal agreement which the supplier uses as recognition that engineering work should commence. Even a letter of nomination however is not a legally binding document, as nomination is made subject to various elements such as acceptable cost analysis *etc.*. Only when a production (open) order has been raised, with Rover's Terms and Conditions printed on the back, and a schedule has been set, does the supplier have something which is legally binding from Rover, and this may be two or more years into a programme, just prior to volume. In essence, agreements are built on trust, especially for those suppliers who the group have used for a long time and with whom they have built up a significant relationship.

Supplier nomination, however, generally occurs after much work has been undertaken by the supplier, engineer and buyer as part of the nomination process. Often this will include some sort of comparative analysis between the suppliers' Quotation Analysis Forms by the buyer. Nomination will only occur once costs have been investigated, understood and accepted by all the concerned parties. The aim is to have 80-85% of suppliers nominated by D-Zero, that is, project buy-off by the Rover Board. (Comments adapted from Purchasing Interview, AL6).

Only 50% of the suppliers were able to state when they had been nominated to supply their component and it was difficult to quantify when the suppliers were nominated in relation to D-Zero without knowing the precise dates of the D-Zero events for each project or the model year derivative chosen by suppliers. Rather than present any ambiguous data it was decided that it would be better not to publish responses to this question. Comparison would also have been difficult as suppliers were talking about different types of projects - carryovers (Discovery), new projects (38A), major revamps (Rover 100) or collaborations (R600).

5.2.3 Number of Chosen Component in one Vehicle

The average number of the chosen component was 4; The minimum of any component was 1 (occurring 51 times) and the maximum was 131 for a component in the body and door section. The latter (Respondent 103) was a category 3 (simpler components in normal or high volume) supplier with a total vehicle set cost of £3.14. This question becomes more informative when comparing buyer and supplier answers, as discussed at the end of the chapter.

5.2.4 Supplier Competitors

Eighty-six percent of suppliers said that they were the only company supplying their indicated component, on their defined vehicle (indicating a single-sourcing strategy). Of the remaining 14%, 10% said that one other company was supplying the same or a similar component (dual-sourcing), 3% indicated 2 other suppliers and 1% said 4 additional suppliers for the same component. An example where two suppliers may each have work for a similar product on the same vehicle was given in Supplier Interview (AL23) and Purchasing Interview (AL5). Zonal sourcing is a strategy for presswork whereby the vehicle is split into zones, with each supplier looking after one zone. Rover then has the responsibility to ensure that compatibility is ensured at the zonal interfaces between suppliers

Similar information for the number of additional suppliers within Rover Group and the automotive industry is shown in Table 4. It must be noted, however, that most of Rover's components are single-sourced, although different part numbers will exist for slightly different parts *e.g.* nuts, washers, brackets *etc.*.

Additional Suppliers	**For Same Vehicle**	**Within Rover Group**	**Within Auto Industry**
0	86%	35%	09%
1	10%	31%	12%
2	03%	25%	07%
3		05%	07%
4	01%	04%	17%
5 - 10		01%	39%
> 10			09%

Table 4 Number of Additional Suppliers

The table implies that in a low number of cases there may be components which are supplied to all automotive manufacturers by one supplier. It would be expected that products such as the new diesel technology, or, areas where there was a high cost of entry, would come under this category.

Although in 35% of cases there were greater than 2 additional Rover Group suppliers for a component, and 79% within the automotive supply base, in only 7% of cases were the Rover Group suppliers *the* total supply base for that component. As a general rule, Rover appears to have 95% of its components supplied by 1 of 4 potential suppliers for that component. Where greater than 4 potential suppliers existed, it may be either that Rover had already eliminated them from the nomination process on previous occasions or that they were unaware of the supplier's competencies in the given area.

5.2.5 Quotations

Only 3 respondents answered the question regarding the number of other suppliers who were being asked to quote for their component on the same vehicle. This may indicate that: 1) suppliers don't understand the process, 2) suppliers are unaware of who their competitors are in relation to a Rover Group nomination, or 3) suppliers are aware of the process and their competitors, but not of the specific competition for each nomination.

Additional Quotes	0	1	2	3	5
Percentage	16%	29%	32%	19%	3%

Table 5 Number of Additional Quotations

An indication of sourcing strategy is shown by the number of suppliers who were asked to quote for a product (see Table 5). When suppliers were asked to state which of the sourcing strategies Rover used for their product they came up with different figures from those in Table 4. For example, 16% believed that no other suppliers were asked to quote for the business; 35 % believed that no other companies supplied a similar product to Rover and 9% within the automotive industry; but two-thirds believed that a single-sourcing strategy existed for their product. The definitions given were:

Single-Sourcing	One supplier per component for the whole Rover Group
Parallel-Sourcing	One supplier per component for each model
Multiple-Sourcing	Many suppliers per component for each model

In total 87 suppliers chose one of the answers above (9 did not feel qualified to answer the question). Of the 87 answers, 66.7% believed that there was a single-sourcing policy, 29.9% felt parallel-sourcing existed and 3.4% said that multiple-sourcing applied to their product.

Several implications may be drawn from the above;

1) A true 'academic' single-sourcing strategy would mean that when Rover had to buy a component they would automatically select the supplier they used for that component

for the rest of their models. This is clearly not happening because in 84% of cases one or more additional suppliers is asked to quote for business with 65% of products potentially being able to be sourced from an existing supplier to Rover. One possible reason for this is because the relationships between Rover and its suppliers are not transparent enough to cope with such a high level of interdependence.

2) In the case of 56% of components either 2 or 3 existing Rover Group suppliers are producing a similar product for Rover; 10% of components are produced by more than 4 different suppliers.

A debate exists within Rover Group as to whether single sourcing, as defined above, is a reality and if so, whether it is desirable. The diversity of Rover's product range determines in many cases that different needs exist for each vehicle, especially between the Land Rover and Cars Business Units, so much so that this can affect the choice of a simple component such as a connector, where it is sometimes necessary to use hybrid versions.

The strategy side of the argument is that if you have two suppliers with whom you source business (but only at one model per supplier) then this gives Rover competitive tension as a business lever, even if there is a 80/20 split in business. This is the approach adopted by Toyota. The second advantage of this method of parallel-sourcing is that the major supplier becomes more dedicated to Rover, whilst the smaller supplier may undertake work for other vehicle manufacturers. The aim of parallel-sourcing is to build up a relationship of trust with two suppliers, whilst using the presence of the second supplier to ensure that both remain competitive within their field (adapted from Purchasing Interviews, AL3 & AL6).

The data suggests that Rover and its suppliers are not ready to adopt either a true single or parallel sourcing policy for components at present, as in 54% of cases at least three suppliers are asked to go through the quotation process. This may be due to the fact that Rover are in the process of rationalising their supply base at the same time as trying to introduce a policy of product rationalisation (and therefore increasing the commonality of use of a component across the product range) whilst also investigating new suppliers to ensure that they are supplied by a *world class* supply base.

5.2.6 Tooling Payment

Rover Group uses several different methods of paying for their suppliers' tooling bills. Amortisation is one method favoured by Honda, and has therefore also been used by Rover; it is unlikely that Rover will continue to use amortisation given the reduced links with Honda. The principle of amortisation is that the cost of tooling is incorporated into the piece price of the supplier's product; a calculation is made as to the volume usage of the component per annum over a set time period (usually 3 years). At the end of the amortisation period Rover tends to take out the cost of the tooling (although in practice with the frequent changeover of buyer it is quite difficult to track). Honda however, because they tend to use soft tools, will keep in the amortisation cost and use it towards tool refurbishment.

Up front payment refers to payment of tooling in 3 stages (generally 1/3 at order placement, 1/3 at completion, and a 1/3 at validation) but payments are not linked to the piece price of the product. In some cases payments may still be outstanding as the product goes to volume production, due to the fact that the supplier's validation process may not satisfy Rover.

The final method is by vendor leasing. Rover started to use this method as a means to reduce the levels of capital investment by getting suppliers to borrow the tooling money. Rover acts as the go-between between supplier and bank in setting up the arrangement, which is in principle a mortgage of tooling with Rover advancing the repayment quantities to the supplier when their repayments to the bank are due.

5.2.7 Review of Costs

Reviews of cost are most frequently conducted by Rover on a yearly basis (in line with the yearly economics deals) for most production parts, with the aim being one of cost down, through continuous improvement. During the development of a product this is more likely due to design changes. The analysis shows that the average time period between reviews is every 11 months with a standard deviation of 3.48, which is in line with this assumption.

5.2.8 Period of Agreement

The length of agreement for supplying a product to Rover Group is an indication of the stability of the relationship between the two companies. A total of 19% of suppliers said that they were supplying under an annual agreement which might indicate that the level of tie-in between the companies is relatively low. A further 40% said that they were supplying their product for the life of the vehicle, with the remaining 41% on an open-ended basis. These agreements indicate longer term, more stable relationships, relying more on trust than written agreements.

5.3 Design

5.3.1 Initial Approach by Rover

Suppliers were approached initially, on average 28 months before a product launch, to discuss the possibility of working on the Rover vehicles. It was expected that those suppliers involved on a Honda run project would have had contact with Rover at an earlier stage in the project; it was found however that the time frame was standard across all projects, although for different reasons. The Japanese are perceived to have shorter and more compact development programmes, and the majority of non-R600 questions were answered on the 38A project, which had a longer development period. In addition the R600 suppliers felt that they had been involved less in the design process than suppliers on other projects, as much of the early design work was undertaken in Japan.

On only 48% of occasions did an invitation to quote come directly from within the purchase department, while 43% came from within engineering, who normally issue the product specification. In the majority of cases there will have been internal core teams who would have met to discuss potential suppliers prior to the release of specifications by engineering. This process has been formalised further in later projects where all competing suppliers are invited to a 'supplier event' where project aims and product specifications are discussed, with equal information being given to each supplier. Eight percent of quotation specifications were recognised as being sent out by the core team for the component, and in 4 cases a joint engineering/purchase approach was used.

A comparison was made between the R600 and all other projects; 10% of R600 approaches were made by engineering versus 59% for non-R600 projects. This suggests that the discipline within Honda is much stricter as to the route for information flows. Additionally, if engineering work was mostly carried out in Japan, Rover engineers would need to have had less involvement in the commercial relationship than would purchasing. An observation made since joining Rover purchase is that if the supplier interface is fronted from one department only then it is easier to track but this can lead to delays in forwarding information to engineers *etc.*.

5.3.2 Product & Process Design Responsibility

Hypothesis 1 suggested that 'differences in design ownership for product and process exist' between different products.

Questions regarding supplier/Rover product/process design capabilities were set as indicators to validate (or otherwise) Asanuma's model. The macro analysis is as shown below in Table 6:

Design Responsibility	Average	Standard Deviation
Supplier Product Design	56%	34%
Supplier Process Design	92%	10%
Rover Product Knowledge	72%	23%
Rover Process Knowledge	54%	17%

Table 6 Average Design Scores

Table 6 shows that on average there is a greater discrepancy between Rover and its suppliers regarding process design responsibility and knowledge, than is seen for product related design.

By definition Rover assigns its RG 2000 categories depending upon the type of design undertaken by suppliers. Prior to the testing of hypothesis 2, that 'a correlation would be seen between Asanuma's model and the RG 2000 classifications' it was necessary to validate the apportionment of categories by Rover. It was expected that the 4 categories would display different scores regarding product and process design.

Asanuma's classifications look at the extent of design responsibility undertaken by suppliers from the OEM. The classifications, with percentage scores given by suppliers, are:

I OEM provide minute instructions for the manufacturing process (0%);

II Supplier designs the manufacturing process based on blueprints of products provided by OEM (13%);

III OEM provides only rough drawings with completion entrusted to supplier (16%);

IV OEM provides specifications and has substantial knowledge of the manufacturing process (20%);

V Intermediate region between IV and VI (17%);

VI OEM issues specifications but has only limited process knowledge (18%);

VII OEM selects a proprietary product offered by the supplier (16%).

(NB: OEM/vehicle assembler here can be either Rover or Honda)

Initial analysis of this question shows that classifications II - VII are recognised by suppliers with at least 13% of replies in each of the groups, as shown above. Category I of Asanuma's definitions would have Rover or Honda dictating responsibility for the manufacturing process. This would only occur in reality if the supplier was supplying excess capacity for a product which was additionally produced in-house by the OEM. The fact that it does not exist within the sample indicates that suppliers are used because of their levels of expertise in areas which Rover has less process knowledge.

Two of the suppliers saw themselves as belonging to three classifications: these were I,II,IV and II,III,IV. A contradiction may be seen in the second example because the supplier appears to be saying that it has the OEM providing both detailed and vague specifications for both the product and process. The conclusion is that this data can only be assumed to mean that across their product range the supplier has differing levels of input from Rover.

Discussion regarding process/product design and knowledge follows with respect to both the RG 2000 and Asanuma models.

5.3.3 Supplier Product Design

The extent of product design undertaken by the supplier is an indication as to how much Rover relies on its supply base to take responsibility for the design of sub-components for a vehicle. On average suppliers undertook 56% of the design for their chosen component. This suggests that suppliers use design input from either Rover and/or second tier suppliers. In addition, this score shows that there are extremes of suppliers undertaking design; the lowest score was 0% for Respondent 9, a trim 1, category 2 supplier, which contrasts to a score of 100% for Respondent 274, a category 1, chassis supplier.

When looking at product design with respect to Rover supplier categories (see Table 7) it was not possible to undertake any inferential statistics because the test of homogeneity was violated and the classes were of unequal sizes (34 in category 1, versus 3 in category 4).

Expectations were met that suppliers were seen to undertake significantly different levels of product design between the 4 categories; Using descriptive statistics, category 4 suppliers gave a mean of 95% and a standard deviation of 4%. The 95% confidence intervals show that category 4 suppliers barely overlap with category 1 suppliers, even though they are the group with which they have the most in common, because both groups (potentially) constitute the supply of 'proprietary' components. The lowest average level of product design was for category 2 suppliers (33%), followed by category 3 (56%) and category 1 (76%) suppliers.

Due to the fact that there are only 3 category 4 suppliers within the sample, it is not possible to surmise much regarding their role and relationship with Rover. Of the three, one supplies a NAS[1] only proprietary product for the Defender (Respondent 349), one supplies products for all vehicles apart from the R600 and the MG (Respondent 774) and the third supplies an item to Land Rover only, at a cost of over £500 per vehicle (Respondent 84); in the latter case, however, it is not known whether the product is an option. It would appear that even though these 3 suppliers provide a different type of service to Rover group (whether as a proprietary item or as a large volume simple item), that all three undertake at least 90% of the product design work.

There was also found to be a significant difference in the spread of data within and between groups, when looking at Asanuma's classifications, with respect to levels of product design, (as validated by having equally numbered groups, rather than by complying with Levene's test).

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[1] NAS: North America Specification

Product Design	**RG 2000 Category**		**Asanuma**
Group Mean		56%	
Std Dev		33.97%	
F Ratio	$F_{3,80} = 12.86$ F Prob = **0.00**		$F_{5,77} = 2.34$ F Prob = **0.05**
Levene	Stat = 3.32 2-Sig = 0.02		Stat = 2.97 2-Sig = 0.02
SNK	2-3, 2-1, 2-4 3-1, 3-4		2-3, 2-7
HSD	2-1, 2-4		2-7

Table 7 Product Design

As is shown in Table 7, suppliers said that there was a significant difference between the level of product design understood by the OEM between group II (OEM provides blueprint) with group III (OEM provides rough drawings), and, group II with group VII (OEM selects a proprietary product from the supplier). The three remaining classifications which were valid for the questionnaire (Asanuma groups IV, V and VI) all assume that the OEM issues product specifications to the supplier.

5.3.4 Supplier Process Design

Suppliers undertook the majority of design responsibility (92%) for the manufacturing process for each product - a much higher score than was seen for the product design responsibility.

Homogeneity of variance was confirmed for the analyses regarding RG 2000 categories and Asanuma's classifications, although Post hoc and ANOVA analyses did not reveal any significant differences (see Table 8). RG 2000 category 4 returned the highest process design scores (99%) and category 2 showed the lowest, at 85%. Asanuma classification VII returned the highest level of process design, at 97%, followed closely by III, II and VI in descending order. This narrowness in responses may show that regardless of the level of process knowledge held by Rover, the actual design of the process is ultimately the responsibility of the supplier.

Process Design	**RG 2000 Category**		**Asanuma**
Group Mean		92%	
Std Dev		10.33%	
F Ratio	$F_{3,79} = 1.91$ F Prob = 0.13		$F_{5,76} = 0.61$ F Prob = 0.69
Levene	Stat = 2.10 2-Sig = **0.11**		Stat = 1.4 2-Sig = **0.21**
SNK	None		None
HSD	None		None

Table 8 Process Design

5.3.5 Rover Process Knowledge

This and the following question, regarding levels of process and product knowledge held by Rover, were trying to establish the design capability held within Rover Group; whether the sourcing decision was one of necessity because Rover does not either have the knowledge, or resource to undertake design, or whether because it chooses to confine its expertise to 'vehicle manufacture'.

Suppliers indicated that on average they undertook 92% of the process design, compared to Rover (and Honda's) average figure of 54% for knowledge held; although Rover is seen to have considerably lower levels of knowledge about the processes used by their suppliers there were instances where Rover was perceived to have "... industry experts in this commodity that act as a reasonable audit for the credibility of process and procedures" (Respondent 544). In contrast, Respondent 349, a category 4 (less complex or special in low volume products) electronics supplier, stated that Rover simply selected their products as if from a catalogue. This company supplies one product for Defender, undertakes 94% of the product design, 100% of the process design and considers that Rover has 1% product knowledge and 0% process knowledge. It would appear that in this case the supplier is providing a product which is required in relatively low quantities.

The Levene Test high-lighted that it was inappropriate to use the ANOVA test for the Asanuma classifications, although analysis of variance was validated for product group and RG 2000 categories, as shown in Table 9.

The indications are that Rover/Honda do not physically have the expertise (or resource) to undertake the design of the manufacturing processes for themselves as analysis by RG 2000 category showed that, although the different groups were of equal variances, ANOVA did not show any significant differences. This conclusion remains consistent across analysis by product group and RG 2000 categories.

Process Knowledge	**RG 2000 Category**		**Asanuma**
Group Mean		54%	
Std Dev		22.61%	
F Ratio	$F_{3,79} = 5.5$ F Prob = 0.65		$F_{5,76} = 3.48$ F Prob = **0.01**
Levene	Stat = 1.8 2-Sig = **0.15**		Stat = 3.50 2-Sig = 0.01
SNK	None		6-4, 2-4, 3-4, 7-4
HSD	None		6-4, 2-4

Table 9 Process Knowledge

The size of classes between Asanuma classifications were sufficiently similar to allow inferences to be made from the ANOVA (showing a 99% confidence limit for significant differences between and within class data), and post hoc tests.

Post hoc analysis showed that Asanuma category IV (OEM gives specifications with some knowledge of manufacturing process) differs significantly with groups VI and II which show the OEM as having limited knowledge of the manufacturing process. The SNK test adds group III (OEM gives rough drawings) and proprietary purchases (group VII).

It is possible that suppliers regard group V - the rather arbitrary "intermediate" classification which Asanuma does little to explain - as being closer to class VI suppliers rather than class IV suppliers because they score class V more closely to VI than IV.

5.3.6 Product Knowledge

No significant difference exists between the Rover product groups with respect to product knowledge (see Table 10). This in fact means that the personnel working with the suppliers of all product types have an equal understanding of product knowledge as is necessary for that product. To expand the point further, this means that even though there is a varying level of understanding of how a product is made engineers are concentrating their expertise in how the supplier's product will be used for a Rover vehicle. On average, Rover scored 72% for their understanding of product knowledge; although this is a relatively high level of understanding, there is still an example of lower perceived product knowledge from Respondent 338 who stated that "Our products are not very well understood by the customer. We recommend product".

Product Knowledge	**RG 2000 category**		**Asanuma**
Group Mean		72%	
Std Dev		17.32%	
F Ratio	$F_{3,79}$= 3.05 F Prob = 0.03		$F_{5,76}$ = 1.75 F Prob = 0.13
Levene	Stat = 3.3 2-Sig = 0.02		Stat = 3.77 2-Sig = 0.00
SNK	4-3, 4-1, 4-2		None
HSD	4-1, 4-2		None

Table 10 Product Knowledge

Although a significant difference was shown from the ANOVA test for levels of product knowledge held by Rover, for the different RG 2000 categories, the test for homogeneity was violated and the groups were of unequal sizes. Descriptive statistics showed that the 95% confidence limits for category 4 suppliers (-64% - 32%) was lower than the lowest limit of all other classes (category 3 suppliers gave the next highest range at (51% - 85%).

The highest level of product knowledge held by Rover was shown for category 2 (75%), followed by category 1 (71%), category 3 (68%) and category 4.

Levene's test for homogeneity was violated for comparison of levels of product knowledge against Asanuma's model. Equally sized classes, however, means that ANOVA and other inferential tests are validated. ANOVA showed that there was no significant difference between the two variables although it may be seen, as might be expected by the result of Levene's test, that at least one class (category VII) had a larger variance; post-hoc analysis showed that classes IV, V and III differed significantly with class VII. It is probable that catalogue goods are purchased because they are standard inter and intra industry items, such as nuts, bolts, relays *etc.*.

5.3.7 Critique of RG 2000 Categories

Figure 13 shows the average scores given by suppliers within each of the 4 RG 2000 categories for supplier product and process design, and Rover product and process knowledge. Additionally the graph shows where the significant differences were seen to exist, and within the legend, whether these differences were 'proved' via Levene's test or the use of descriptive statistics.

Category 4 suppliers have the largest difference between Rover and supplier design responsibility and understanding, with the highest level of design being undertaken by these suppliers, both in relation to process and product (either because they are less complex products which Rover has little knowledge of for process (49%) and product (34%), or, because they are proprietary products in low volume and high cost. It is probable that the latter is the most accurate view, as the cost of one of the category 4 products was £500.

Rover holds slightly less knowledge of products from *Category 1 suppliers* , relative to that for category 4 supplier products, although suppliers undertake, on average, 20% less product design than these. It would be expected that category 1 suppliers would command high levels of Rover Group resource given that their products are made in high volumes and to a high level of supplier design responsibility. The Rover scores indicate that information is exchanged, probably through the forum of core teams, and joint design.

Category 3 suppliers undertake less product design (by 20%) than category 1 suppliers and this score is actually lower than the level of product knowledge held by Rover (68%). Rover has the highest ratio of product knowledge to supplier product design of any of the categories, this may be because category 3 products are simple, such as for nuts and bolts, and therefore Rover is able to understand and work on the design of the products, without employing much resource.

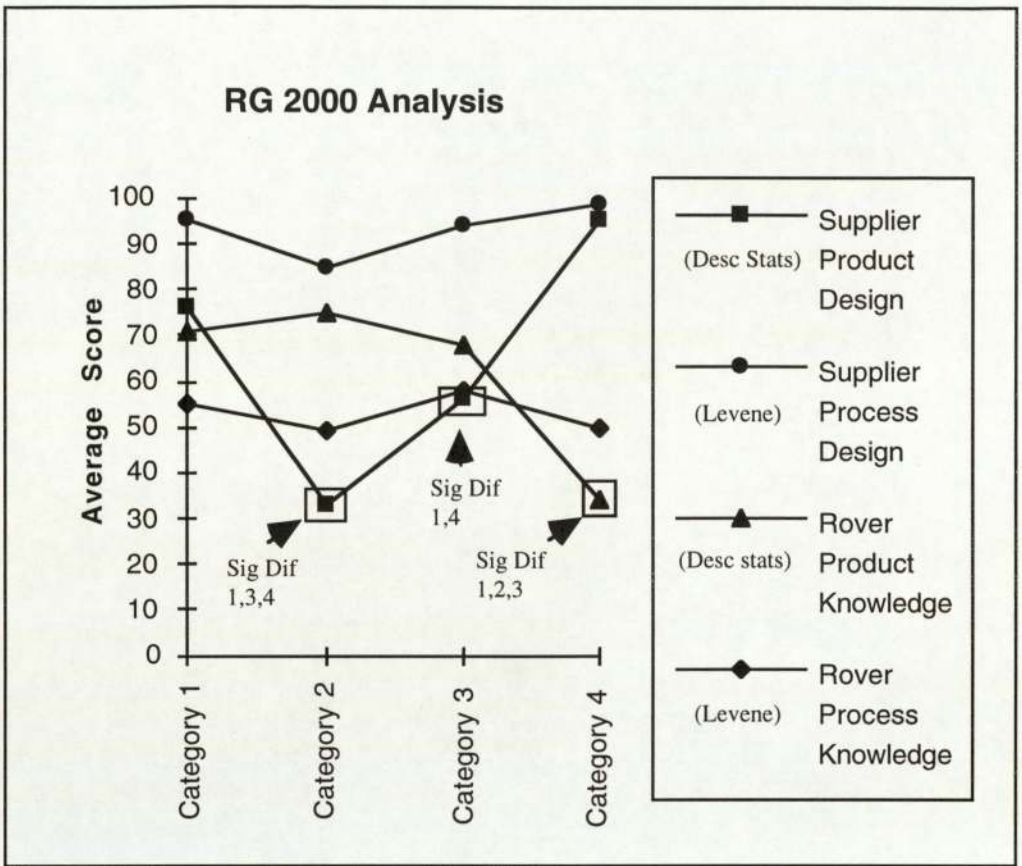

Figure 13 Average Scores by RG 2000 Category

The highest product knowledge score obtained by Rover was for *category 2 suppliers;* linked with the lowest supplier design scores, this suggests that category 2 suppliers would be 'design supplied'. The graph shows that the Rover product knowledge scores map the inverse of the supplier product design scores, with category 2 (Rover has greater product design knowledge than the suppliers have product design) and category 4 (supplier has greater product design that Rover has product knowledge).

Rover showed consistently poor levels of process knowledge, regardless of the RG 2000 category, and as validated to the 95% significance level, relying instead on the high scores for process design shown from the suppliers. This means that regardless of how strategic the product is for Rover, or how much understanding of the product is held, Rover does not have a full understanding of how the product is made, relying instead on the supplier. This has implications as to how Rover manages a supplier's 'design for manufacture' (DFM) philosophy.

The conclusion reached from this part of the analysis is that through the definition of the RG 2000 categories Rover has recognised that there are different levels of design being undertaken by their suppliers. Although some anomalies do exist and inconsistencies occur, Rover are reasonably consistent in their classification of the RG 2000 categories with their suppliers. It is therefore possible to use the RG 2000 classifications as an indication for levels of product and process design and as a statistical benchmark for further analysis of the questionnaire.

5.3.8 Critique of Asanuma's Model

Figure 14 shows the average design scores given by suppliers within categories II to VII of Asanuma's model. Results were validated using either Levene's test or Anova via equally sized classes; the results from each class are discussed below.

I - Core firm provides minute instructions for the manufacturing process: No suppliers recognised this group as being applicable as a description of their relationship with Rover. It is possible that this section would only be a short term classification, for example, when a core firm out-sources business with a supplier for the first time and transplants their manufacturing process as well as the product design with a new supplier. Transplants of one vehicle assembler's assembly line to another vehicle manufacturer would also be expected to come under this category. The closest that Rover comes to this type of relationship is with Rover Body & Pressings which is classed as a 'supplier' even though it is technically one of the Rover business units (Purchase Interview, AL5).

II - Supplier designs the manufacturing process based on blueprints of products provided by the core firm: Those suppliers who perceived themselves to belong to this class only gave Rover a product knowledge score of 74% with their own company undertaking the lowest level (28%) of product design for themselves. There is also a discrepancy with the scores for category IV where Rover scored 83% on product knowledge when they were simply writing a specification rather than undertaking a blueprint design.

The maximum score for supplier product design within this group was 90% which is high due to the fact that the design is 'handed over' to the supplier. These scores appear to suggest that even where a 'blueprint' design is given to a company, some design initiative would also be needed from the supplier.

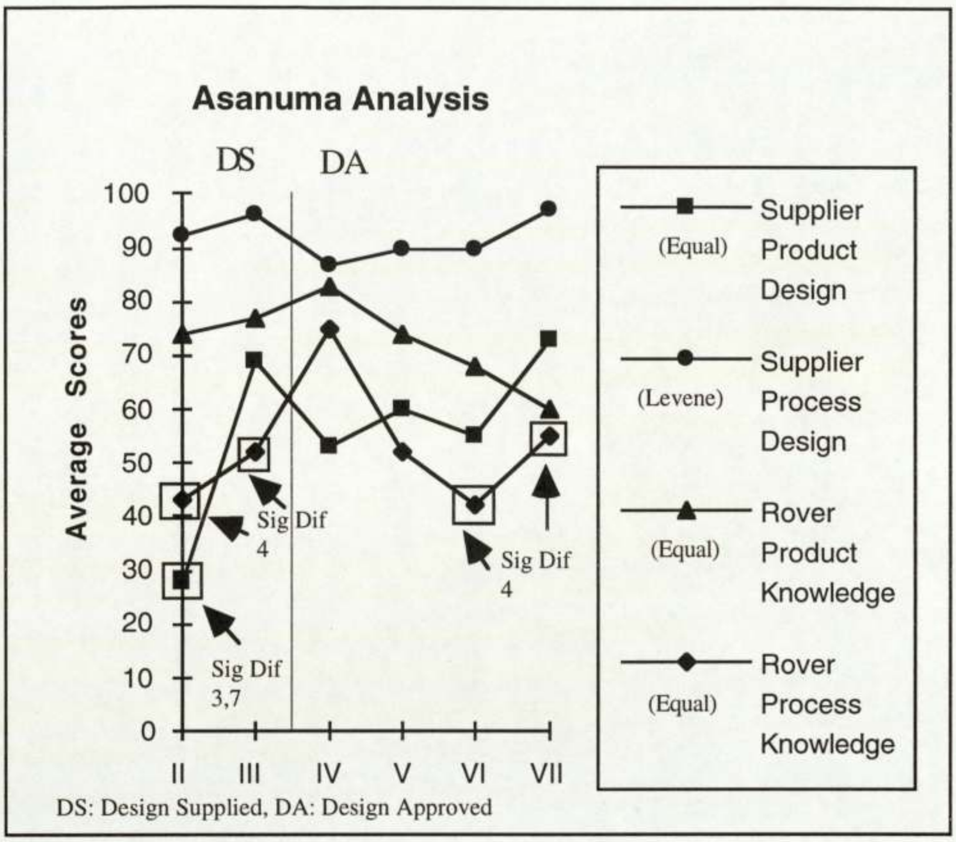

Figure 14 Average Design Scores by Asanuma's Model

Asanuma's model suggests that the supplier alone would design the manufacturing process; the data backs this up with 92% of the design on average being the supplier's responsibility, with Rover understanding less than half of the manufacturing process (43%).

III - Core firm provides only rough drawings with completion entrusted to the supplier: As would be expected the extent of product design undertaken by the supplier is considerably higher than was seen in category II (69% compared with 28%). Rover displayed the second highest score for product knowledge (77%), which, surprisingly, was higher than that shown for the 'blueprint' design, as discussed above for classification II. The model suggests that Rover should be supplying rough drawings within a 'design supplied' context; however, it would have been expected that the supplier product design score would have been lower than was seen for the 'design approved' categories.

IV - Core firm provides specifications and has substantial knowledge of the manufacturing process: Ironically the suppliers associated with this group gave Rover the highest levels of product and process knowledge amongst all classes, even though the model states that suppliers of this class are 'design approved' suppliers. In addition, suppliers undertook only 53% of the product design for themselves (the fifth lowest score) and came bottom for process design with 87%. With respect to levels of supplier process design, it must be remembered that ANOVA and Levene's tests showed that there was no significant difference between Asanuma classifications. This indicates that even though suppliers in class IV undertook the lowest amount of design, this was not significantly different from suppliers of all other classes.

As suggested by the class title, category IV suppliers did show a 'substantial knowledge of the manufacturing process' but this was still lower than the levels of manufacturing knowledge held, on average, by the suppliers. It is possible that the wording of the category confused some of the answers.

V - Intermediate region between IV and VI: Scores for suppliers in this section did fall between those scores given by category IV and VI suppliers except for supplier product design which was slightly higher than the other two categories.

VI - Core firm issues specifications but has only limited process knowledge: Rover displayed the minimum level of process knowledge (42%) and the second lowest product knowledge score (68%). In fact, Rover scored lower for providing product specifications than it did when giving only rough drawings (83%). Suppliers in this category scored similarly to those in category IV for product design, although still only achieving the 4th highest score, at 55%.

VII - Core firm selects from a catalogue offered by the supplier: Category VII suppliers undertook the highest levels of both product (73%) and process (97%) design. Rover displayed the least level of product knowledge (60%), but the second highest level of process knowledge, at 55% which was surprising as a catalogue good is an area where Rover would expect to have the least amount of influence and contact with a supplier.

Thirteen companies said that they were category VII suppliers but levels of product design ranged from 0% to 100% for products which you would expect the core firm to have little or no input into their development, except if the core firm was such a large customer that they could heavily influence the market research for suppliers. In this case Respondent 308, who gave the 0% score is a category 3 (simpler components in normal or high volumes) supplier of "widget" like components. The score therefore reflects the fact that no design work was undertaken for the product because it is a standard item although process improvements are being undertaken continuously.

Respondent Number	Product Group	RG 2000 Category	Supplier Product Design	Supplier Process Design	Rover Process Know	Rover Product Know
51	J	1	82	100	79	97
231	A	1	95	91	65	66
257	A	3	79	78	87	89
274	G	1	100	100	18	26
302	E	1	96	99	89	96
308	L	3	0	100	22	76
314	R	3	95	100	86	6
338	C	3	100	100	5	10
349	E	4	99	100	1	0
397	C	3	0	100	37	87
401	A	1	10	100	62	62
505	G	4	93	98	76	77
559	L	3	98	98	83	83

Table 11 Breakdown of Category VII Suppliers

Of the 13 suppliers, all the product groups were represented, and all but category 2 of the RG 2000 categories had at least 2 products within this class. Examples of products with their RG 2000 categories are: wheel nuts (3), airbags (1), wheel bearings (1), and convoy lights (4). Table 11 shows the range of scores for process and product design.

The maturity of a supplier's product may also affect the level of design input by Rover. For example, the first time a new concept is entertained for a vehicle, Rover may have a high input into the design of that component. As the product is proven, and used over successive models, however, a project integration role may instead become all that is appropriate for Rover to undertake. Examples of this may be the movement from a steel to a plastic petrol tank, or the use of electronics for power assisted steering (EPAS), such as Rover have introduced on the new MGF (a technology which has previously only been used on the 'micro' vehicles used in Japan).

The above results suggest that a larger sample would be needed to fully validate Asanuma's model although there was evidence to suggest the validity of the model. Figure 14 shows that the trends between the categories were not unexpected although the distinction between DS and DA suppliers was not as clear as the model had suggested (although the definition had not been stated within the questionnaire). The breakdown of one category (as seen for Category VII suppliers above) showed that each class contained a degree of diversity in some of the scores.

5.3.9 Consideration of Asanuma and Rover RG 2000 Models

Analysis of the Asanuma and RG 2000 models suggests that it is possible to accept hypothesis 1, that differences in design ownership for product and process exist. It was seen that the statistical tools chosen could not fully validate the data in some cases due to the size and spread of some of the classes. Analysis by RG 2000 category revealed that scores for supplier product design and Rover product knowledge were significantly different. All of these findings however, were based on descriptive statistics only as it was not appropriate to use the ANOVA test.

The central limit theorem states that groups should be at least 50 cases in size in order that an approximation to the normal distribution is valid. Clearly in a sample of only 95 which has been split into 6 classes (for Asanuma), class sizes tended to range from between 10 and 16, indicating that a larger sample is needed. Any further split of these classes into the RG 2000 categories would be statistically incorrect as the class sizes would be too small.

Responses to the 4 questions concerning Asanuma's classifications are not clearly defined. As shown for category V product design above, the range of responses for just one of the factors appears to legitimately range from 0-100%, with obvious implications for the size of the mean and standard deviation. A larger sample would be able to swallow any anomalies which exist within a class, without them making such an impact on the output of the data. Concerns over the statistics were felt because where no significant difference was found the analysis was validated by Levene's test; when a significant difference was found however, the same size of classes was not large enough to 'prove' the difference except by equally sized classes or descriptive statistics. It was therefore not possible to statistically investigate further hypothesis 2 that, a correlation would be seen between Asanuma's model and the RG 2000 classifications.

The RG 2000 and Asanuma models do not have a 'scoring' system against which to compare the results of this study; it is therefore difficult to define the boundaries between each class in terms of scores for product/process design and knowledge. The questions regarding the level of OEM input were focused on their knowledge of product and process rather than their level of input into the area during a project. It is possible that even though a high score in product knowledge was realised, this does not have necessarily mean that Rover have, for example, more than a project management role for a DA product.

5.3.10 Exchange of Expertise

The majority of suppliers (81%) believed that an exchange of expertise had taken place between their company and Rover with respect to either process or product knowledge. The high use of inter-company core teams helps to create a forum in which current and future products and their manufacture are discussed.

The questionnaire answers showed that different levels of exchange of knowledge resulted from the "... open factory/book policy to Rover Group (*which*) has enabled them to gain most of the knowledge on product and process" (Respondent 226), to "Honda advised method of X and Y as it was an ex-Japanese practice" (Respondent 80) and "Rover has industry experts in this commodity that act as a reasonable audit on the credibility of process and procedures" (Respondent 544).

5.3.11 Communication

Suppliers were asked to score Rover's ability to communicate their vision of the new model programmes to themselves; it was expected that those suppliers which undertook more design responsibility would have more communication with Rover. The average score across the supply base was 59%, with a standard deviation of 25%. This expresses a view that there is a wide difference in how project aims are projected across the group.

Levene's test indicated violation of homogeneity of variance for both independent variables; inferential statistics was undertaken for the Asanuma analysis and descriptive statistics for the RG 2000 categories.

Communication	RG 2000 Category		Asanuma
Group Mean		59%	
Std Dev		24.69%	
F Ratio	$F_{3,73} = 3.83$ F Prob = **0.01**		$F_{5,71} = 1.94$ F Prob = 0.10
Levene	Stat = 5.1 2-Sig = 0.00		Stat = 3.08 2-Sig = 0.01
SNK	3-2, 3-1		None
HSD	3-2, 3-1		None

Table 12 Communication

Category 1 suppliers returned the highest mean (68%) and the lowest standard deviation (23%) of all classes. The ANOVA test showed that this was significantly different from other categories. Group 3, simpler and high volume suppliers showed the lowest scores for communication (a 37% mean and 39% standard deviation).

ANOVA revealed that communication within the Asanuma model was not significantly different, although the best communication was seen within classification III and the worst within classification II.

5.3.12 Integration into the Design Team

Suppliers were asked how integrated they felt with the Rover project team; it was expected that those suppliers with higher design responsibility would perceive a higher level of synergy with the Rover teams. The classes did not exhibit homogeneity of variances, but equal class sizes existed for analysis by Asanuma's model. On average suppliers gave a score of 55% with a standard deviation of 30% (see Table 13); this is a score which indicates that there is a need for improvement to incorporate the supplier with the project team.

Although ANOVA is not valid for analysis by supplier category and the class sizes are not similar in size, it was shown that category 1 suppliers were integrated well into the Rover teams, and they returned a mean of 72%. Category 2 suppliers gave a mean of 53%, category 3 said 40% and the three category 4 suppliers returned the lowest score at 13%. Discussion elsewhere has shown that at least one of the category 4 suppliers provides proprietary parts, but category 4 suppliers gave a maximum score of 20 for this question. This shows that levels of resource given to a supplier vary depending upon that volume of business for that supplier.

The score for category 1 suppliers shows that integration with the supplier is higher because there is a need to ensure that the project focus is maintained and understood, to ensure compatibility of the supplier's product with interacting parts from other suppliers. Some category 1 suppliers, however, who supply off the shelf engineered solutions (such as for relays) would not need such close contact with the teams because their products are familiar and already in use by Rover.

Integration	**RG 2000 Category**		**Asanuma**
Group Mean		55%	
Std Dev		29.95%	
F Ratio	$F_{3,73} = 5.96$ F Prob = **0.00**		$F_{5,70} = 1.47$ F Prob = 0.21
Levene	Stat = 6.2 2-Sig = 0.00		Stat = 2.97 2-Sig = 0.02
SNK	4-1, 3-1, 2-1		None
HSD	4-1, 3-1		None

Table 13 Integration

When considering Asanuma's classifications for integration scores, it was seen that group III suppliers felt that they were better integrated into teams than all other classes. This is because Rover only supplies rough drawings to the supplier and discussions need to take place to ensure that expectations are met.

5.3.13 Ability to Deliver to Vehicle Concept

Suppliers were asked to rate how successful they thought they were in delivering their product to Rover requirements. On average suppliers saw themselves as being able to achieve 84% of the goals needed to meet the vehicle concept (see Table 14).

Category 1 suppliers were more satisfied with their achievements even though many may use new technologies; they may also have higher scores here because they sometimes define the specifications for themselves since they are the experts.

Ability	RG 2000 Category		Asanuma
Group Mean		84%	
Std Dev		15.01%	
F Ratio	$F_{3,73} = 3.90$ F Prob = **0.01**		$F_{5,70} = 1.51$ F Prob = 0.20
Levene	Stat = 6.9 2-Sig = 0.00		Stat = 2.79 2-Sig = 0.02
SNK	3-1, 2-1		None
HSD	3-1		None

Table 14 Ability

No significant differences were seen with the suppliers' abilities to deliver to expectation, when considering Asanuma's model. This may be because Rover are good at allowing suppliers to contribute to design in the most appropriate way for each supplier (whether design is to a greater or lesser extent carried out by the supplier).

5.3.14 Input Into the Design Process

On average, suppliers felt that they were able to contribute some input into the design process, to the extent of 48%, with a standard deviation of 32% (see Table 15). Levene's test confirmed that all analysis for this question was viable for ANOVA tests; *i.e.* that variances of all groups were similar.

Input	RG 2000 Category		Asanuma
Group Mean		47.93%	
Std Dev		31.01%	
F Ratio	$F_{3,72} = 6.93$ F Prob = **0.00**		$F_{5,69} = 2.37$ F Prob = **0.05**
Levene	Stat = 2.8 2-Sig = **0.05**		Stat = 0.70 2-Sig = **0.63**
SNK	4-1, 3-1, 2-1		None
HSD	4-1, 3-1, 2-1		None

Table 15 Input Into Design Process

Supplier input differed significantly for category 1 suppliers, coinciding with higher scores for their perceived ability to achieve the desired concept. The average scores for the RG 2000 categories show that the less design suppliers undertake for themselves the more they feel that they influence the design process.

5.3.15 Geba Events

Seventy-six suppliers answered the question relating to project gebas and out of these 21 said that they had not attended a single event. This should be seen as a lost opportunity for Rover Group as it ignores the wider system implications for suppliers of interacting components. For example, even if Supplier A's component is conforming 100% to its specification, a problem with Supplier B's component may be more quickly and cheaply overcome by a change to Supplier A's, rather than Supplier B's, product.

5.4 Communication Links

Suppliers were asked to consider the type and frequency of their contact between Rover, Honda, themselves and other suppliers. Types of communication indicated by respondents were written, face to face, presentation, fax, phone calls and EDI (electronic data interchange). The Rover/Honda departments noted were design, manufacturing, marketing, finance, sales, logistics, 'other', machine tool manufacturers and other component suppliers.

Within the communication grid in the questionnaire, the question was aimed at looking at the Rover relationship specifically, and then asking for a yes/no comparison indicating whether contact with Honda was greater or less than that with Rover. It is unclear with some suppliers whether they have filled in the grid for Honda instead of Rover. It is therefore not possible to use this part of the analysis as an inter company comparison and therefore it can only be used to show how levels of communication differ depending on the stage in the project.

During the transcription of the grid from paper to PC, the 'purchasing' department was omitted from the grid; fortunately most of the respondents used the 'other' category for their information regarding purchase. The fact that respondents realised that purchasing was missing indicates that the relationship with purchasing is important to suppliers because of the commercial implications. A single paged letter was sent out to any named respondents who had not filled in the grid for purchasing and in all but one case all these were returned promptly.

5.4.1 Interpretation by Communication Type

Written Communication: The level of written communication between a supplier and Rover Group may indicate the extent to which a formal relationship exists. The level of contact with the manufacturing and logistics functions shows that suppliers are considering these aspects, even though no schedules, for example, would be seen from logistics for many months. The types of information passed between the companies are specifications, commercial information, core team minutes *etc.*.

Face-to-Face Communication: The business meeting is used as a forum for discussions, decision making, and the exchange of information (written and verbal). Minutes of meetings are normally taken via the use of a nobo board which allows hand written white board notes to be printed off instantly and photocopied so that participants can take away copies when they leave the meeting. Core team, commercial and other meetings allow a more personal relationship to be established with members of the team. There are benefits and costs to such a close working relationship; It is possible for individuals to base an opinion of a company on the relationship with a few people. Rover overcomes this by using a mixed team of people from different functions when undergoing a sourcing decision.

Presentations: The formal method of using presentations as a means to transfer information is used relatively infrequently. At the pre D-zero stage presentations are used to discuss quotation proposals and to gain general information on the supplier.

Fax Transmissions: The fax machine is the life saver of Rover Group; it allows for the deficiencies of people to be quickly rectified where, for example: information has been lost that needs to be instantly available; confirmation of changes in costs or build requirements need to be made; and signatures need to be sought from people at different sites.

At the same time the fax machine is a liability, potentially showing an area where lax security exists as suppliers are able to walk past piles of incoming faxes which sometimes contain proprietary information from other companies. Suppliers should be accompanied at all times when on site but this is unlikely to be 100% reliable due to the fact that car parks *etc.* are located a long distance away from the relevant buildings, meeting rooms within purchasing mean that suppliers are marched past many desks several times in the course of a visit, made worse due to the fact that the closest amenities are located several minutes walk away from the various meeting rooms.

Telephone Calls: The telephone call is the most popular and convenient method of communication between suppliers and Rover Group and made more useful by functions, such as putting phones on call forward *etc*.. The telephone is the quickest way to ensure that any message has been understood by the recipricant and that any outstanding actions have been committed to within a defined time frame.

Electronic Data Interchange (EDI): The use of EDI was seen to be lower than other methods of communication, even at the volume stage of a project. This is because not many companies are using EDI at present although this is said to increase dramatically in the next few years. It was, however, surprising to note that the computer network is hardly utilised internally within Rover and externally with its suppliers.

This would appear to be an area where there is a vast opportunity to increase efficiency by the use of technology. Since starting work with Rover there has been very little sign of the utilisation of IT as an effective tool. It is surprising that a company such as Rover is not fully utilising the basic forms of IT such as e-mail in place of the fax machine to ensure that confidentiality and security of material is maintained in a 'less paper' if not 'paper-less' environment.

5.4.2 Analysis by Function

Manufacturing: All forms of communication are used throughout the life of the model although contact increases the closer the vehicle is to volume production. The fax and phone are the most frequently used modes of communication but there is also a relatively high level of personal contact which shows that suppliers are trying to design for manufacture and remaining in close contact to ensure that the ongoing use of their product is satisfactory. Electronic communication increases with volume production but is still relatively under utilised or backed up with alternative methods of communication, such as faxes. Any problem during volume production where the assembly lines are stopped means that money is lost to Rover at the cost of approximately £2-3,000 per minute (in terms of labour plus overhead associated with idle time, plus labour required for 'catch back', plus any rectification time, plus the cost of extra-ordinary action required to keep the lines going). One supplier's bill in the

1980's came to £250,000 for a 20 minute stoppage because the stoppage affected the whole assembly line.

Engineering: Contact with engineering is continuous and without much variance amongst suppliers until volume production, where there is a slight difference in the level of telephone calls. Engineering rely heavily on the telephone and fax machine. Contact is maintained by the engineer with the supplier into volume production which means that any feedback on the suppliers part in volume production is being fed back into the cycle so that continuous improvement can continue.

Finance: The supplier/finance interface is the one which sees the least personal interaction; the majority of communication is written, by fax or by telephone. Contact by telephone doubles at volume production which is not surprising because the throughput of invoices increase considerably. It would be expected that as more suppliers use a self-billing process, less contact with finance would be necessary.

Sales: The sales graph is very similar to that of marketing indicating that the functions are very similar. Rover do not actually support a large sales force because they rely heavily on their dealerships for sales.

Logistics: The logistics team are at the cutting edge of the business because they manage the daily relationship with suppliers, ensuring that schedules are correct and managing levels of stock so that the JIT system is supplied at the correct levels. There is a very high reliance on the fax machine and telephones and at volume they have the most frequent contact with the supplier from within Rover with almost no deviation from this figure amongst the different suppliers. Logistics also have the highest use of EDI as they have as one of their goals that all suppliers will receive their schedules by EDI within the next few years. However, only 50% of suppliers said that they received their schedules by this method at the time of the questionnaire.

Purchasing: As stated previously the response rate for this question was lower because it was missed off from the original grid. Despite this, about 60 responses were received which shows that purchasing is one of the most frequent contact points within Rover Group for the supplier. Again a high reliance was shown on the use of the fax and telephone even more than with logistics at volume production. This was surprising but could be attributed to the fact that purchasing act as a backup for logistics in times of crisis and that buyers are generally concerned with more than one project per supplier and have non-project team based roles such as economics deals to consider.

Machine Tool Manufacturers: The most contact that suppliers had with their machine manufacturers was during volume production. The communication took the form of telephone calls and meetings.

Other Suppliers: Responses to this question show that links with other suppliers are considered to be important, with continuing contact throughout a programme at least at the bi-weekly level. This shows that the interface between the various suppliers is at a relatively good level as the need for co-operation at the system level is required.

5.5 Opinions

5.5.1 Trust

Suppliers said that the level of trust which exists between Rover and themselves is on average 74% with a standard deviation of 15.5% (see Table 16). Expectations were that higher levels of trust would be seen to correspond with higher levels of supplier design.

This question complied with homogeneity of variance requirements for analysis by RG 2000 categories, even though group 4 suppliers displayed, on average, a larger degree of trust (90%, compared to the next highest of 75% for category 1) and a smaller standard deviation (8%, compared to the next smallest, again for category 1, of 18%). These differences, however, were not shown to be significant under the analysis of variance test, giving a F probability of 0.49. Category 4 suppliers may feel higher degrees of trust exist between themselves and Rover Group, especially if they are a small company who offer proprietary designs for a specialist product.

Trust	**RG 2000 Category**		**Asanuma**
Group Mean		74%	
Std Dev		15.55%	
F Ratio	$F_{3,82} = 0.82$ F Prob = 0.49		$F_{5,76} = 1.14$ F Prob = 0.35
Levene	Stat = 1.01 2-Sig = **0.39**		Stat = 1.12 2-Sig = **0.35**
SNK	None		None
HSD	None		None

Table 16 Levels of Trust

No significant difference was found to exist between suppliers of the different classifications within Asanuma's model, although the highest levels were shown for group III (complementing their higher perceived levels of communication, integration, ability, and input).

5.5.2 Levels of Openness

Suppliers scored levels of openness with Rover at a similar level to that of trust (74%). The highest score was 100% and the lowest 21%, given by a category 1 Trim 1 supplier (see Table 17). Analysis might have been expected to show that suppliers who undertook more product design were either very open because they have to work closely with Rover to ensure that the product is suitable, or that they were very secretive because they did not want to disclose too much information in order to maintain a competitive advantage. Rover commit to levels of confidentiality for suppliers, but even so supplier 531 said "... we also know that costs that appear on QAFs get given to competitors". Whether this is perception or reality, this is an issue which Rover needs to address. Post-hoc analysis however showed that no classifications were significantly different.

All the tests complied with homogeneity of variance and all of the ANOVA results showed that there was no significant difference from analysis by RG 2000 category and Asanuma's classifications. Once again category III suppliers returned the best mean value, of 83%, as well as showing the smallest standard deviation, of 11%.

Openness	**RG 2000 Category**		**Asanuma**
Group Mean		74%	
Std Dev		15.1%	
F Ratio	$F_{3,82} = 1.06$ F Prob = 0.37		$F_{5,76} = 1.98$ F Prob = 0.09
Levene	Stat = 0.9 2-Sig = **0.42**		Stat = 1.68 2-Sig = **0.15**
SNK	None		None
HSD	None		None

Table 17 Levels of Openness

5.5.3 Extent of Buyer-Supplier Lock-In

This question was designed to ascertain whether suppliers who undertook higher levels of design for Rover felt that their relationship was more secure because it would be more difficult for Rover to resource away from them in future models. Table 18 shows that the average score was 64% with a standard deviation of 24.8%. Ranges within the four RG 2000 categories show the minimum and maximum scores for each group as being group 1 (9-97), group 2 (23-100), group 3 (4-94) and group 4 (21-50). This shows that the level of confidence within the supply base is varied and that this is not dependant upon the type of service offered by the supplier.

Lock-In	**RG 2000 Category**		**Asanuma**
Group Mean		64%	
Std Dev		24.80%	
F Ratio	$F_{3,81}$ 2.78 F Prob = **0.05**		$F_{5,76}$ = 1.89 F Prob = 0.11
Levene	Stat = 4.37 2-Sig = 0.01		Stat = 4.91 2-Sig = 0.00
SNK	None		None
HSD	None		None

Table 18 Extent of lock-In

Only descriptive statistics were used for the analysis by RG 2000 category, due to the small class size of category 4. The highest 95% confidence interval was shown by category 2, followed by categories 1, 3 and 4. It is interesting to note that even though the category 1 suppliers undertake proprietary design work, perhaps this is not so secure because Rover may own the Intellectual Property Rights (IPR) for some of the product concepts.

No significant difference was revealed through conducting an analysis of variance for the extent of lock-in with Asanuma's categories. Category V suppliers cited the highest levels of lock-in with Rover Group, which is surprising because they lay within the middle ranks within Figure 14. Class III did not exhibit the highest score with this variable, although the 100% score was given by at least one supplier; the total range being 9 - 100%.

5.5.4 Chance of Future Business

Suppliers thought they had a slightly higher chance of supplying a replacement model vehicle on current business (79%) than there was in general of gaining new business over Rover Group as a whole (70%).

5.5.5 Quality Vs. Cost

Suppliers were asked whether they thought that Rover Group weighed 'quality' with more importance than 'cost' when considering the selection of a supplier: 27% thought that cost was seen as being the most important factor; 15% thought that quality was ranked highest; and the remaining 58% thought that the two were considered in such close proximity that they were inseparable. Six suppliers were unable to make a choice on this question.

There is a perceived risk when introducing a new and leading edge technology; Rover is sometimes forced to make a decision as to whether to accept increased costs in order to achieve higher quality levels. Electronics is an area where this is currently the case; where it is a requirement that a current is switched within an electrical control unit (ECU) the supplier has an option to use a mechanical relay (known technology) or a Smart FET (Field Effect Transistor): a relatively new technology which is more expensive but has a lower parts per million failure rate and lower packaging requirements. A disadvantage of using a Smart FET is that it may also be necessary to use a 'heat sink' to aid the dissipation of the heat given off by the Smart FETs, but this may be out-weighed by the advantage of higher reliability and therefore lower service costs. The external functionality of the ECU would be unaffected, but the cost and packaging constraints on Rover would be influential in this choice and is the type of decision which would be discussed at a Core Team meeting.

5.5.6 First-Choice Suppliers

Nine suppliers did not know whether they were considered to be first choice suppliers. Of those who answered the question, 91% believed that they were first choice suppliers. Rover's selection criterion is that suppliers must be first choice suppliers in order that they are used by the group for new products.

5.6 Best Practice

Out of the 95 suppliers, 43% said that they had received at least one visit from the Best Practice Team. A couple of suppliers said that they had received about 20 such visits which seems very high given that most suppliers had provided a figure of between 1 and 4 visits. The average number of visits was 1.88 which shows that most suppliers who have had such visits have had return visits, possibly to see how any suggestions had been incorporated by the supplier.

When asked whether they considered that any savings had been derived from a Rover Best Practice suggestion, the replies were fairly split, 63% said 'yes' and 38% said 'no' from the 32 responses to the question. The role of Best Practice teams may not be clearly understood within the supply base and certainly in some of their earlier visits it was felt by some suppliers that the Best Practice teams lost credibility (Supplier Interview, AL22).

5.7 RG 2000

Questions regarding RG 2000 scores were derived from the Rover booklet "RG 2000 - A Supplier's Guide". Most suppliers were unable to provide two sets of data so analysis was only undertaken on the earliest set of scores. The later four sections (quality systems accreditation, delivered product quality, delivery performance and product warranty performance) were not recognised by suppliers because they have not been widely used in the RG 2000 assessments as yet. Scores for the various sections varied widely because Rover had changed its scoring system some time after introduction. Scores have therefore been adapted to allow a like-for-like comparison to be undertaken. It must also be noted that the aim of RG 2000 is to identify opportunities for improvement, rather than to provide a direct comparison between suppliers.

Comments from suppliers were mixed although the overall response was positive regarding the scheme as a "good consultancy opportunity" (Respondent 573); "RG 2000....is an excellent bench marking program towards attaining world class standard" (Respondent 9) although some felt that it took a "major effort by (us) in time and management resource...a concern is duplication resulting from other auto companies doing similar exercises...*there is a* ...need for a common approach" (Respondent 273).

5.7.1 **Project Management** (Maximum score 310)

The average score for project management was 186 with a standard deviation of 31. According to the booklet, only category 1 and 2 suppliers should be asked questions on project management but only category 4 suppliers did not have scores for this section. The mean score shows that 40% of the available scores are being missed by suppliers - a huge opportunity for improvement!

Project Management	**RG 2000 category**		**Asanuma**
Group Mean		186	
Std Dev		31.11	
F Ratio	$F_{2,44} = 1.19$ F Prob = 0.31		$F_{5,40} = 1.85$ F Prob = 0.12
Levene	Stat = 0.93 2-Sig = **0.40**		Stat = 1.02 2-Sig = **0.42**
SNK	None		None
HSD	None		None

Table 19 Project Management

Scores for project management, as seen in Table 19, were not seen to be significantly different when analysed by RG 2000 category or Asanuma classification although category 1 and class VII returned the highest scores: in addition, all tests complied with Levene's test. Scores could be similar due to the fact that project management is a necessary part of a project, regardless of the level of design responsibility undertaken by the supplier. It should also be noted that the maximum score for this question was 310, a relatively high weighting within the RG 2000, but with the highest score achieved by a supplier being just over 200. The scores show that Rover perceives that its suppliers do not satisfy its expectations as to the management of Rover projects.

5.7.2 **Total Quality Management (TQI)** (Maximum Score 99)

The mean score for TQI was 56 with a standard deviation of 13.8 - 57% of the available scores being captured by suppliers. Again, the scores reflect that suppliers should be encouraging a TQ culture within their companies. Table 20 shows that all ANOVA results revealed that there was no significant difference between classes.

TQI	**RG 2000 Category**		**Asanuma**
Group Mean		56	
Std Dev		13.8	
F Ratio	$F_{2,44} = 2.17$ F Prob = 0.13		$F_{5,40} = 1.46$ F Prob = 0.22
Levene	Stat = 0.97 2-Sig = **0.39**		Stat = 0.42 2-Sig = **0.82**
SNK	None		None
HSD	None		None

Table 20 Total Quality Improvement

5.7.3 Business Performance (Maximum score 345)

Business Performance	**RG 2000 Category**		**Asanuma**
Group Mean		224	
Std Dev		34.09	
F Ratio	$F_{2,43}$.= 5.24 F Prob = **0.01**		$F_{5,39} = 1.97$ F Prob = 0.11
Levene	Stat = 0.72 2-Sig = **0.49**		Stat =3.15 2-Sig = 0.02
SNK	3-2, 3-1 2-1		None
HSD	3-1		None

Table 21 Business Performance

Sixty-five percent of the available scores were met by suppliers for business performance. This indicates that suppliers are meeting their business opportunities to 65% of their potential. The implication is that if the TQI scores *etc.* were higher, suppliers would be making higher business performance scores because they would be reaching an output by an improved means.

Analysis by product group showed that no significant difference existed between groups. Analysis by RG 2000 category, however, showed that only one category 3 supplier, and no category 4 suppliers had been tested for business performance.

5.8 Cost Management

5.8.1 Yearly Economics

Cost reductions were attributed to supplier led process improvements (68%), Best Practice suggested improvements (22%), overhead reductions (36%) and design changes (62%). These elements are not mutually exclusive, indeed some suppliers used a combination of all or some of the above. In addition, suppliers cited the following as reasons for reducing costs:

Localising sourcing;
Reduced profit margins from Rover demands (*i.e.* not retrieved from savings);
Increased volumes, reducing overheads;
Logistics and administration savings;
Increased business with Rover;
Replacing old parts having negative margins;
Management awareness;
Price pressure;
Tooling improvements;
Bought out material cost reductions and increased volumes.

5.8.2 Open-Book

On average, suppliers said that they adopted an open-book policy to the extent of sharing 75% of information with Rover Group. It would be expected that suppliers would be marking 100% as being an open-book supplier is a condition of business for a Rover supplier, although for this question this was scored by only 10% of the respondents. The lowest scores were given by a category 1 electronics supplier (2%) and a category 3 trim 1 supplier (1%). The electronics supplier has a 20% reliance on Rover for business and has a vehicle set of over £30 for its chosen vehicle. Such a lack of openness shows that this contradicts the supplier's own evaluation of levels of openness (90%) and trust (90%) between Rover and itself.

Respondent 531 stated:

> "The QAF details are fine but Rover often use it as a weapon to compare other QAFs, but of different process and materials, questions are asked and we have to justify ourselves continuously. We also know that costs that appear on QAFs get given to competitors".

Table 22 shows that all the classes of the independent variables comply with homogeneity of variance, and that no significant differences were extrapolated from the data.

Open-Book	**RG 2000 Category**		**Asanuma**
Group Mean		75%	
Std Dev		18.4%	
F Ratio	$F_{3,78}$= 0.18 F Prob = 0.91		$F_{5,69}$ = 1.08 F Prob = 0.38
Levene	Stat = 0.39 2-Sig = **0.76**		Stat = 1.56 2-Sig = **0.18**
SNK	None		None
HSD	None		None

Table 22 Degree of Open-Book Relationship

5.8.3 Further Help

Eighty percent of suppliers said that they would be happy to help further with the research and 92% said that they would like to receive a copy of the report when written. This shows a substantial interest in how others perceive the supplier relationship with Rover and also the opportunity to use a benchmark with other suppliers.

5.9 Rover 600 Vs Non-Rover 600 Analysis

The aim of analysis between the Rover 600 and 38A was to establish whether any perceived differences existed between the suppliers' relationships with Rover and Honda (hypothesis 4). Analysis for this was via the T-Test, which was again validated by Levene's test for homogeneity of variance. If Levene showed a probability of greater than 0.05 the pooled-variance estimate to the T-Test was used; *i.e.* the assumptions were that the distributions between the two models were equal, to a 95%

level of probability. If the classes were shown to be unequal (*i.e.* Levene's test showed a probability of less than 0.05) the separate-variance estimate was used. Once it was established which of the T-Tests should be applied, the relevant '2-tail sig' figure denoted whether or not there was a significant difference between the classes. If the probability was greater than 0.05 it was possible to accept the null hypothesis and state that there was no significant difference between the classes (Dometrius, 1992: pp. 217-233). Results from the analysis may be seen in Table 23 and full details of the SPSS output in Appendix 7.

Variable	Levene	2-Tail Sig	Sig Dif?
Ability	Pooled	0.271	No
Asanuma	Pooled	0.788	No
Communication	Separate	0.021	Yes
Lock-In	Pooled	0.435	No
Integration	Pooled	0.001	Yes
Input	Pooled	0.004	Yes
Business Perf	Pooled	0.217	No
Openness	Pooled	0.071	No
Project Mgt	Pooled	0.375	No
TQI	Pooled	0.733	No
Process Design	Separate	0.090	No
Process Know	Pooled	0.641	No
Product Design	Separate	0.003	Yes
Product Know	Pooled	0.526	No
Rover Cat	Pooled	0.777	No
Tooling	Separate	0.000	Yes
Trust	Pooled	0.033	No

Table 23 R600 / 38A Comparison

Table 23 shows that there was a significant difference in the perceived relationship which suppliers had with Honda, during the development of the R600, in the areas of communication of project concepts, integration of the supplier into the design team, the supplier's input into the design process. These 3 elements were concerned with the interface between the core firm and the supplier. In all cases, suppliers rated Honda with a lower score than that which was given to Rover for the 38A.

The question regarding communication of project concept to suppliers was concerned primarily with 'Rover's' communication of project concept. The data may therefore be reflecting the fact that it was Rover, and not Honda, who scored less on this question. Alternatively, if the respondent was scoring Honda for its communication, the data shows that suppliers had less indication of the project concept because they undertook significantly less product design on behalf of the R600, than for the 38A. Analysis regarding integration and input into the design process also suffers due to the fact that it is not clear whether suppliers were talking about Rover or Honda.

Data regarding levels of supplier product design, however, was less open to ambiguity. On average, the Honda designs meant that suppliers took on more of a *design supplied* role; the average level of supplier product design for the R600 was 40.9%, compared with 68.9% for the 38A.

The last area to show a significant difference was in that of payment for tooling. The T-Test showed that there was a definite bias towards the use of amortisation by Honda which was not reflected in the 38A, Rover only project. This is a strategy which has now been discouraged within Rover as they feel that tooling payment is easier to track if it has not been amortised (Purchasing Interviews, AL6 & AL8).

Analysis between the R600 and 38A showed signs that a difference may exist regarding the core firm/supplier interface for Rover and Honda. However, due to the ambiguity in the interpretation of the wording of the original questions it is difficult to draw meaningful conclusions from the data.

5.10 Control 1: Analysis by Product Group

One of the two control hypotheses was that Rover would conduct its relationship with its suppliers consistently across the product group areas. The use of project teams by Rover Group means that within its matrix style of organisation there is a requirement to ensure that the needs of individual projects are not met at the expense of the group as a whole. To this end commodity strategies are set within the purchase department and continuity is maintained by using buyers within the core teams.

The questionnaire aimed to establish whether relationships with suppliers differed depending upon which of the commodity product groups their product belonged; if no differences were perceived, then this would satisfy control hypothesis 1. Product groups A,C,E,G,J,L and R were coded into groups 1 to 7 respectively for the purpose of data analysis. The product groups are:

Data Analysis Number	Product Group
1	A - Trim I
2	C - Trim II
3	E - Power Train
4	G - Chassis
5	J - Electrical
6	L - Body & Door
7	R - Steel Coils

Table 24 summarises the results from the statistical analysis and shows that 3 significant differences were high-lighted when comparing levels of communication, ability to deliver to concept, and levels of process design. In each of these cases the Levene test was violated and Anova was still considered to be an appropriate measure because of the equal sizes of the classes.

	Analysis by Product Group			
	F Ratio	Levene	SNK	HSD
Product Design	$F_{5,73} = 1.99$ F Prob = 0.09	Stat = 3.4 2-Sig = 0.01	None	None
Process Design	$F_{5,72} = 3.12$ F Prob = **0.01**	Stat = 6.66 2-Sig = 0.00	1-3, 1-5	1-5
Process Knowledge	$F_{5,72} = 1.78$ F Prob = 0.13	Stat = 2.34 2-Sig = **0.05**	None	None
Product Knowledge	$F_{5,72} = 0.3$ F Prob = 0.91	**Stat = 2.18** **2-Sig = 0.07**	None	None
Communication	$F_{5,67} = 2.94$ F Prob = **0.02**	Stat = 4.17 2-Sig = 0.00	2-3, 5-3	2-3, 5-3
Integration	$F_{5,65} = 1.05$ F Prob = 0.39	Stat = 6.51 2-Sig = 0.00	None	None
Ability	$F_{5,65} = 3.36$ F Prob = **0.01**	Stat = 7.49 2-Sig = 0.00	6-1, 6-5 6-2, 6-3	6-2, 6-3

	F Ratio	Levene	SNK	HSD
Input	$F_{5,64} = 1.03$ F Prob = 0.41	Stat = 0.91 2-Sig = **0.48**	None	None
Trust	$F_{5,74} = 1.02$ F Prob = 0.41	Stat = 3.67 2-Sig = 0.01	None	None
Openness	$F_{5,74} = 0.55$ F Prob = 0.74	Stat = 0.6 2-Sig = **0.70**	None	None
Lock-In	$F_{5,73} = 1.41$ F Prob = 0.23	Stat = 2.78 2-Sig = 0.02	None	None
Project Management	$F_{5,37} = 0.78$ F Prob = 0.57	Stat = 1.11 2-Sig = **0.37**	None	None
TQI	$F_{5,37} = 1.31$ F Prob = 0.28	Stat = 0.60 2-Sig = **0.70**	None	None
Business Performance	$F_{5,36} = 0.37$ F Prob = 0.87	Stat = 0.79 2-Sig = **0.57**	None	None
Open-Book	$F_{5,68} = 1.46$ F Prob = 0.21	Stat = 1.89 2-Sig = **0.11**	None	None

Table 24 Analysis by Product Group

Trim I suppliers undertook significantly less process design than that undertaken by Power Train and Electronics suppliers.

Power Train suppliers returned a significantly higher score for communication than was seen from other product group sections. The question aimed to look at how involved suppliers felt in the wider vehicle programme rather than just the requirements of their particular product. One reason for a higher score may be because Power Train suppliers have a greater focus on the engine, rather than a vehicle, and this focus is manifested because engines are a 'stand alone' item which are sold to other vehicle manufacturers, and as such, have become to be seen as an end product. It is possible therefore, that a Power Train supplier has a clearer view of the engine, as a whole, than a non Power Train supplier does of the vehicle. For example, an electronics supplier may have high visibility of the electrical architecture, without actually being able to visualise the final vehicle product.

Body and Door suppliers indicated that they were significantly less able to deliver to concept and this is an area which traditionally Rover has seen problems in the fitness for purpose of the panels. Reasons for this may not always be a suppliers inability but constraints set outside of a supplier's control. The most satisfied product groups with their achievements were Trim II and Power Train suppliers.

The analysis by product group acts as a control element because it shows that although some significant differences were seen to exist on some of the variables, none of these complied with Levene's test. It is therefore possible to conclude that Rover conducts its relationships with its suppliers on a relatively consistent basis across all product group areas.

5.11 Control 2: Buyer Questionnaires

Seven questionnaires were returned by buyers which could be linked with questionnaires received from suppliers. A selection of variables are discussed below against answers received from the supplier. This gives an indication as to the level of similarity in perception between buyers and sellers within Rover.

Table 25 shows the answers given by suppliers and their buyers for 27 questions in the questionnaire; not all of the questions will, however, be discussed.

Respondents were asked to state the approximate cost of a vehicle set of the supplier's products. Differences in answers between the supplier and buyer, may be because a 'rounded' cost has been given. However, data sets 2 and 3 show quite large differences, indicating that perhaps one of the parties does not have a clear view of the suppliers cost contribution to the whole vehicle. Both parties would be expected to have an understanding of the exact cost implications of each part due to the use of QAFs. Some of the difference must be attributed to the fact that assumptions regarding the 'number of components per vehicle' were different between the two parties. Some products are determined by the trim level of the vehicle, therefore, it would have been more beneficial to ask for the turnover for the each supplier within each commodity code or section.

The figures regarding the number of other suppliers per vehicle, within Rover Group and, within the automotive industry, show that suppliers do not know the Group's

	S_1	P_1	S_2	P_2	S_3	P_3	S_4	P_4	S_5	P_5	S_6	P_6	S_7	P_7
Product Group	J	J	G	G	G	G	J	J	E	E	G	G	J	J
RG 2000 category	4	4	1	1	4	4	1	2	3	3	1	1	3	1
% Business	2		20	20	5	1	27	40	11	10	18		10	10
Vehicle Set	20	18	35	43	500	> 550	20	20	.4	.64	8	10	6	7
No Vehicle	1	1	5	6	1	1	1	1	1.5	4	1	1	3	3
Supp per Vehicle	0	0	0	0	1	1	0	0	0	0	0	3	0	0
Supp per RG	0	0	1	2	1	1	0	0	0	0	0	3	0	0
Supp per Industry	0	1	5	n/a	3		4	1	0	2	11	?	0	3
No Quote	?	0	1	?	?	?	?	0	?	0	?	0	?	0
Tooling	n/a	?	F	F	n/a	n/a	F	A	n/a	n/a	F	F	A	F
Sourcing	?	?	P	P	?	F	S	S	S	S	S	S	S	S
Open Bk	Y	N	Y	Y			Y	Y	Y	Y	Y	Y	Y	Y
Comp Analysis	N	N	Y	N			N	Y	N	N	N	N	N	N
CDTS	N	N	Y	Y			Y	Y	Y	Y	N	Y	Y	Y
Agreement	A	O	A	M	O	A	A	O	O	O	O	O	A	A
Product Design	99		75	75	93	93	88	50	71	60	91	100	82	89
Process Design	100		100	98	98	98	100	88	99	96	100	100	100	97
Product Know	1		50	24	76	76	12		18	60	12	88	79	65
Process Know	0		76	73	77	77	50		60	76	60	50	97	64
Trust	97	18	50	18	81	92	77	73	82	74	81	75	86	89
Openness	95	77	50	19	85	45	50	72	82	73	68	74	86	89
Lock-In	50	80	75	23	21	38	70	46	30	50	16	50	86	89
Future Model	50	80	70	2	51	90	73	22	85	86	85	77	87	96
Future RG	50	3	50	2	50	50	75	91	81	89	84	100	88	81
Remove Business	-	98	-	21	-	23	-	44	-	9	-	27	-	45
Working Relations	-	78	-	4	-	55	-	64	-	73	-	26	-	75
1st Choice	Y	N	N	N	N	?	Y	Y	Y	Y	Y	Y	Y	Y
Open Book	88	42	50	11	79	4	23		88	96	78	95	75	76

Table 25 Buyer / Supplier Comparison

Note:
S1 = Supplier answers for example 1;
P2 = Purchasing answers for example 2;
For 'Tooling', A = amortisation, F = up-front payment, n/a = not applicable;
For 'Sourcing', P = parallel, F = factor. S = Single;
For 'Agreement', O = open-ended, M = model-life, 36 = 36 months.

sourcing policy for their component. The contrast is made when considering the available suppliers within the industry because the two views clearly do not match. In half the cases the buyer thought that there were more available suppliers than the current supplier perceived there were as competitors. In the remaining cases the suppliers appeared to have a greater understanding of their industry, especially as two buyers were unable to hazard a guess (possibly because they were a new buyer to that area). Both of the scenarios are worrying to some extent because it shows that either the supplier is not fully aware of the movements within their area of specialism, or, it shows that Rover is missing out on possible opportunities. The level of 'don't knows', with respect to asking how many suppliers were asked to quote for business, may also be due to the fact that there has been a turnover of staff within both the buyers and sellers during the course of the project. The more recent 'concept competition' events give the supplier higher visibility of their exact competitors for each component.

Scores given for product and process, design and knowledge, were in some cases very similar (see case 3). The highest discrepancies occurred when considering Rover's level of process and product knowledge. Large differences were also apparent between perceptions of trust and openness existing between Rover and its suppliers; the trend being that the buyer often gave a score below that of the supplier. The suppliers in this sample were not overly optimistic as to their chance of receiving future work within Rover.

The buyers were asked two additional questions regarding how easy it would be to resource business away from the supplier in question (a low score indicates that resourcing would be relatively easy). The second question asked buyers to rate their supplier's working relationship with Rover, against the 'best in class' for each buyer; the buyers in this small sample all showed that their suppliers had some way to go before they compared with 'the best'. It is interesting to note that in some cases the buyer stated that new business with Rover was relatively likely, but that it would, if they so wished, be relatively easy to actually source the business elsewhere (case 5).

The perception of levels of open-book practice between suppliers and buyers also differed in some instances. Case 3 showed that both parties thought that a high level of trust existed in their relationship, although the buyer was less certain as to levels of openness. This was again reflected by the fact that the buyer thought that the supplier was open-book up to a level of only 4%, as opposed to the supplier's perception that it was as high as 79%.

Analysis of Table 25 shows that a difference does exist between perceptions of relationships of Rover and their suppliers. A larger sample would be needed, however, to establish whether a significant difference existed in these perceptions. Implications for the ANOVA analysis are that the perception of the relationship differs according to whom is answering the question. The questions have been evaluated according to the perceptions of *one* person within a company, where many others are involved in the relationship with Rover. Internal analysis at Rover shows that engineers may have a different perception of a supplier than that which is held by manufacturing, purchasing, logistics *etc.*.

5.12 Summary of Findings

A summary of the research findings is shown below in Table 26. The table shows whether the results were validated via Levene's test, equally sized classes, or were purely descriptive statistics. If any significant differences were found, the class which was significantly different is shown.

	RG 2000 Category		Asanuma Class	
		Sig?		Sig?
Communication	Desc	Cat 1	Equal	No
Integration	Desc	Cat 1	Equal	No
Ability	Desc	Cat 1	Equal	No
Input	Levene	Cat 1	Levene	III-V
Trust	Levene	No	Levene	No
Openness	Levene	No	Levene	No
Lock-In	Desc	No	Equal	No
Project Mgt	Levene	No	Levene	No
TQI	Levene	No	Levene	No
Bus Perf	Levene	All	Levene	No
Open-Bk	Levene	No	Levene	No
Product Design	Desc	Cat 2	Equal	II-III,II-VII
Process Design	Levene	No	Equal	No
Product Know	Desc	Cat 4	Equal	No
Process Know	Levene	No	Equal	IV-VI,IV-II

Table 26 Summary of Findings

5.12.1 Design

The study showed that the RG 2000 categories were not clearly understood by some suppliers and associates within Rover Group. The supplier ratings were however applied relatively consistently across the group. The 'volume' factor was seen to be a critical indicator as to the prioritisation of the level of Rover resource available to the suppliers, particularly those in category 4. Category 1 suppliers perceived a more satisfying business relationship, possibly because they had a higher involvement with Rover core team activities.

Opportunities were seen to exist outside of the Rover supply base; however, there are costs and benefits associated with resourcing business, such as suppliers having to learn 'the Rover way' of doing business. In addition, a new supplier may be less ready to give Rover 'preferred customer status'.

5.12.2 Sourcing

Suppliers were seen to be relatively aware as to competitors within their industry, but not who the direct competition were for each sourcing decision. Answers from this question showed that 'one supplier per commodity' single-sourcing does not yet occur, although most products are sourced with one supplier for each vehicle model. The number and range of Rover's products meant that rationalisation of suppliers to levels such as Toyota (UK) has, is extremely optimistic. Instead, Rover would be better concentrating on a combination of supplier and product rationalisation to increase the level of commonality amongst the Cars and 4 X 4 sides of the business and to explore future opportunities with BMW.

The relationship with a specific project team was seen to differ according to the level of design undertaken. The relationship with Rover in general, trust, openness *etc.* was not seen to be dependant on levels of design, showing that Rover is consistent across its supply base in terms of an overall commercial relationship. Consistent, however, does not necessary mean consistently good at its relationships!

5.12.3 General Relationships

A tendency towards more open, less formal relationships was seen to exist, with 80% of suppliers believing that their business was secure, at least until the end of the life of each vehicle model. Cost reviews were on the whole conducted on an annual basis, with ongoing efforts to achieve the agreed cost down targets. This is in contrast to the yearly price increases which were more prevalent in the industry several years ago.

Levels of trust and openness both returned scores of 74%; as an average score, this means that many suppliers rated the relationship much lower than this, indicating that both sides of the relationship have room for improvement in this area.

SECTION 6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Validation of Hypotheses

6.1.1 Hypothesis 1: Design Ownership

Analysis of design showed that differences in the level of supplier responsibility and Rover knowledge of process and product design was evident. Rover's method of categorising suppliers (RG 2000) was seen to be applied relatively consistently across the supply base, although Rover had not communicated the implications of the various RG 2000 categories sufficiently well both internally and externally to Rover Group.

Category 4 suppliers showed the highest Rover/supplier differences for levels of design, indicating that most of the suppliers in the sample were proprietary suppliers. Category 1 suppliers undertook 20% less product design than category 4 suppliers, but there were a greater number of them so the need for Rover Group's resource was perceived to be larger. Category 3 supplier scores showed that Rover had some design input; Category 2 suppliers held the lowest levels of product design, because they were essentially 'design supplied' suppliers.

High levels of Rover Group product knowledge depended on the product either being simple (category 3) or being more complex, and hence requiring more engineering resource (category 1). The persistently low process knowledge scores showed that this is an area upon which Rover needs to focus (even if a strategic decision is made not to undertake any of the process design), in order that Rover is able to manage the design process effectively and ensure that Rover's own 'D-Phase Philosophy' is not compromised by a supplier's inability to comply at each stage of the engineering cycle.

Rover needs to maintain and increase its interest in its suppliers' process capability and ensure that suppliers meet the engineering targets at each build of the vehicle development cycle. Personal observations are that very often manufacturing representatives are not present at core team meetings and decisions are made where the full DFM implications are not understood.

6.1.2 Hypothesis 2: Asanuma & RG 2000 Correlation

The research suggested that the Asanuma and RG 2000 models were compatible with each other in respect of their attempts to classify types of design relationships. It was not possible to prove this statistically due to the variations within classes and the small sample size when split by the 7 Asanuma classes.

If there had been a larger sample, it may have been possible to investigate statistically whether the RG 2000 categories and Asanuma classifications were intrinsically linked. Category 1 suppliers returned scores which showed that they were design approved suppliers, but that there was some process design input from Rover. Given that Rover scores were in the mid 50% range for process knowledge, this suggested that Rover had 'some', but not 'substantial' levels of understanding, meaning that they would belong within either Asanuma's categories V or VI. It was therefore possible to renege on earlier assertions, that category V remained unsubstantiated.

Category 3 suppliers undertook less product design, indicating that they were probably 'design supplied' suppliers. As suppliers scored highly on process design, they were considered to compliment Asanuma's category III.

Category 4 suppliers were perceived to fall within two boundaries within the model. High product design indicated 'design approved' and as suppliers returned a high process design score, with Rover showing the lowest process understanding, suppliers were considered to be category VI. As low volume 'simple' designs (the other part of the category 4 supplier definition), it would be expected that suppliers would be classed as category II suppliers.

A problem existed in trying to establish a home for category 2 suppliers within the model. A low supplier product design score indicated a 'design supplied' definition. The suppliers did not fit within class III because of the highest Rover product knowledge score, and they did not fit in class II because they returned the lowest process design score. Hence it was proposed that a new class existed "category II.5", which defined the relationships where the core firm provided specifications, but had limited process knowledge.

As a 'Japanese model' Asanuma described relationships within industry where there were high levels of vertical integration. Rover however returned scores where there was a high reliance on outside process design. The Keiretsu structure is one of the major factors in the differences which exist between supplier and a core firm in Japan, compared to those in the UK. Japanese firms have a vested interest in co-operating with their suppliers because profitability on one side is not perceived as being at the expense of the other partner, but an achievement for the group as a whole.

6.1.3 Hypothesis 3: Supplier Relation Differences

The hypothesis regarding different relationships according to RG 2000 category showed that differences were only significant for those activities relating to design within the 'core team' framework: those of communication, integration, and supplier input into the design process and ability to deliver to concept.

The maturity of a supplier's product was seen to influence the level of familiarity Rover engineers had with the product and to affect their knowledge scores.

As with the RG 2000 categories, Asanuma's model showed no significant differences in the general business relationship between classes. Differences were shown, however, between integration, input into the design process, product design and process knowledge. Ranking the scores showed that category III suppliers gained higher scores in most areas. This could either be attributed to the fact that suppliers did not realise that this definition applied to 'design supplied' products, or because the need for effective communication was greater because discussion between the supplier and Rover was such that Rover understood the designs but did not choose to undertake the work for themselves.

6.1.4 Hypothesis 4: The Honda Influence

The R600-38A analysis remained relatively inconclusive; although the 38A project teams scored significantly higher on the 'core-team' relationship for the communication, integration, and input into design process variables. It was not clear whether this was because Rover had not been the design owners for R600 or because Honda were significantly worse at this type of relationship, given that a significantly higher level of design was conducted in Japan by Honda.

6.1.5 Control Elements

Analysis of data showed that no extreme differences were perceived between suppliers of different product groups. One reason for this may be because some suppliers belonged to a range of commodity groups. The main exception to this was that Power Train appeared to be able to communicate better with their suppliers than other product groups. It is therefore possible to conclude that Rover conducts its relationship with its suppliers consistently across the product group areas.

The second control attempted to assess the level of similarity in views held by the buyer and supplier of a given commodity. Several perceived differences were seen to exist and a wider sample would be necessary to understand more fully any discrepancies in this area.

6.2 Implications For Rover Group

Rover is an organisation with limited resource, and as such, it has concentrated that resource in areas in which it is able to maintain competitive advantage, and retain profitability. A strategic decision has been taken within Rover to keep its focus on the design of the vehicle (Director Interview, AL9); it is from necessity therefore that Rover finds that it has to rely so much on its suppliers. A recent report by Anderson Consulting (1994) confirmed what was said within interviews, that UK suppliers are still not reaching world class standards. The implication of this is that both suppliers and Rover Group have a vested interest in working together to ensure that they have a future together, in a mutually beneficial relationship.

What then must Rover do to ensure that its relationship with its suppliers is more beneficial for both sides? Communication of information in a timely manner is one of the most crucial elements of the SE model. Rover needs to make sure that it presents a coherent message to its suppliers, even in the 'simple' information such as confirming volumes for vehicles (information which affects tooling capacities, investment decisions, lead times for products *etc.*).

High reliance is placed on communication via telephones and fax machines. Security of information sent via the fax machine was perceived as an issue by several suppliers; the need to send confidential information in such a manner is a symptom of inefficiencies elsewhere - the time it takes to get the appropriate paperwork signed-off so that an order can be placed, or the supplier who has been late in completing a QAF to the required deadline. Rover needs to ensure that its employees are responsible in their handling of sensitive material - buyers will not show a supplier's QAF to a competitor, but as long as the perception is there that this is happening, Rover have a responsibility to rectify the situation in order to remove this barrier to an open relationship.

One missed opportunity is the lack of IT currently being used within Rover. Security of information could be better controlled if e-mail was available. Additionally, this would speed up the passing on of memos from Team Leaders to their groups, and would reduce the level of paper-mail required.

Rover needs to ensure that a culture of a two-way partnership is perceived by its suppliers. One way around the 'double-standards syndrome' would be for a consortium of suppliers to conduct an RG 2000 on Rover. Rover would need to consider the implications of allowing such an activity carefully, ensuring that the credibility of RG 2000 and the whole company would not be compromised. Suppliers are making efforts to design-in quality and take cost out of a product before it hits volume; however, the purchasing department is currently measured on the cost taken out of products in volume only. There will always be opportunities to make continuous improvements with existing designs, but these cannot be expected to yield such high cost savings as those where higher quality gets designed into products up front, in a proactive way.

In order for Rover to achieve higher levels of open-book costing, including the presentation of 'real' figures, it is necessary for buyers and suppliers to understand the true two sided benefits of this system. History depicts that both parties are suspicious of the other side, but unless Rover sees ALL costs, then how, for example, can they be sure that a piece of tooling is not being paid for twice within a process cost? To approach it from the other side, how can suppliers expect to justify an increase in the cost of a bought-in part, when Rover has not had the visibility of the cost of that part in the past?

6.3 New Conceptual Model

Rover is still in a period of much transitional change. They are in the process of rationalisation and it would appear from the questionnaire results that neither Rover or its suppliers are quite ready for a one supplier per commodity relationship. Competitive tension still plays a strong role within the group's purchasing department, but only as a secondary round of cost interrogation, while trying to understand the cost implications behind each solution.

The conceptual model (Figure 15) was revised to show the relationships linked intrinsically by the questionnaire (communication, trust *etc.*). It shows that the choice of suppliers is derived from a commodity strategy whereby considerations of Rover and the supplier's process and product capabilities are considered. Each product strategy helps to devise the overall sourcing strategy for the organisation, but not all sourcing decisions will go via this route, because once a high level of confidence has been shown in a strategy, the sourcing decision will gradually become more easily defined as confidence in one or two suppliers increases. The suppliers who will achieve this status in the future are those who Rover feels have the least hidden agendas, are the most capable in the quality of their engineering and manufacturing abilities and who are shown to be consistent in their application of the open-book philosophy.

6.4 The Future for Rover Group

An analysis of Rover Group would not be complete without a discussion on the impact of the BMW take-over in 1994. Rover will still be making vehicles for the foreseeable future, from its period of Honda collaboration, although it is unlikely that they will remain in production for as long as the Mini has survived! Opportunities are there for shared vehicle platforms with BMW, and more importantly for the supply base, shared suppliers so that both can enjoy the benefits of economies of scale. The implications of this for suppliers is that at present BMW is the customer with whom current Rover suppliers have the least work; this can be seen as either a threat or an opportunity for each supplier, depending on their current performance.

6.5 Criticisms of the Study

Any ethnographical study is only a good as the questions asked, the information gained and the interpretations of that data. The questionnaire had several flaws in it which would have benefited from receiving responses from the pilot study. However, as a pilot questionnaire for a wider reaching study, such as would cover all automotive manufacturers within the UK, valuable lessons have been learnt.

The purchasing questionnaire appeared, in many cases, to ask for a non-typical supplier to be discussed. Any future work should consider more closely the opinions of the buyer, and evaluate in more depth the differences in opinions between the buyer and supplier. Achieving an understanding of the differences would lead to a vision as to the aims of both sides in order to make the relationship with each other more satisfying.

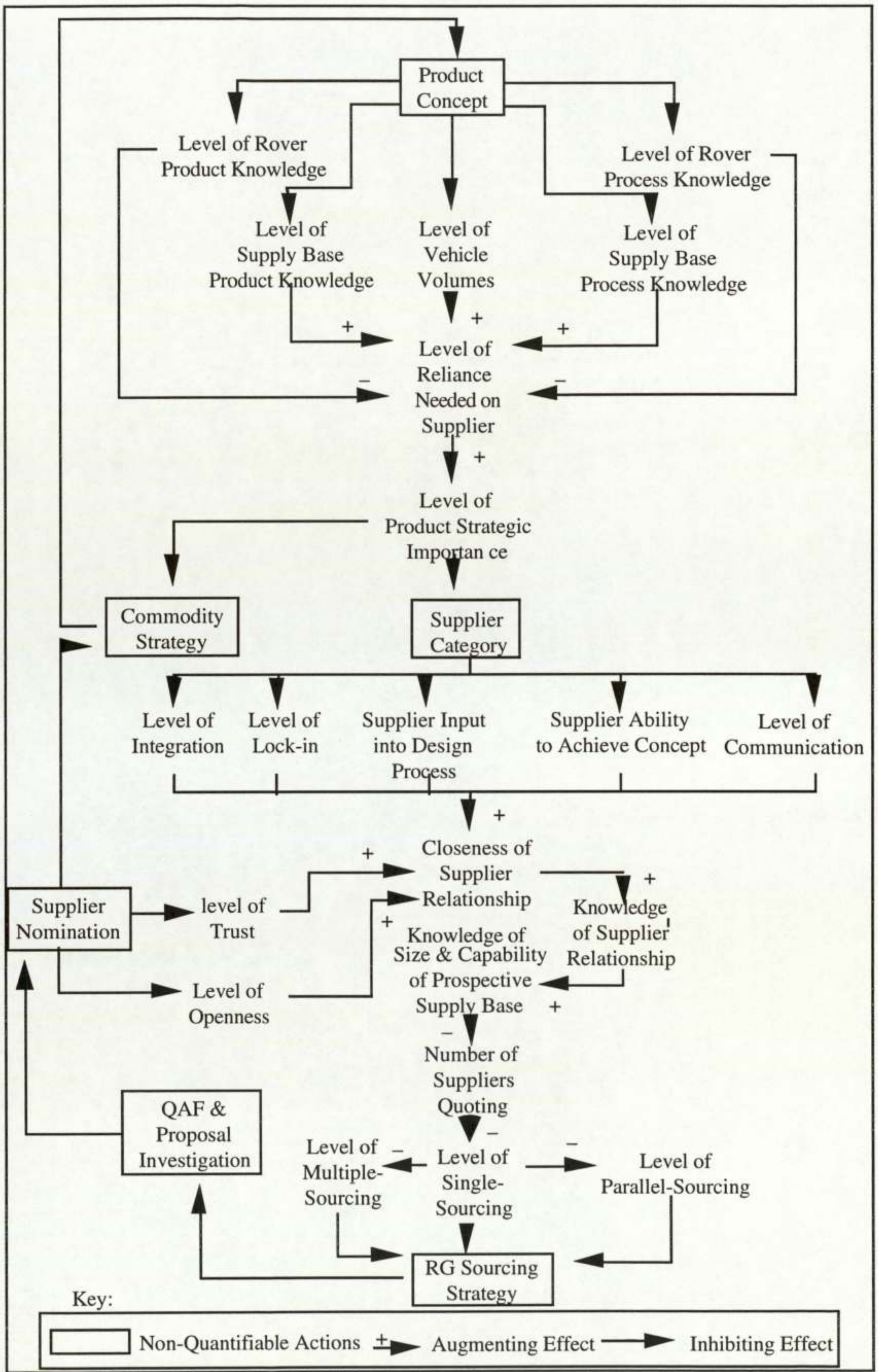

Figure 15 New Conceptual Model

The disadvantage of conducting a questionnaire was that only one person's view was considered from within each supplying company and that the role of the respondent within that organisation was not known. Levene's test was used in order that any biases may be shown within the statistical analysis.

6.6 Areas for further research

Any future work, using Rover Group as a customer of the research, should look more closely at the specific case of Rover Group, with an aim to structuring a strategy towards closer business relationships with its suppliers. A more proactive approach should be taken, getting buyers and suppliers to work together to form this strategy (as is being done already for the Rover Logistics Strategy).

In order to widen the knowledge base on transferring purchasing practices between organisations and cultures, a study on BMW's influences on Rover's purchasing policy (and vice-versa) would identify where each company perceived the other gained a competitive advantage by their management of their supply base and whether Rover maintain the 'Japanese' aspect of supplier relations.

Finally, a closer look at the differences between Japanese transplants and their Japanese parent companies would establish where adaptations have been made in order to adapt their business philosophy for the UK (and/or the US) business environment.

6.7 The Japanese Model

The research has shown that some elements of the Japanese Model do exist in the relationship between Rover and its suppliers. Some of these are due to their direct relationship with Honda (close monitoring of costs, core teams, emphasise on quality *etc.*). Others, however, are a mixture of these and the economic circumstances in which Rover found itself (high levels of out-sourcing, long-term relationships). Simultaneous Engineering was shown to have been as equally successful for non-Honda collaboration projects, in projects such as the Discovery, although experience gained from Honda would have helped to gain the acceptance of the majority to these new working methods.

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APPENDICES

APPENDIX 1: Supplier Questionnaire

This questionnaire is designed to discover the extent of supplier integration into the design of the Rover 600 car (hereafter R 600) which was released in April 1993. All responses remain the property of the researcher and total confidentiality from the Rover Group and Honda is guaranteed.

Supplier Information

Company Name:

Please name all the components which you supply to the Rover Group.

Which of the following categories is used by the Rover Group to describe the current classification of your company? Please tick the appropriate box.

☐	One	Proprietary/jointly designed
☐	Two	Major functional and selected non-functional components and assemblies
☐	Three	Simpler components in normal or high volumes
☐	Four	Less complex or special components in low volumes

Date of Classification ☐ Month 19 Year

If your company used to be in a different Rover classification which one was it and when did the change occur? (If not applicable, put 'N/A').

☐ Original Classification ☐ Month 19 Year

Are any changes of category likely within the next 2 years?

☐ Yes ☐ No

What percentage of your company's business is given to the Rover Group?

☐ %

How long has your company been a supplier for the Rover Group?

☐ New for R 600

☐ Less than 5 Years ☐ More than 5 Years

On which other Rover models does your company work?

☐ R 200	☐ Mini	☐ Defender
☐ R 400	☐ Metro	☐ Range Rover
☐ R 800	☐ Montego	☐ Discovery
☐ MG RV8	☐ Maestro	☐ New 4 Wheel Drive

For which other vehicle manufacturers does your company undertake work?

☐ Nissan UK/Japan	☐ Renault
☐ Toyota UK/Japan	☐ BMW
☐ Honda UK/Japan	☐ Vauxhall/GM
☐ Ford	☐ Other *(please name)*

For which other industries does your company supply components?

What is the approximate value of a 'vehicle set' of your products on the R 600?

£

Component Information

Specify the major component for which you will complete the remainder of this questionnaire; please select the component which has the highest cost contribution on the 1993 R 600.

When, approximately, was your company nominated to supply this component for the R 600?

Month   19 Year

How many of these components exist in **one** R 600 car?

Per R 600 Car

How many other suppliers do you know of making the same (or similar) type of component?

For the R 600

Within the Rover Group

Within the Industry

How many other suppliers were asked to quote for this component for the R 600?

Suppliers   Don't Know

How was the tooling for this component paid for?

☐ Amortised Payment ☐ Upfront Payment ☐ N/A

Which of the following strategies exist for the sourcing of this component within the Rover Group?

- ☐ Single-Sourcing
(one supplier per component for the whole Rover Group)
- ☐ Parallel-Sourcing
(one supplier per component for each model)
- ☐ Multiple-Sourcing
(many suppliers per component for each model)
- ☐ Don't Know

Which of the following Effective Cost Management tools (or Honda equivalents) are used for this component?

- ☐ Open Book Costing
- ☐ Competitive Analysis
- ☐ Cost Detail Tracking sheets

Once volume production is reached, how frequently do you review costs with Rover?

Every ☐ Months

How long is the current agreement valid for the supply of this component to the Rover Group ?

- ☐ Annual Renewal Basis
- ☐ Model Life Basis
- ☐ Open-Ended

Design

How many months before the product launch in April 1993 were you first approached by Rover/Honda?

[ ] Months

From which Rover/Honda department did this first contact come?

[ ]

Using the classifications below, which best describes the extent of design undertaken by your company for this component?

- I Rover/Honda provided minute instructions for the manufacturing process
- II Supplier designs the manufacturing process based on blueprints of products provided by Rover/Honda
- III Rover/Honda provides only rough drawings with completion entrusted to supplier
- IV Rover/Honda provides specifications and has substantial knowledge of the manufacturing process
- V Intermediate region between IV and VI
- VI Rover/Honda issues specifications but has only limited process knowledge
- VII Rover/Honda selects a proprietary product offered by the supplier

[ ] I [ ] II [ ] III [ ] IV [ ] V [ ] VI [ ] VII

The following questions look at the design and processes for your company's component. If you consider that your company undertakes 60% of the design of this component (with Rover/Honda the remaining 40%), then mark your answer as:

0% —— 50% — X —— 100%

What percentage of **product design** does your company undertake for this component?

0% —— 50% —— 100%

What percentage of **process design** does your company undertake for this component?

0% 50% 100%

What level (%) of product and process knowledge would you consider that Rover/Honda have for this component?

0% 50% 100%

Process Knowledge

0% 50% 100%

Product Knowledge

Has there been an exchange of expertise between Rover and your company in either process or product knowledge?

☐ Yes ☐ No

Please Comment:

On a scale of 0-100, how would you rate the following?

☐ Rover's Communication of the R 600 Project Concept

☐ Your Company's Integration into the R 600 Design Team

☐ Your Company's Ability to Deliver to the R 600 Concept

☐ Your Company's Input into the R 600 Design Process

How many Geba events has your company been involved with at Rover?

☐ Geba Events

Communication

The following questions look at the frequency and type of contact between your company, Rover and Honda departments and other suppliers.

Please indicate generally whether the contact was weekly (W), monthly (M) or yearly (Y). For example, if you had two meetings per week with designers, you would enter the result as:

	Face to Face	
Design	2	W M Y

The question looks at 3 stages in the product life cycle (Up to D-Zero; D-Zero to D-01; and Post Volume). For each time-frame table answer (a), as shown above for Rover and other suppliers and (b), which offers a comparison with Honda.

Up to D-Zero	(a)		Frequency and Type of Contact									
Rover Department /Supplier	Written		Face to Face		Presenta-tions		Fax		Phonecalls		EDI	
* Design		W M Y		W M Y		W M Y		W M Y		W M Y		W M Y
* Manufacturing		W M Y		W M Y		W M Y		W M Y		W M Y		W M Y
* Marketing		W M Y		W M Y		W M Y		W M Y		W M Y		W M Y
* Finance		W M Y		W M Y		W M Y		W M Y		W M Y		W M Y
* Sales		W M Y		W M Y		W M Y		W M Y		W M Y		W M Y
* Logistics		W M Y		W M Y		W M Y		W M Y		W M Y		W M Y
* Other _______		W M Y		W M Y		W M Y		W M Y		W M Y		W M Y
Machine Tool Manufacturer		W M Y		W M Y		W M Y		W M Y		W M Y		W M Y
Other Component Suppliers		W M Y		W M Y		W M Y		W M Y		W M Y		W M Y

NB: '' denotes Rover Department*

(b) Contact with Honda was

☐ Greater than that with Rover

☐ Less than that with Rover

D-Zero to D-01	(a) Frequency and Type of Contact					
Rover Department /Supplier	Written	Face to Face	Presenta- tions	Fax	Phonecalls	EDI
* Design	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
* Manufacturing	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
* Marketing	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
* Finance	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
* Sales	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
* Logistics	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
* Other _______	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
Machine Tool Manufacturer	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
Other Component Suppliers	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y

(b) Contact with Honda was

☐ Greater than that with Rover

☐ Less than that with Rover

Post Volume	(a) Frequency and Type of Contact					
Rover Department /Supplier	Written	Face to Face	Presenta- tions	Fax	Phonecalls	EDI
* Design	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
* Manufacturing	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
* Marketing	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
* Finance	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
* Sales	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
* Logistics	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
* Other _______	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
Machine Tool Manufacturer	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
Other Component Suppliers	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y

(b) Contact with Honda was

☐ Greater than that with Rover

☐ Less than that with Rover

For face to face contact, what percentage of meetings were held at Rover, Honda and your company's sites?

☐ % Rover Site ☐ % Honda Site ☐ % Supplier Site

Opinions

Using a percentage score, indicate with a 'X' the levels of trust and openness you think exists between your company and the Rover Group.

0% 50% 100%

Trust

0% 50% 100%

Openness

How reliant are your company and Rover on each other; to what extent is there a 'lock-in' relationship for the manufacture of this component?

Low Lock-In High Lock-In

What is the likelihood that you will be used on future Rover models and in particular the replacement for the R 600?

0% 50% 100%

Percentage Chance of use for Future R 600 Models

0% 50% 100%

Percentage Chance of use for Non-R 600 Models

In your opinion, do you think that the Rover Group weights 'quality' over 'cost' when considering the selection of a supplier?

☐ Yes ☐ No ☐ Equal Rating ☐ Don't Know

Do you consider your company to be a first choice supplier?

☐ Yes ☐ No ☐ Don't Know

Best Practice

How many visits has the Best Practice team made to your company?

☐ Visits

Do you consider that there is a fair split between the Rover Group and your own company regarding savings made via direct influence from the Best Practice teams?

☐ Yes ☐ No ☐ Don't Know

RG 2000

What are the differences between the original RG 2000 scores and any subsequent assessment RG 2000 scores?

Original Score (Pre - 1993 R 600)	Re-Assessment Score (1993 R 600)	
☐	☐	Date of Assessment
☐	☐	Project Management
☐	☐	Total Quality Improvement
☐	☐	Business Performance

Original Score (Pre - 1993 R 600)	Re-Assessment Score (1993 R 600)	
☐	☐	Quality Systems Accreditation
☐	☐	Delivered Product Quality
☐	☐	Delivery Performance
☐	☐	Product Warranty Performance

What are your opinions regarding RG 2000? What are the costs and benefits?
Please Comment:

Cost Management

What level of cost raises/reductions have been passed on by your company over the last 3 years?

☐ 1992 % Cost Raises/Reductions ☐ 1993 % Cost Raises/Reductions ☐ 1994 % Cost Raises/Reductions

What were the major contributing factors to any cost reductions?

- ☐ Internal Supplier Led Process Improvements
- ☐ Improvements as a Result of RG2000 and Best Practice
- ☐ Reduction in Overheads
- ☐ Cost Down Through Design Changes/New Technology
- ☐ Other (Please State ______________________________)

Please Comment:

On a scale of 0-100%, how 'open-book' would you consider your company to be?

0% 50% 100%

Company Tendancy to be 'Open-Book'

The opportunity is given below to add any further comments which you feel are relevant to this study.

An analysis of replies received from the questionnaire will be available in report format. Please tick whether you would like to receive a copy.

☐ Yes Please, Marked for the Attention of Mr/Mrs/Miss

Please Indicate whether you would be able to help further with this investigation.

☐ Yes ☐ No

Thank you for your help and co-operation.

APPENDIX 2: Rover Group Purchasing Questionnaire

This questionnaire is designed to discover the extent of supplier integration into the design of vehicles manufactured by the Rover Group. All responses remain the property of the researcher and total confidentiality is guaranteed.

Please answer the following questions relating to ONE supplier.

Supplier Information

Company Name: [ ]

Please name all the components which the supplier supplies to the Rover Group.

[ ]

Which of the following categories is used by the Rover Group to describe the current classification of the supplier? Please tick the appropriate box. ✓

[ ]	One	Proprietary/jointly designed
[ ]	Two	Major functional and selected non-functional components and assemblies
[ ]	Three	Simpler components in normal or high volumes
[ ]	Four	Less complex or special components in low volumes

Date of Classification [ ] Month [19] Year

If the supplier used to be in a different Rover classification which one was it and when did the change occur? (If not applicable, put 'N/A').

[ ] Original Classification [ ] Month [19] Year

Are any changes of category likely within the next 2 years?

☐ Yes ☐ No

Please Comment:

What percentage of the supplier's business do you estimate is with the Rover Group?

☐ %

How long has the supplier been a supplier for the Rover Group?

☐ Less than 5 Years ☐ More than 5 Years

On which Rover models does the supplier work?

☐ R 200	☐ Mini	☐ Defender
☐ R 400	☐ Metro	☐ Range Rover
☐ R 600	☐ Montego	☐ Discovery
☐ R 800	☐ Maestro	☐ New 4 Wheel Drive
	☐ MG RV8	

Please name the most recently released vehicle on which the supplier works with the Rover Group. All remaining questions will focus on this model.

What is the approximate value of a 'vehicle set' of the supplier's products on this model?

£ [ ]

Component Information

Specify the major component for which you will complete the remainder of this questionnaire; please select the component which has the highest cost contribution on your selected vehicle from above.

[ ]

When, approximately, was the supplier nominated to supply the above component for this vehicle?

[ ] Month [19] Year

How many of these components exist in **one** vehicle?

[ ] Per vehicle

How many other suppliers do you know who make the same (or similar) type of component?

[ ] For the Same Vehicle
[ ] Within the Rover Group
[ ] Within the Industry

How many other suppliers were asked to quote for this component for the vehicle model?

[ ] Suppliers [ ] Don't Know

How was the tooling for this component paid for?

☐ Amortised Payment ☐ Upfront Payment ☐ N/A

Which of the following strategies exist for the sourcing of this component within the Rover Group?

☐ Single-Sourcing
(one supplier per component for the whole Rover Group)

☐ Parallel-Sourcing
(one supplier per component for each model)

☐ Multiple-Sourcing
(many suppliers per component for each model)

☐ Don't Know

Which of the following effective cost management tools (or Honda equivalents) are used for this component?

☐ Open Book Costing

☐ Competitive Analysis

☐ Cost Detail Tracking sheets

Once volume production is reached, how frequently does the supplier review costs with Rover?

Every ☐ Months

How long is the current agreement valid for the supply of this component to the Rover Group?

☐ Annual Renewal Basis

☐ Model Life Basis

☐ Open-Ended

Design

How many months before the product launch was the supplier first approached by Rover/Honda?

☐ Months

From which Rover/Honda department did this first contact come?

☐

Using the classifications below, which best describes the extent of design undertaken by the supplier for this component?

- I Rover/Honda provided minute instructions for the manufacturing process
- II Supplier designs the manufacturing process based on blueprints of products provided by Rover/Honda
- III Rover/Honda provides only rough drawings with completion entrusted to supplier
- IV Rover/Honda provides specifications and has substantial knowledge of the manufacturing process
- V Intermediate region between IV and VI
- VI Rover/Honda issues specifications but has only limited process knowledge
- VII Rover/Honda selects a proprietary product offered by the supplier

☐ I ☐ II ☐ III ☐ IV ☐ V ☐ VI ☐ VII

The following questions look at the design and processes for the supplier's component. If you consider that the supplier undertakes 60% of the design of this component (with Rover/Honda the remaining 40%), then mark your answer as:

X

0% 50% 100%

What percentage of **product design** does the supplier undertake for this component?

0% 50% 100%

What percentage of **process design** does the supplier undertake for this component?

0% 50% 100%

What level (%) of product and process knowledge would you consider that Rover/Honda have for this component?

0% 50% 100%

Process Knowledge

0% 50% 100%

Product Knowledge

Has there been an exchange of expertise between Rover and the supplier in either process or product knowledge?

☐ Yes ☐ No

Please Comment:

For this component what percentage of time do you spend on design, rather than daily production, related issues?

☐ % Design Related ☐ % Production Related

On a scale of 0-100, how would you rate the following?

☐ The Supplier's Understanding of the R 600 Project Concept

☐ The Supplier's Integration into the R 600 Design Team

☐ The Supplier's Ability to Deliver to the R 600 Concept

☐ The Supplier's Input into the R 600 Design Process

How many Geba events has the supplier been involved with at Rover?

Geba Events

Communication

The following questions look at the frequency and type of contact between the supplier, Rover and Honda.

whether the contact was weekly (W), monthly (M) or yearly (Y). For example, if you had ith designers, you would enter the result as:

	Face to Face	
Design	2	W M Y

The question looks at 3 stages in the product life cycle (Up to D-Zero; D-Zero to D-01; and Post Volume). For each time-frame table answer (a), as shown above for Rover and the supplier and (b), which offers a comparison with Honda.

Up to D-Zero	(a)		Frequency and Type of Contact									
Supplier Department	Written		Face to Face		Presenta-tions		Fax		Phonecalls		EDI	
Design		W M Y		W M Y		W M Y		W M Y		W M Y		W M Y
Manufacturing		W M Y		W M Y		W M Y		W M Y		W M Y		W M Y
Marketing		W M Y		W M Y		W M Y		W M Y		W M Y		W M Y
Finance		W M Y		W M Y		W M Y		W M Y		W M Y		W M Y
Sales		W M Y		W M Y		W M Y		W M Y		W M Y		W M Y
Logistics		W M Y		W M Y		W M Y		W M Y		W M Y		W M Y
Other________		W M Y		W M Y		W M Y		W M Y		W M Y		W M Y

(b) Contact with Honda was

☐ Greater than that with Rover

☐ Less than that with Rover

D-Zero to D-01	(a) Frequency and Type of Contact					
Supplier Department	Written	Face to Face	Presenta-tions	Fax	Phonecalls	EDI
Design	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
Manufacturing	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
Marketing	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
Finance	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
Sales	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
Logistics	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
Other________	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y

(b) Contact with Honda was

☐ Greater than that with Rover

☐ Less than that with Rover

Post Volume	(a) Frequency and Type of Contact					
Supplier Department	Written	Face to Face	Presenta-tions	Fax	Phonecalls	EDI
Design	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
Manufacturing	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
Marketing	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
Finance	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
Sales	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
Logistics	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y
Other________	W M Y	W M Y	W M Y	W M Y	W M Y	W M Y

(b) Contact with Honda was

☐ Greater than that with Rover

☐ Less than that with Rover

For face to face contact, what percentage of meetings were held at Rover, Honda and the supplier's sites?

☐ % Rover Site ☐ % Honda Site ☐ % Supplier Site

Opinions

Using a percentage score, indicate with an 'X' the levels of trust and openness you think exists between the supplier and the Rover Group.

0% 50% 100%
Trust

0% 50% 100%
Openness

How reliant are the supplier and Rover on each other; to what extent is there a 'lock-in' relationship for the manufacture of this component?

Low Lock-In High Lock-In

What is the likelihood that the supplier will be used on future Rover models and in particular the replacement for this vehicle model?

0% 50% 100%
Percentage Chance of use for Future Models of this Vehicle

0% 50% 100%
Percentage Chance of use for Other Rover Group Models

Ignoring any business ethics opinions which you may have, and taking into account the type of component provided by this supplier, how difficult would it be for Rover to remove business from this supplier and place it with another supplier?

Difficult ——————————————— Easy

Think of the supplier, which in your opinion, has the best working relationship with the Rover Group. How do you rate the quality of the working relationship between Rover and your chosen Supplier in comparison with the 'best' relationship which exists at present?

Excellent ——————————————— Poor

Do you consider the supplier to be a first choice supplier?

☐ Yes ☐ No ☐ Don't Know

Best Practice

How many visits has the Best Practice team made to the supplier's company?

☐ Visits

Do you consider that there is a fair split between the Rover Group and the supplier regarding savings made via direct influence from the Best Practice teams?

☐ Yes ☐ No ☐ Don't Know

RG 2000

What are the differences between the original RG 2000 scores and any subsequent assessment RG 2000 scores?

Original Score
(Pre - 1993 R 600)
☐

Re-Assessment Score
(1993 R 600)
☐ Date of Assessment

Original Score (Pre - 1993 R 600)	Re-Assessment Score (1993 R 600)	
☐	☐	Project Management
☐	☐	Total Quality Improvement
☐	☐	Business Performance
☐	☐	Quality Systems Accreditation
☐	☐	Delivered Product Quality
☐	☐	Delivery Performance
☐	☐	Product Warranty Performance

What are your opinions regarding RG 2000? What are the costs and benefits?
Please Comment:

Cost Management

What level of cost raises/reductions have been passed on by the supplier to the Rover Group over the last 3 years?

☐ 1992 % Cost Raises/Reductions ☐ 1993 % Cost Raises/Reductions ☐ 1994 % Cost Raises/Reductions

What were the major contributing factors to any cost reductions?

- [ ] Internal Supplier Led Process Improvements
- [ ] Improvements as a Result of RG2000 and Best Practice
- [ ] Reduction in Overheads
- [ ] Cost Down Through Design Changes/New Technology
- [ ] Other
  (Please State ______________________________)

Please Comment:

On a scale of 0-100%, how 'open-book' would you consider the supplier to be?

0% ———————— 50% ———————— 100%

Supplier Tendancy to be 'Open-Book'

The opportunity is given below to add any further comments which you feel are relevant to this study.

Thank you for your help and co-operation.

APPENDIX 3: Open-Ended Responses

Exchange of Expertise

Comments regarding exchanges of expertise between Rover and the supplier in either process or product knowledge:

Levels/standards of illumination (2).

Before deciding final design, we normally have several contacts with engineers of customer to find best solution (3).

We have manufactured this component from drawings (9).

We presented our advanced technology developments to Rover (17)

Best practice meetings; comments directly to engineering regarding new design feasibility (19).

Discussion on X options but another supplier eventually chosen to meet Honda Engineering requirement (27).

Mainly discussions with purchasing although Japanese engineers were available on 2 occasions (28).

Product review at design and modelling stage (49).

Discussions on nominated toolmaker sources to define strategy and also on raw materials for preferred raw material supply base (60).

Honda advised method of X and Y as it was an ex Japanese practise (80).

Limited mainly fit to vehicle (81).

Material recommendation to meet specification (82).

Little interest by Rover and Honda in process. Supplier not allowed any design input. Component sent from Japan (101).

Our business is achieved by constant application engineering proposals to improve quality and reduce assembly costs (103).

On-going liaison on all aspects of the project (107).

X are considered a proprietary item, design of length, brackets and installation is association with Rover (202).

Full explanation and several presentations made on benefits of X process to both engineering and purchasing teams (221).

Our open factory/book policy to Rover Group has enabled them to gain most of the knowledge on product and process (226).

Simultaneous engineering activities (230).

Regular project team meetings (231).
We designed all the process machinery (242).

On both knowledges, exchange of expertise on process and designing demands to complete. As the project has been extended to several types by several stages, re-design for having 'universal products' (245).

Rover engineering have some input into the size, shape *etc.* of X (257).

Continental input from us ensures that the design remains within best practice and competitive prices (270).

X vetted by our advisory engineers to establish process and product parameters to make part successfully. Trials completed prior to production runs. Weekly technical exchange of information on performance (273).

Almost exclusively one way only - from us to Rover (302).

Best practice involvement in manufacturing process (303).

Regular meetings between Rover and our engineers review opportunities for specifying our X process (311).

As proprietary part there has been very little process or product flow of data from Rover to ourselves (331).

Our products are not very well understood by the customer. We recommend product (338).

Design of the main X ..... allowing cost reduction in machining process (341b).

Joint project work on new vehicle development (355).

Regular process reviews held at all development build phases (359).

Particularly critical features to component operation are discussed in an open fashion to compare Rover's requirements with our ability to manufacture (360).

We have had a close co-operation in engineering with, among other things, guest engineers at Rover (374).

When direct supplier were of a greater volume (as against indirect today) regular visits by liaison metallurgist to steelworks. Today however this is not so for exiting products, but there are ongoing discussions with Land Rover on development projects (391).

Close contact with the Rover engineers is essential to optimise the product (405).

Exchange of expertise ongoing with product development (411).

Process and design for manufacturability guidelines from us to Rover (450).

Regular meetings and presentations made to engineers and buyers (452).

Rover and ourselves have done the product development very closely together (critical characteristics list) (470).

Through numerous meetings at Rover and plant visits at our manufacturing area (480).

Principal contact has been with Honda on X and Y (483).

Rover special vehicles staff were very helpful at all stages of prototype development (486).

Continuous during development with samples provided (490).

We both could have been much better (496).

A series of product/process training days were held at our plant over a period of 12 months in 1991; 60-70 Rover engineers attended (511).

Exchange of knowledge has been given to Rover (531).

Rover has industry experts in this commodity that act as a reasonable audit on the credibility of process and procedures (544).

Rover engineers have been to our company and are always welcome as are VCE and Best Practice teams (552).

Discussions with X process engineering (559).

Frequent meetings at Honda and our plant in Y (568).

Comments and opinions regarding RG 2000:

- Identifies strengths and weaknesses
- Provides identification of specific areas of the business with a measure to improve against
- Develops customer/supplier partnerships and relationships (2).

I think this RG 2000 is one of the best ways to develop competitiveness, but we just started applying because we are still learning how to utilise this (3).

I believe it is an excellent bench marking program towards attaining world class standard (9).

It is an administrative burden for which there is presently no benefit (cost = £30K) (19).

An independent assessment of the company's overall status. The assessment and report allow us to build the improvements into our continuous improvement programme. The costs are recouped by the improvements made (27).

A useful exercise to examine the strengths and weakness of the business and then take actions to improve (28).

We are a much improved company as a result of cementing our long term partnership with Rover Group (60).

RG 2000 is heavyweight. Benefits are few compared to their assessment systems. Costs are not specific To RG 2000 other than administration (61).

A very good business model, we are underway to incorporate most of its ideas, measures and working practices. The main costs are people's time. We anticipate substantial benefits but have seen none yet - too early (80).

Very good system although geared for the larger companies. It helps you to focus on real drivers although highly dependent on hard facts as opposed to soft issues (81).

We improved in all areas following re-assessment (82).

Difficult to use as a measure to date as time between assessments is too long and assessment criteria is changing (92).

Lots more paperwork systems with little benefit at present (101).

Our 1993 overall score was 46.9/70. It is very costly but benefits are good 'spin-offs' inefficiency, providing positive effect on confirming costs and burdens (202).

Enforces adherence to procedures and policies; can be effective in any company; in line with ISO 9000 accreditation; fits in with our own programs (226).

RG 2000 is adopted by this company as an auditable assessment of our performance enabling cost reducing activities to be effective (230).

Good monitor on overall business performance - treated in an open and honest manner on both sides (231).

Good assessment criteria has identified areas for improvement. Cost of assessment and resulting action has been well off set by benefits (238).

Interesting as the TQ approach is there. It should be helpful if some examples by Rover could also be disclosed (245).

Danger of becoming a procedural paper chase. Spends a lot of time looking at procedure and ignores end product, cost, quality, delivery, technical performance of company (270).

RG 2000 compliments our own TQ process. Assessment by our customers of our systems and progress is very useful/ With TQ continuous improvement is our driver upon which Rover and our other customers help us to remain focused (302).

Good business practical consultancy. High-lighted weakness/strengths; compares with competition. Requires us to review training and human resources more (303).

We are accredited through component manufacturers and sub-contract companies who are licensed by ourselves (311).

It is a system that has brought about cultural change and will continue to do so. A more comprehensive appreciation of TQ gradually comes into focus. Costs arise through training and the implementation of formalised practices/controls. A return on these actions is already evident and should be of benefit across our business (322).

To receive a completely independent assessment on our company's operating procedures and performance, in addition to maintain the assurances for long lasting business relationships (328).

Major effort by us in time and management resource. Benefits - some weaknesses high-lighted which are being addressed. Help in way forward. Concern - Duplication resulting from other auto companies doing similar exercises. Need for common approach (273).

RG 2000 is over the top on project management. Costs too much time. However it does make us think more of procedures than before (331).

A good basis for bench marking improvements and failures. costs are minimal as we are always being audited by most companies. Benefits are improved relationship with Rover (341b).

The audit acts as a stimulus to improve areas otherwise ignored. currently, the cost to our company outweighs the benefits but we expect this situation to reverse in time (357).

Costs - Pressure to fulfil all criteria could mean that overall cost effectiveness of some organisations may be diminished.
Benefits - Valued feedback is obtained which can aid/focus change improvements (359).

RG 2000 is useful in formalising communication of the customer's general business requirements (360).

Presently in the first years experience. Programmes have been developed but are at various levels of implementation (364).

We have not been assessed to RG 2000. In principal I believe RG 2000 to be an excellent strategy (375).

Costs in relation to RG 2000 are not separated. Current manpower only are involved with all customer variations to the them. Benefits are not major (405).

RG 2000 is a very good complement to ISO 9000 (411).

Big company bias. Smaller companies need degree of flexibility to reduce paperwork. greater degree of focus on general business issues. Opens doors within Rover for further opportunities (414).

A more flexible approach needs to be taken, recognising the supplier's own industry and initiatives; current approach is very prescriptive. We feel that in some cases RG 2000 is trying to force us backwards "because the manual says so" (450).

Too early to comment (452).

The RG 2000 program is a superior analysis system. Strong and weak points can be recognised. It is support for the customer as well as for the supplier. We welcome the RG 2000 program (470).

Beneficial to both companies (472).

It high-lights areas where improvements are required. Areas of comparison with competitors should be able to be discussed (483).

Costs are high; Benefits - has made us think more about our business (489).

Rover do not work to RG 2000 themselves (496).

Excellent audit tool, good searching questions, mostly objective assessment, relevant to achievement of ISO 9000. Costly in terms of people time but benefits of the "Japanese" approach are unquestionable. Good scores and ongoing performance equate to a larger share of Rover business! (544).

A good business management system (551).

RG 2000 makes sense, but new systems take time to implement. We are not only supplying Rover, so other companies quality initiatives also have to be met (552).

RG 2000 is a clear structured specification which tells us all necessary customer needs without misunderstandings (555).

All negotiations have been made between Honda and ourselves so we are not really aware of RG 2000 (568).

Good consultancy opportunity (573).

We have not yet had an RG 2000. RG 2000 covers good business practice - however it requires presentation in a format to suit Rover which is a minor customer, therefore cost is great with little or no benefit (666).

Cost Management:

A 4% price increase had been agreed with Rover on the current product at that time. During the year a number of products were identified for potential cost savings which equated to a 4% reduction. Therefore the price increase to Rover was offset with savings to the same value for 1994 (2).

1993 5% improved cost down. 1994 increase because of reduced requirements and raw material increase. Possible cost down in hand (19).

Many of our parts are low value and savings are of no interest to Rover because of internal costs at Rover or cost of retooling therefore savings on major parts only while low value jobs become less profitable (28).

We have not undertaken any cost-down activities with RG yet. However we are about to offer some cost reductions through Honda's cost-down initiative (80).

Cost down programme and supplier reduction threats help supplier focus on best 'in house' practices and efficiencies. Sometimes however increasing demands and lack of full understanding of supplier admin' processes is counter to efficiency and ability to continue cost down programmes (103).

Initially under quoted product has made cost down difficult. RG are not cost tracking our R600 parts. Honda rigorously cost track and are leagues ahead of RG in their approach to cost tracking (107).

Although these were piece price reductions due to Discovery rebate the actual prices increased to take account of Yen increases to cover Y. Prices static in 1994 for 4X4 due to re-alignment to market prices as part of recost in 1994 for mini/metro/R800 (202).

Purchasing policy needs to be clarified and to be able to "display" the rules (245).

New technology, reductions in overheads and new design have led to the past three years cost reductions. The future problem is that the opportunity for more cost reductions are exhausted (257).

Many ideas cannot go forward without extensive lab testing which adds to the general overhead for the products (270).

We have initiated cost reduction exercise involving down gauging and down grading, supply chain analysis aimed at reduction is stock levels throughout the process chain of 25% and a reduction in lead time of 50% (273).

Best practice has been restricted by Rover to one product. Potential for improvement in most areas has already been identified by an internal improvement team (302).

Rover Best Practice want to take 100% of our cost reduction as opposed to 50/50 split as originally agreed (303).

We operate in a competitive market where man of the costs are known to Rover Group via other sources. Has encouraged a much more open relationship, which is dependent on mutual trust and our willingness to operate in this manner is highly dependent on a true partnership (322).

Our management is becoming aware of need for global rationalisation and improvements to stay competitive (341b).

Selling price changes have previously been based on an agreed formula in a supply contract. Price changes on new components will be negotiated outside this framework (360).

Currency fluctuations have been the major cause of cost increases (375).

Rover plucked reductions from thin air and attempted to impose them without due regard to the product or process (383).

There is a mismatch between the RG 2000 objectives and our in house objectives. We don't have resources for both. Rover don't care about our resources (383).

Good commercial assessment system. Cost benefits not defined (401).

Rover have only learnt the cost reduction element of the Japanese business method (405).

Cost tracking should and could go either way - feeling of standing alone in respect of imposed raw material increases (414).

Rover focus is still "price" not "cost" led. There is also reluctance to change product to achieve real cost savings. In our experience the majority of cost savings should be available through design not process improvements (450).

Very little input from Rover, just a demand to reduce prices (480).

Many best practise RG 2000 results are capital intensive. Others are very simple. Concern is to ability to monitor small BP savings (483).

If design and manufacturing methods are correct in the first place then there is little scope for movement (489).

VE/VA cost down initiatives are welcomed by Rover but should be weighted such that the supply base gets at least one year's credit against price reduction objectives. At the moment, they give only the amount of credit left in a particular calendar year. This in our opinion is unfair (544).

Most cost savings are generally supplier led, although we have developed new technologies to compliment our product range (552).

A number of "in place" cost savings at Rover have been identified but not yet implemented due to resource issues 7% turnover 1993 (559).

Additional Comments

Generally the R600 programme was well run and the transfer of information between both companies was good (2).

Rover Group are still not fully committed to partnership in the Japanese style which to some degree may hold back investment (27).

Still concern that cost savings ideas will be used to place business with competitors. Problem when suggesting change from X to Y and this would mean new buyer and the new buyer would not want to add a new X supplier to his list as he has enough already therefore some business was resourced (28).

As design partner with Honda, very little input to Rover (49).

Where we have indicated zero EDI contact this was based on Honda not being ready for full EDI interface. We do have full EDI interface with Rover Group (60).

The engineering for our product was conducted with Honda. Rover accepted the same product only confirming that it met Rover specification. It was logical to conduct the business this way rather than 2 customers pulling in different directions. We regard the operation as successful for all parties concerned (61).

The R600 project almost exclusively handled via Honda, Swindon. We were not a Rover supplier until R600 gave us the opportunity. We have since been selected by RG as a preferred supplier. Consequently, we are behind most RG suppliers on RG 2000 progress *etc.* (80).

As you would expect the younger element within Rover appear to be the most committed. There remains an opportunity for future development/co-operation, since one of our products in particular is already proven as a significant cost saver in comparison with conventional material (391).

This survey is not really applicable to our company as we do not manufacture anything. We only finish Rover Manufacturing parts (397).

Rover Group are not making the progress which we would find beneficial in regard to forward information on production volumes. The feedback of technical information is very poor, only problems are high-lighted (405).

Open book relations can be improved by increased business volume (411).

Rover need to give far more consideration to the supplier's ideas and knowledge and need to commit to the supplier at an early stage. There is a need to "practice what they preach" when it comes to true supplier partnerships (450).

Cost reductions have not yet been realised for the considered parts because of the starting phase of the 38A series. We already worked out several cost reduction proposals and passed them on to Rover. Rover is checking the cost reduction proposals at the moment (470).

Our situation is changing. We were imposed upon Rover by Honda (and not wanted initially by Rover). Our performance over the last 2 years has enabled us to become a Rover preferred supplier (483).

It is time that Rover understood how good their supply base is (489).

Due to the nature of our product, small fixings, it is difficult to approach vehicle projects from project team concept. "A bolt is a bolt" Rover engineers do not pass on their project timing, volumes *etc.* as a matter of course because of the nature of our product (511).

The QAF details are fine but Rover often use it as a weapon to compare other QAFs, but of different process and materials, questions are asked and we have to justify ourselves continuously. We also know that costs that appear on QAFs get given to competitors (531).

Rover and the improvement of our business relationship and business levels is a major leg of our long-term strategy. We currently have too little business with Rover and wish to increase such that we become at least as equal as X, their major Y supplier. We shall continue to push to achieve and exceed this objective! (554).

We have an open relationship with purchase and VCE and hold regular meetings with all present (522).

Again all negotiations and meetings were attended by Honda and ourselves. We are supplying exactly the same product for the Honda Accord and the Rover 600 (568).

Design and purchasing at Land Rover always seem to be on opposing sides (611).

APPENDIX 4: Letter

Dear

ROVER GROUP SUPPLIER QUESTIONNAIRE

As a component supplier to Rover Group, I would like to offer your company the opportunity to partake in an industry wide analysis of the automotive industry which is investigating 'supplier relations within the context of design'.

RESEARCH METHODOLOGY

Available literature has revealed that the designer-supplier-purchasing triad is one of critical importance to the implementation of a successful design project. Many of the changes in this triad may be attributed to the Japanese who, with their 'innovation' of simultaneous engineering and team work, have heavily influenced the design process. Their new relationships are reported to be ones of trust and co-operation, with the supplier being seen as a fully integrated member of the wider organisation, who now undertakes a higher proportion of design responsibility. Rover Group models pose interesting examples of how these and other techniques are being utilised by Rover Group through the direct influence of a Japanese company.

This questionnaire hopes to establish the extent to which these changes are really happening within the industry and whether they provide the promised benefits to the supplier, as well as the automotive manufacturer. For example, is the supply base coping with the growing demand being made upon them to increase levels of quality, delivery *etc.* whilst being expected to reduce levels of cost?

RESEARCH FOCUS

All suppliers to the Rover Group are being asked to fill in this questionnaire and their responses will be compared with information from (a) similar questionnaires being sent specifically to supplier of Rover 600 material, (b) a selection of suppliers from within the UK automotive component supply base and (c) interviews and questionnaires with Rover employees.

RESEARCH REPORT

As a respondent to the questionnaire you will be eligible for a complementary copy of the final report. Information form each questionnaire will be collated and analysed at the Aston Business School. Complete confidentiality of all replies and identities is guaranteed.

As a post-graduate who has studied the car industry for the past 8 months I am intrigued by the opportunities which seem to be presenting themselves in this area. The questionnaire is being sent to you with the full knowledge and approval of Rover Group. In September I am due to start work within the purchasing department at Rover and I hope that the report compiled from the information provided by you and others will help towards improving your working relationship with Rover Group.

WHY YOU SHOULD COMPLETE THIS QUESTIONNAIRE

This is your opportunity to state the areas of satisfaction and dissatisfaction with your relationship with Rover. The advantage to your company is hat your views will be represented by someone who is an impartial observer to the situation, whilst indirectly and anonymously feeding back your comments to Rover Group. This is not a questionnaire for Rover, who like yourselves, will receive only a copy of the final report, ensuring that personal and company identity is integrally maintained.

Please complete this questionnaire, which should take only 25 minutes of you time, and return this in the *Freepost* envelope provided. If you have any queries relating to the questionnaire or any additional comments which you wish to make, then please feel free to contact me on 021-359-3611, extension 4429.

May I thank you in advance for your time and co-operation.

Yours sincerely

Alison Lawrence

APPENDIX 5: SPSS Analysis

Analysis by Product Group

Ability

Variable ABILITY
By Variable G

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	5542.4068	1108.4814	3.3618	.0092
Within Groups	65	21432.2411	329.7268		
Total	70	26974.6479			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	11	87.2727	12.7208	3.8355	78.7268	TO	5.8187
Grp 2	12	91.6667	8.0716	2.3301	86.5382	TO	6.7951
Grp 3	14	92.8571	8.4840	2.2674	87.9586	TO	97.7557
Grp 4	11	79.0909	24.1680	7.2869	62.8546	TO	95.3272
Grp 5	13	87.6923	10.9193	3.0285	81.0939	TO	94.2908
Grp 6	10	66.0000	34.7851	11.0000	41.1163	TO	90.8837
Total	71	84.9296	19.6304	2.3297	80.2831	TO	9.5760

GROUP	MINIMUM	MAXIMUM
Grp 1	60.0000	100.0000
Grp 2	75.0000	100.0000
Grp 3	75.0000	100.0000
Grp 4	30.0000	100.0000
Grp 5	70.0000	100.0000
Grp 6	.0000	100.0000
TOTAL	.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
7.4938	5	65	.000

Variable ABILITY
By Variable G

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 12.8399 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.39	3.73	3.97	4.15

(*) Indicates significant differences which are shown in the lower triangle

```
                                  G G G G G G
                                  r r r r r r
                                  p p p p p p

                                  6 4 1 5 2 3
     Mean       G

    66.0000     Grp 6
    79.0909     Grp 4
    87.2727     Grp 1         *
    87.6923     Grp 5         *
    91.6667     Grp 2         *
    92.8571     Grp 3         *


      Variable  ABILITY
   By Variable  G

Multiple Range Tests:  Tukey-HSD test with significance level .050

The difference between two means is significant if
  MEAN(J)-MEAN(I)  >= 12.8399 * RANGE * SQRT(1/N(I) + 1/N(J))
  with the following value(s) for RANGE: 4.15

   (*) Indicates significant differences which are shown in the lower triangle

                                  G G G G G G
                                  r r r r r r
                                  p p p p p p

                                  6 4 1 5 2 3
     Mean       G

    66.0000     Grp 6
    79.0909     Grp 4
    87.2727     Grp 1
    87.6923     Grp 5
    91.6667     Grp 2         *
    92.8571     Grp 3         *
```

Trust

```
     Variable  TRUST
  By Variable  G
```

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	1675.5606	335.1121	1.0218	.4111
Within Groups	74	24269.4394	327.9654		
Total	79	25945.0000			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	11	76.4545	12.9179	3.8949	67.7762	TO	85.1329
Grp 2	14	72.0714	19.5388	5.2220	60.7901	TO	83.3528
Grp 3	17	78.9412	15.5783	3.7783	70.9315	TO	86.9508
Grp 4	12	80.5000	15.9402	4.6015	70.3721	TO	90.6279
Grp 5	15	67.2667	26.1137	6.7425	52.8054	TO	81.7279
Grp 6	11	73.9091	11.8866	3.5839	65.9236	TO	81.8946
Total	80	74.7500	18.1223	2.0261	70.7171	TO	78.7829

GROUP	MINIMUM	MAXIMUM
Grp 1	50.0000	93.0000
Grp 2	39.0000	97.0000
Grp 3	40.0000	100.0000
Grp 4	40.0000	97.0000
Grp 5	15.0000	100.0000
Grp 6	51.0000	100.0000
TOTAL	15.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
3.6715	5	74	.005

```
     Variable  TRUST
  By Variable  G
```

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

```
The difference between two means is significant if
  MEAN(J)-MEAN(I)  >= 12.8056 * RANGE * SQRT(1/N(I) + 1/N(J))
  with the following value(s) for RANGE:
```

Step	2	3	4	5	6
RANGE	2.83	3.38	3.72	3.95	4.14

- No two groups are significantly different at the .050 level

```
     Variable  TRUST
  By Variable  G
```

Multiple Range Tests: Tukey-HSD test with significance level .050

```
The difference between two means is significant if
  MEAN(J)-MEAN(I)  >= 12.8056 * RANGE * SQRT(1/N(I) + 1/N(J))
  with the following value(s) for RANGE: 4.14
```

- No two groups are significantly different at the .050 level

RG 2000 Category

Variable RG 2000
By Variable G

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	4.1472	.8294	.9878	.4312
Within Groups	73	61.2959	.8397		
Total	78	65.4430			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	11	1.6364	.6742	.2033	1.1834	TO	2.0893
Grp 2	13	1.8462	.9871	.2738	1.2497	TO	2.4427
Grp 3	17	1.3529	.6063	.1471	1.0412	TO	1.6647
Grp 4	12	1.6667	.9847	.2843	1.0410	TO	2.2923
Grp 5	15	1.6000	1.1212	.2895	.9791	TO	2.2209
Grp 6	11	2.0909	1.0445	.3149	1.3892	TO	2.7926
Total	79	1.6709	.9160	.1031	1.4657	TO	1.8761

GROUP	MINIMUM	MAXIMUM
Grp 1	1.0000	3.0000
Grp 2	.0000	3.0000
Grp 3	1.0000	3.0000
Grp 4	.0000	4.0000
Grp 5	.0000	4.0000
Grp 6	.0000	3.0000
TOTAL	.0000	4.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
1.3895	5	73	.238

Variable RG 2000
By Variable G

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= .6479 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.38	3.72	3.96	4.14

- No two groups are significantly different at the .050 level

Variable RG 2000
By Variable G

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= .6479 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.14
- No two groups are significantly different at the .050 level

Supplier Product Design

Variable PDTDES
By Variable G

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	11503.0711	2300.6142	1.9915	.0899
Within Groups	73	84331.9669	1155.2324		
Total	78	95835.0380			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean
Grp 1	11	48.0909	34.9384	10.5343	24.6190 TO 71.5628
Grp 2	14	46.5000	40.1167	10.7216	23.3373 TO 69.6627
Grp 3	17	67.5294	29.9314	7.2594	52.1401 TO 82.9187
Grp 4	12	83.1667	22.5624	6.5132	68.8312 TO 97.5021
Grp 5	14	62.9286	35.5992	9.5143	42.3742 TO 83.4829
Grp 6	11	58.5455	38.4639	11.5973	32.7051 TO 84.3859
Total	79	61.4051	35.0522	3.9437	53.5538 TO 69.2563

GROUP	MINIMUM	MAXIMUM
Grp 1	4.0000	95.0000
Grp 2	.0000	100.0000
Grp 3	5.0000	100.0000
Grp 4	19.0000	100.0000
Grp 5	4.0000	100.0000
Grp 6	.0000	98.0000
TOTAL	.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
3.3992	5	73	.008

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 24.0336 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.38	3.72	3.96	4.14

- No two groups are significantly different at the .050 level

Variable PDTDES
By Variable G

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 24.0336 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.14

- No two groups are significantly different at the .050 level

Rover Process Knowledge

Variable PCSKNOW
By Variable G

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	5824.7853	1164.9571	1.7793	.1280
Within Groups	72	47141.0095	654.7362		
Total	77	52965.7949			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	11	67.4545	19.6589	5.9274	54.2475	TO	80.6616
Grp 2	14	44.9286	20.7567	5.5475	32.9440	TO	56.9131
Grp 3	17	50.1765	29.7893	7.2250	34.8602	TO	65.4927
Grp 4	11	43.5455	31.1941	9.4054	22.5890	TO	64.5019
Grp 5	14	55.5714	27.1342	7.2519	39.9046	TO	71.2382
Grp 6	11	64.4545	20.4321	6.1605	50.7280	TO	78.1810
Total	78	53.7179	26.2272	2.9696	47.8046	TO	59.6313

GROUP	MINIMUM	MAXIMUM
Grp 1	22.0000	88.0000
Grp 2	5.0000	80.0000
Grp 3	10.0000	96.0000
Grp 4	1.0000	86.0000
Grp 5	12.0000	94.0000
Grp 6	22.0000	85.0000
TOTAL	1.0000	96.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
2.3365	5	72	.050

Variable PCSKNOW
By Variable G

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 18.0933 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.38	3.72	3.96	4.14

- No two groups are significantly different at the .050 level

Variable PCSKNOW
By Variable G

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 18.0933 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.14

- No two groups are significantly different at the .050 level

Rover Product Knowledge

Variable PRTKNOW
By Variable G

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	762.0652	152.4130	.2971	.9130
Within Groups	72	36930.1528	512.9188		
Total	77	37692.2179			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	11	71.7273	13.1992	3.9797	62.8599	TO	80.5946
Grp 2	14	68.2857	24.4019	6.5217	54.1965	TO	82.3749
Grp 3	17	70.2941	28.2174	6.8437	55.7861	TO	84.8022
Grp 4	11	72.0000	29.1513	8.7895	52.4159	TO	91.5841
Grp 5	14	77.2857	19.3686	5.1765	66.1026	TO	88.4688
Grp 6	11	75.5455	11.5444	3.4808	67.7898	TO	83.3011
Total	78	72.3718	22.1249	2.5051	67.3834	TO	77.3602

GROUP	MINIMUM	MAXIMUM
Grp 1	54.0000	89.0000
Grp 2	10.0000	100.0000
Grp 3	10.0000	100.0000
Grp 4	.0000	100.0000
Grp 5	26.0000	100.0000
Grp 6	50.0000	89.0000
TOTAL	.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
2.1752	5	72	.066

Variable PRTKNOW
By Variable G

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 16.0143 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.38	3.72	3.96	4.14

- No two groups are significantly different at the .050 level

Variable PRTKNOW
By Variable G

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 16.0143 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.14

- No two groups are significantly different at the .050 level

Supplier Process Design

Variable PCSDES
By Variable G

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	1219.0009	243.8002	3.1157	.0133
Within Groups	72	5633.8709	78.2482		
Total	77	6852.8718			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	11	87.9091	15.6106	4.7068	77.4217	TO	98.3964
Grp 2	14	93.7857	8.2944	2.2168	88.9967	TO	98.5747
Grp 3	17	97.5882	4.5834	1.1116	95.2317	TO	99.9448
Grp 4	11	96.4545	6.6538	2.0062	91.9845	TO	100.9246
Grp 5	14	98.6429	2.4371	.6513	97.2357	TO	100.0500
Grp 6	11	89.3636	12.0272	3.6263	81.2836	TO	97.4436
Total	78	94.4103	9.4339	1.0682	92.2832	TO	96.5373

GROUP	MINIMUM	MAXIMUM
Grp 1	50.0000	100.0000
Grp 2	79.0000	100.0000
Grp 3	85.0000	100.0000
Grp 4	78.0000	100.0000
Grp 5	93.0000	100.0000
Grp 6	66.0000	100.0000
TOTAL	50.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
6.6645	5	72	.000

Variable PCSDES
By Variable G

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 6.2549 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.38	3.72	3.96	4.14

(*) Indicates significant differences which are shown in the lower triangle

```
                         G G G G G G
                         r r r r r r
                         p p p p p p

                         1 6 2 4 3 5
    Mean        G

    87.9091     Grp 1
    89.3636     Grp 6
    93.7857     Grp 2
    96.4545     Grp 4
    97.5882     Grp 3    *
    98.6429     Grp 5    *


      Variable  PCSDES
   By Variable  G

Multiple Range Tests:  Tukey-HSD test with significance level .050

The difference between two means is significant if
  MEAN(J)-MEAN(I)  >= 6.2549 * RANGE * SQRT(1/N(I) + 1/N(J))
  with the following value(s) for RANGE: 4.14

   (*) Indicates significant differences which are shown in the lower triangle

                         G G G G G G
                         r r r r r r
                         p p p p p p

                         1 6 2 4 3 5
    Mean        G

    87.9091     Grp 1
    89.3636     Grp 6
    93.7857     Grp 2
    96.4545     Grp 4
    97.5882     Grp 3
    98.6429     Grp 5    *
```

Total Quality Management

Variable OTQI
By Variable G

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	1648.0292	329.6058	1.3097	.2811
Within Groups	37	9311.6452	251.6661		
Total	42	10959.6744			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	9	62.5556	16.8976	5.6325	49.5669	TO	75.5442
Grp 2	7	55.7143	15.6175	5.9028	41.2706	TO	70.1579
Grp 3	9	59.7778	14.7121	4.9040	48.4691	TO	71.0864
Grp 4	5	64.8000	17.6267	7.8829	42.9139	TO	86.6861
Grp 5	9	46.8889	12.3839	4.1280	37.3698	TO	56.4080
Grp 6	4	61.7500	21.3131	10.6566	27.8365	TO	95.6635
Total	43	57.7674	16.1538	2.4634	52.7960	TO	62.7388

GROUP	MINIMUM	MAXIMUM
Grp 1	42.0000	87.0000
Grp 2	29.0000	79.0000
Grp 3	39.0000	79.0000
Grp 4	50.0000	91.0000
Grp 5	25.0000	66.0000
Grp 6	30.0000	75.0000
TOTAL	25.0000	91.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
.6044	5	37	.697

Variable OTQI
By Variable G

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 11.2175 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.87	3.45	3.80	4.05	4.25

- No two groups are significantly different at the .050 level

Variable OTQI
By Variable G

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 11.2175 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.25

- No two groups are significantly different at the .050 level

Openness

Variable OPEN
By Variable G

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	1024.3672	204.8734	.5504	.7375
Within Groups	74	27543.5203	372.2097		
Total	79	28567.8875			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	11	73.6364	22.0285	6.6418	58.8374	TO	88.4353
Grp 2	14	75.5000	22.0026	5.8804	62.7961	TO	88.2039
Grp 3	17	77.7059	16.6161	4.0300	69.1627	TO	86.2491
Grp 4	12	78.1667	17.6214	5.0869	66.9705	TO	89.3628
Grp 5	15	67.8667	21.8203	5.6340	55.7830	TO	79.9503
Grp 6	11	75.3636	13.7788	4.1545	66.1069	TO	84.6203
Total	80	74.6625	19.0163	2.1261	70.4306	TO	8.8944

GROUP	MINIMUM	MAXIMUM
Grp 1	21.0000	98.0000
Grp 2	30.0000	97.0000
Grp 3	40.0000	100.0000
Grp 4	40.0000	97.0000
Grp 5	23.0000	100.0000
Grp 6	51.0000	100.0000
TOTAL	21.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
.5953	5	74	.704

Variable OPEN
By Variable G

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 13.6420 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.38	3.72	3.95	4.14

- No two groups are significantly different at the .050 level

Variable OPEN
By Variable G

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 13.6420 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.14

- No two groups are significantly different at the .050 level

Open Book

Variable OPBK
By Variable G

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	5080.0126	1016.0025	1.9462	.0976
Within Groups	70	36542.7769	522.0397		
Total	75	41622.7895			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	11	87.5455	9.2343	2.7843	81.3418	TO	93.7492
Grp 2	14	80.2143	13.7795	3.6827	72.2583	TO	88.1703
Grp 3	17	62.4706	30.6495	7.4336	46.7121	TO	78.2291
Grp 4	10	73.3000	26.3146	8.3214	54.4757	TO	92.1243
Grp 5	14	69.7143	25.9894	6.9460	54.7084	TO	84.7201
Grp 6	10	72.5000	18.7927	5.9428	59.0565	TO	85.9435
Total	76	73.4474	23.5578	2.7023	68.0642	TO	78.8306

GROUP	MINIMUM	MAXIMUM
Grp 1	67.0000	100.0000
Grp 2	50.0000	100.0000
Grp 3	2.0000	100.0000
Grp 4	23.0000	100.0000
Grp 5	11.0000	98.0000
Grp 6	40.0000	100.0000
TOTAL	2.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
4.9564	5	70	.001

Variable OPBK
By Variable G

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 16.1561 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.39	3.72	3.96	4.14

- No two groups are significantly different at the .050 level

Variable OPBK
By Variable G

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 16.1561 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.14

- No two groups are significantly different at the .050 level

Asanuma Classifications

Variable ASAN
By Variable G

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	3.7309	.7462	.2502	.9382
Within Groups	65	193.8466	2.9823		
Total	70	197.5775			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	10	4.6000	1.8974	.6000	3.2427	TO	5.9573
Grp 2	12	4.7500	1.8647	.5383	3.5652	TO	5.9348
Grp 3	15	4.3333	1.5887	.4102	3.4536	TO	5.2131
Grp 4	12	4.6667	1.7753	.5125	3.5387	TO	5.7946
Grp 5	13	4.7692	1.4806	.4107	3.8745	TO	5.6640
Grp 6	9	4.1111	1.8333	.6111	2.7019	TO	5.5203
Total	71	4.5493	1.6800	.1994	4.1516	TO	4.9470

GROUP	MINIMUM	MAXIMUM
Grp 1	2.0000	7.0000
Grp 2	2.0000	7.0000
Grp 3	2.0000	7.0000
Grp 4	2.0000	7.0000
Grp 5	2.0000	7.0000
Grp 6	2.0000	7.0000
TOTAL	2.0000	7.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
.4012	5	65	.846

Variable ASAN
By Variable G

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 1.2211 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.39	3.73	3.97	4.15

- No two groups are significantly different at the .050 level

Variable ASAN
By Variable G

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 1.2211 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.15

- No two groups are significantly different at the .050 level
Fewer than two non-empty groups.

Communication

Variable COMMUN
By Variable G

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	10731.4637	2146.2927	2.9376	.0186
Within Groups	67	48952.0979	730.6283		
Total	72	59683.5616			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	11	70.9091	18.1409	5.4697	58.7219	TO	83.0963
Grp 2	13	46.5385	34.1189	9.4629	25.9206	TO	67.1563
Grp 3	15	77.0000	13.7321	3.5456	69.3954	TO	84.6046
Grp 4	11	65.4545	26.1204	7.8756	47.9067	TO	83.0024
Grp 5	13	46.5385	29.9572	8.3086	28.4355	TO	64.6414
Grp 6	10	57.0000	35.6838	11.2842	31.4734	TO	82.5266
Total	73	60.7534	28.7913	3.3698	54.0359	TO	67.4709

GROUP	MINIMUM	MAXIMUM
Grp 1	30.0000	90.0000
Grp 2	.0000	100.0000
Grp 3	50.0000	100.0000
Grp 4	20.0000	100.0000
Grp 5	.0000	95.0000
Grp 6	.0000	95.0000
TOTAL	.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
4.1667	5	67	.002

Variable COMMUN
By Variable G

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 19.1132 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.39	3.73	3.96	4.15

```
(*) Indicates significant differences which are shown in the lower triangle

                         G G G G G G
                         r r r r r r
                         p p p p p p

                         2 5 6 4 1 3
    Mean      G

    46.5385   Grp 2
    46.5385   Grp 5
    57.0000   Grp 6
    65.4545   Grp 4
    70.9091   Grp 1
    77.0000   Grp 3      * *


      Variable  COMMUN
   By Variable  G

Multiple Range Tests:  Tukey-HSD test with significance level .050

The difference between two means is significant if
  MEAN(J)-MEAN(I)  >= 19.1132 * RANGE * SQRT(1/N(I) + 1/N(J))
  with the following value(s) for RANGE: 4.15

  (*) Indicates significant differences which are shown in the lower triangle

                         G G G G G G
                         r r r r r r
                         p p p p p p

                         2 5 6 4 1 3
    Mean      G

    46.5385   Grp 2
    46.5385   Grp 5
    57.0000   Grp 6
    65.4545   Grp 4
    70.9091   Grp 1
    77.0000   Grp 3      * *
```

Input

Variable INPUT
By Variable G

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	6081.4283	1216.2857	1.0273	.4092
Within Groups	64	75770.3574	1183.9118		
Total	69	81851.7857			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean
Grp 1	11	45.0000	36.1248	10.8920	20.7310 TO 69.2690
Grp 2	13	53.0769	39.2396	10.8831	29.3647 TO 76.7892
Grp 3	13	61.9231	27.0446	7.5008	45.5802 TO 78.2660
Grp 4	11	58.6364	33.8446	10.2045	35.8993 TO 81.3734
Grp 5	13	60.3846	37.1069	10.2916	37.9611 TO 82.8081
Grp 6	9	33.8889	30.5959	10.1986	10.3708 TO 57.4070
Total	70	53.2143	34.4421	4.1166	45.0019 TO 61.4267

GROUP	MINIMUM	MAXIMUM
Grp 1	.0000	90.0000
Grp 2	.0000	100.0000
Grp 3	20.0000	100.0000
Grp 4	5.0000	100.0000
Grp 5	.0000	100.0000
Grp 6	.0000	90.0000
TOTAL	.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
.9147	5	64	.477

Variable INPUT
By Variable G

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 24.3301 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.39	3.73	3.97	4.15

- No two groups are significantly different at the .050 level

Variable INPUT
By Variable G

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 24.3301 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.15

- No two groups are significantly different at the .050 level

Integration

Variable INTEGRAT
By Variable G

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	5299.2603	1059.8521	1.0526	.3948
Within Groups	65	65450.4580	1006.9301		
Total	70	70749.7183			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	11	64.5455	19.0335	5.7388	51.7586	TO	77.3323
Grp 2	13	46.3846	39.6433	10.9951	22.4284	TO	70.3408
Grp 3	13	73.4615	22.2097	6.1599	60.0404	TO	86.8827
Grp 4	11	60.0000	27.2947	8.2297	41.6632	TO	78.3368
Grp 5	13	56.9231	30.7231	8.5211	38.3573	TO	75.4889
Grp 6	10	55.5000	45.0586	14.2488	23.2670	TO	7.7330
Total	71	59.4789	31.7917	3.7730	51.9539	TO	67.0038

GROUP	MINIMUM	MAXIMUM
Grp 1	30.0000	90.0000
Grp 2	.0000	100.0000
Grp 3	25.0000	100.0000
Grp 4	10.0000	100.0000
Grp 5	.0000	90.0000
Grp 6	.0000	100.0000
TOTAL	.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
6.5117	5	65	.000

Variable INTEGRAT
By Variable G

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 22.4380 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.39	3.73	3.97	4.15

- No two groups are significantly different at the .050 level

Variable INTEGRAT
By Variable G

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 22.4380 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.15

- No two groups are significantly different at the .050 level

Lock-In

Variable LOCKIN
By Variable G

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	5575.3481	1115.0696	1.4098	.2309
Within Groups	73	57738.1962	790.9342		
Total	78	63313.5443			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	11	76.4545	19.6131	5.9136	63.2783	TO	89.6308
Grp 2	13	74.0769	30.9770	8.5915	55.3577	TO	92.7962
Grp 3	17	53.5294	30.4490	7.3850	37.8740	TO	69.1848
Grp 4	12	66.2500	19.2029	5.5434	54.0491	TO	78.4509
Grp 5	15	57.6667	32.0862	8.2846	39.8979	TO	75.4354
Grp 6	11	62.5455	30.1210	9.0818	42.3099	TO	82.7810
Total	79	64.0759	28.4906	3.2054	57.6944	TO	70.4575

GROUP	MINIMUM	MAXIMUM
Grp 1	23.0000	97.0000
Grp 2	15.0000	100.0000
Grp 3	9.0000	100.0000
Grp 4	23.0000	97.0000
Grp 5	8.0000	100.0000
Grp 6	4.0000	89.0000
TOTAL	4.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
2.7772	5	73	.024

Variable LOCKIN
By Variable G

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 19.8864 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.38	3.72	3.96	4.14

- No two groups are significantly different at the .050 level

Variable LOCKIN
By Variable G

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 19.8864 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.14

- No two groups are significantly different at the .050 level

Business Performance

Variable OBPERF
By Variable G

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	3145.8468	629.1694	.3710	.8651
Within Groups	36	61050.6294	1695.8508		
Total	41	64196.4762			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	9	238.5556	42.5327	14.1776	205.8621	TO	71.2490
Grp 2	7	229.8571	37.6627	14.2351	195.0252	TO	264.6891
Grp 3	9	228.3333	31.5674	10.5225	204.0685	TO	252.5982
Grp 4	5	239.2000	30.5974	13.6836	201.2089	TO	277.1911
Grp 5	8	214.0000	58.3756	20.6389	165.1969	TO	262.8031
Grp 6	4	230.2500	28.8487	14.4244	184.3459	TO	276.1541
Total	42	229.5238	39.5698	6.1058	217.1930	TO	241.8546

GROUP	MINIMUM	MAXIMUM
Grp 1	170.0000	315.0000
Grp 2	193.0000	288.0000
Grp 3	173.0000	276.0000
Grp 4	196.0000	269.0000
Grp 5	134.0000	311.0000
Grp 6	196.0000	262.0000
TOTAL	134.0000	315.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
.7877	5	36	.565

Variable OBPERF
By Variable G

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 29.1192 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.87	3.45	3.81	4.06	4.25

- No two groups are significantly different at the .050 level

Variable OBPERF
By Variable G

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 29.1192 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.25

- No two groups are significantly different at the .050 level

Project Management

Variable OPM
By Variable G

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	5038.8447	1007.7689	.7838	.5679
Within Groups	37	47569.9460	1285.6742		
Total	42	52608.7907			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean
Grp 1	9	211.1111	35.2507	11.7502	184.0151 TO 238.2072
Grp 2	7	186.8571	39.4438	14.9083	150.3780 TO 223.3363
Grp 3	9	189.0000	27.1201	9.0400	168.1537 TO 209.8463
Grp 4	5	184.4000	32.0359	14.3269	144.6228 TO 224.1772
Grp 5	9	180.3333	44.4466	14.8155	146.1687 TO 214.4980
Grp 6	4	190.5000	28.8733	14.4366	144.5568 TO 236.4432
Total	43	191.0698	35.3920	5.3972	180.1777 TO 201.9618

GROUP	MINIMUM	MAXIMUM
Grp 1	146.0000	249.0000
Grp 2	136.0000	245.0000
Grp 3	153.0000	248.0000
Grp 4	133.0000	214.0000
Grp 5	120.0000	258.0000
Grp 6	165.0000	231.0000
TOTAL	120.0000	258.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
1.1098	5	37	.372

Variable OPM
By Variable G

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 25.3542 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.87	3.45	3.80	4.05	4.25

- No two groups are significantly different at the .050 level

Variable OPM
By Variable G

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 25.3542 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.25

- No two groups are significantly different at the .050 level

Analysis by RG 2000 Category

Ability

Variable ABILITY
By Variable RG 2000

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	4798.0677	1599.3559	3.8957	.0122
Within Groups	73	29969.4648	410.5406		
Total	76	34767.5325			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	31	93.2258	8.7129	1.5649	90.0299	TO	96.4217
Grp 2	32	80.6250	21.2037	3.7483	72.9803	TO	88.2697
Grp 3	11	71.3636	36.8165	11.1006	46.6300	TO	96.0973
Grp 4	3	80.0000	10.0000	5.7735	55.1583	TO	104.8417
Total	77	84.3506	21.3885	2.4374	79.4961	TO	89.2052

GROUP	MINIMUM	MAXIMUM
Grp 1	70.0000	100.0000
Grp 2	20.0000	100.0000
Grp 3	.0000	100.0000
Grp 4	70.0000	90.0000
TOTAL	.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
6.9116	3	73	.000

Variable ABILITY
By Variable RG 2000

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 14.3273 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4
RANGE	2.83	3.38	3.72

(*) Indicates significant differences which are shown in the lower triangle

Mean	RG 2000	Grp 3	Grp 4	Grp 2	Grp 1
71.3636	Grp 3				
80.0000	Grp 4				
80.6250	Grp 2				
93.2258	Grp 1	*		*	

```
       Variable  ABILITY
    By Variable  RG 2000

Multiple Range Tests:  Tukey-HSD test with significance level .050

The difference between two means is significant if
  MEAN(J)-MEAN(I)  >= 14.3273 * RANGE * SQRT(1/N(I) + 1/N(J))
  with the following value(s) for RANGE: 3.72

    (*) Indicates significant differences which are shown in the lower triangle

                           G G G G
                           r r r r
                           p p p p

                           3 4 2 1
     Mean        RG 2000

     71.3636     Grp 3
     80.0000     Grp 4
     80.6250     Grp 2
     93.2258     Grp 1     *
```

Trust

Variable TRUST
By Variable RG 2000

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	1000.1657	333.3886	.8177	.4877
Within Groups	82	33431.2878	407.6986		
Total	85	34431.4535			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	34	74.6765	18.2934	3.1373	68.2936	TO	81.0594
Grp 2	33	71.5152	21.5423	3.7500	63.8766	TO	79.1537
Grp 3	16	71.9375	22.2215	5.5554	60.0965	TO	83.7785
Grp 4	3	89.6667	8.0829	4.6667	69.5874	TO	09.7459
Total	86	73.4767	20.1265	2.1703	69.1616	TO	77.7919

GROUP	MINIMUM	MAXIMUM
Grp 1	15.0000	100.0000
Grp 2	25.0000	100.0000
Grp 3	8.0000	100.0000
Grp 4	81.0000	97.0000
TOTAL	8.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
1.0148	3	82	.390

Variable TRUST
By Variable RG 2000

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 14.2776 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4
RANGE	2.83	3.38	3.71

- No two groups are significantly different at the .050 level

Variable TRUST
By Variable RG 2000

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 14.2776 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 3.71

- No two groups are significantly different at the .050 level

Supplier Product Design

Variable PDTDES
By Variable RG 2000

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	36430.2256	12143.4085	12.8576	.0000
Within Groups	80	75556.1911	944.4524		
Total	83	111986.4167			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	34	76.3529	27.5768	4.7294	66.7310	TO	85.9749
Grp 2	33	32.7273	31.8907	5.5515	21.4193	TO	44.0352
Grp 3	14	55.6429	37.0937	9.9137	34.2256	TO	77.0601
Grp 4	3	94.6667	3.7859	2.1858	85.2618	TO	94.0716
Total	84	56.4167	36.7319	4.0078	48.4454	TO	64.3880

GROUP	MINIMUM	MAXIMUM
Grp 1	.0000	100.0000
Grp 2	.0000	100.0000
Grp 3	.0000	100.0000
Grp 4	92.0000	99.0000
TOTAL	.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
3.3245	3	80	.024

Variable PDTDES
By Variable RG 2000

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 21.7308 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4
RANGE	2.83	3.38	3.71

(*) Indicates significant differences which are shown in the lower triangle

```
                                          G G G G
                                          r r r r
                                          p p p p

                                          2 3 1 4
     Mean        RG 2000

    32.7273      Grp 2
    55.6429      Grp 3                    *
    76.3529      Grp 1                    * *
    94.6667      Grp 4                    *


      Variable  PDTDES
   By Variable  RG 2000

Multiple Range Tests:  Tukey-HSD test with significance level .050

The difference between two means is significant if
  MEAN(J)-MEAN(I)  >= 21.7308 * RANGE * SQRT(1/N(I) + 1/N(J))
  with the following value(s) for RANGE: 3.71

   (*) Indicates significant differences which are shown in the lower triangle

                                          G G G G
                                          r r r r
                                          p p p p

                                          2 3 1 4
     Mean        RG 2000

    32.7273      Grp 2
    55.6429      Grp 3
    76.3529      Grp 1                    *
    94.6667      Grp 4                    *
```

Rover Process Knowledge

Variable PCSKNOW
By Variable RG 2000

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	1200.4242	400.1414	.5459	.6523
Within Groups	79	57902.4673	732.9426		
Total	82	59102.8916			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	34	55.2353	26.7628	4.5898	45.8973	TO	64.5733
Grp 2	32	48.5313	23.6384	4.1787	40.0087	TO	57.0538
Grp 3	14	58.1429	31.9756	8.5458	39.6807	TO	76.6050
Grp 4	3	50.3333	42.7356	24.6734	-55.8290	TO	156.4957
Total	83	52.9639	26.8471	2.9469	47.1016	TO	58.8261

GROUP	MINIMUM	MAXIMUM
Grp 1	10.0000	96.0000
Grp 2	3.0000	90.0000
Grp 3	5.0000	97.0000
Grp 4	1.0000	76.0000
TOTAL	1.0000	97.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
1.8093	3	79	.152

Variable PCSKNOW
By Variable RG 2000

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 19.1434 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4
RANGE	2.83	3.38	3.71

- No two groups are significantly different at the .050 level

Variable PCSKNOW
By Variable RG 2000

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 19.1434 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 3.71

- No two groups are significantly different at the .050 level

Rover Product Knowledge

Variable PRTKNOW
By Variable RG 2000

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	4699.1845	1566.3948	3.0495	.0334
Within Groups	79	40578.2854	513.6492		
Total	82	45277.4699			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean
Grp 1	34	71.3824	24.0366	4.1222	62.9956 TO 79.7691
Grp 2	32	74.5625	15.2335	2.6929	69.0702 TO 80.0548
Grp 3	14	68.1429	29.3699	7.8494	51.1852 TO 85.1006
Grp 4	3	33.6667	39.3997	22.7474	-64.2086 TO 31.5419
Total	83	70.6988	23.4982	2.5793	65.5678 TO 75.8298

GROUP	MINIMUM	MAXIMUM
Grp 1	10.0000	100.0000
Grp 2	33.0000	100.0000
Grp 3	6.0000	100.0000
Grp 4	.0000	77.0000
TOTAL	.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
3.3153	3	79	.024

Variable PRTKNOW
By Variable RG 2000

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 16.0257 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4
RANGE	2.83	3.38	3.71

(*) Indicates significant differences which are shown in the lower triangle

```
                         G G G G
                         r r r r
                         p p p p

                         4 3 1 2
     Mean       RG 2000

    33.6667     Grp 4
    68.1429     Grp 3    *
    71.3824     Grp 1    *
    74.5625     Grp 2    *


      Variable  PRTKNOW
   By Variable  RG 2000

Multiple Range Tests:  Tukey-HSD test with significance level .050

The difference between two means is significant if
  MEAN(J)-MEAN(I)  >= 16.0257 * RANGE * SQRT(1/N(I) + 1/N(J))
  with the following value(s) for RANGE: 3.71

    (*) Indicates significant differences which are shown in the lower triangle

                         G G G G
                         r r r r
                         p p p p

                         4 3 1 2
     Mean       RG 2000

    33.6667     Grp 4
    68.1429     Grp 3
    71.3824     Grp 1    *
    74.5625     Grp 2    *
```

Supplier Process Design

Variable PCSDES
By Variable RG 2000

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	2102.6018	700.8673	1.9110	.1346
Within Groups	79	28973.0850	366.7479		
Total	82	31075.6867			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean
Grp 1	34	95.4118	17.3661	2.9783	89.3524 TO 101.4711
Grp 2	32	85.0313	24.0060	4.2437	76.3762 TO 93.6863
Grp 3	14	93.6429	9.4185	2.5172	88.2048 TO 99.0810
Grp 4	3	99.3333	1.1547	.6667	96.4649 TO 102.2018
Total	83	91.2530	19.4672	2.1368	87.0022 TO 95.5038

GROUP	MINIMUM	MAXIMUM
Grp 1	.0000	100.0000
Grp 2	.0000	100.0000
Grp 3	70.0000	100.0000
Grp 4	98.0000	100.0000
TOTAL	.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
2.1019	3	79	.107

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 13.5416 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4
RANGE	2.83	3.38	3.71

- No two groups are significantly different at the .050 level

Variable PCSDES
By Variable RG 2000

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 13.5416 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 3.71

- No two groups are significantly different at the .050 level

Fewer than two non-empty groups.

Supplier Product Design

Variable PDTDES
By Variable ASAN

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	14893.4484	2978.6897	2.3373	.0497
Within Groups	77	98128.9612	1274.4021		
Total	82	113022.4096			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 2	11	28.0909	26.5159	7.9948	10.2773	TO	45.9045
Grp 3	13	69.6154	26.4498	7.3358	53.6320	TO	85.5988
Grp 4	17	53.4706	38.6428	9.3723	33.6023	TO	73.3389
Grp 5	14	59.8571	36.6813	9.8035	38.6780	TO	81.0363
Grp 6	15	55.3333	39.5685	10.2165	33.4210	TO	77.2456
Grp 7	13	72.8462	40.2075	11.1515	48.5490	TO	97.1433
Total	83	57.0843	37.1258	4.0751	48.9777	TO	65.1910

GROUP	MINIMUM	MAXIMUM
Grp 2	2.0000	90.0000
Grp 3	10.0000	100.0000
Grp 4	.0000	98.0000
Grp 5	.0000	100.0000
Grp 6	1.0000	100.0000
Grp 7	.0000	100.0000
TOTAL	.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
2.9685	5	77	.017

Variable PDTDES
By Variable ASAN

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 25.2428 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.38	3.71	3.95	4.13

(*) Indicates significant differences which are shown in the lower triangle

```
                    G G G G G G
                    r r r r r r
                    p p p p p p

                    2 4 6 5 3 7
    Mean      ASAN

   28.0909    Grp 2
   53.4706    Grp 4
   55.3333    Grp 6
   59.8571    Grp 5
   69.6154    Grp 3     *
   72.8462    Grp 7     *
```

```
     Variable  PDTDES
  By Variable  ASAN

Multiple Range Tests:  Tukey-HSD test with significance level .050

The difference between two means is significant if
  MEAN(J)-MEAN(I)  >= 25.2428 * RANGE * SQRT(1/N(I) + 1/N(J))
  with the following value(s) for RANGE: 4.13

   (*) Indicates significant differences which are shown in the lower triangle

                    G G G G G G
                    r r r r r r
                    p p p p p p

                    2 4 6 5 3 7
    Mean      ASAN

   28.0909    Grp 2
   53.4706    Grp 4
   55.3333    Grp 6
   59.8571    Grp 5
   69.6154    Grp 3
   72.8462    Grp 7     *
```

Total Quality Management

Variable OTQI
By Variable RG 2000

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	1048.7022	524.3511	2.1724	.1260
Within Groups	44	10620.2765	241.3699		
Total	46	11668.9787			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	22	60.4091	16.1294	3.4388	53.2577	TO	67.5605
Grp 2	24	52.7083	14.9738	3.0565	46.3854	TO	59.0312
Grp 3	1	37.0000					
Total	47	55.9787	15.9271	2.3232	51.3023	TO	60.6551

GROUP	MINIMUM	MAXIMUM
Grp 1	25.0000	91.0000
Grp 2	29.0000	81.0000
Grp 3	37.0000	37.0000
TOTAL	25.0000	91.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
.9681	2	44	.388

Variable OTQI
By Variable RG 2000

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 10.9857 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3
RANGE	2.86	3.43

- No two groups are significantly different at the .050 level

Variable OTQI
By Variable RG 2000

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 10.9857 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 3.43

- No two groups are significantly different at the .050 level

Openness

Variable OPEN
By Variable RG 2000

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	1115.4339	371.8113	1.0562	.3724
Within Groups	82	28866.6591	352.0324		
Total	85	29982.0930			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	34	75.0000	18.7164	3.2098	68.4695	TO	81.5305
Grp 2	33	71.5152	19.3409	3.3668	64.6572	TO	78.3731
Grp 3	16	75.8750	18.7683	4.6921	65.8741	TO	85.8759
Grp 4	3	90.6667	5.1316	2.9627	77.9189	TO	103.4144
Total	86	74.3721	18.7811	2.0252	70.3454	TO	78.3988

GROUP	MINIMUM	MAXIMUM
Grp 1	21.0000	100.0000
Grp 2	28.0000	100.0000
Grp 3	44.0000	100.0000
Grp 4	85.0000	95.0000
TOTAL	21.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
.9426	3	82	.424

Variable OPEN
By Variable RG 2000

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 13.2671 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4
RANGE	2.83	3.38	3.71

- No two groups are significantly different at the .050 level

Variable OPEN
By Variable RG 2000

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 13.2671 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 3.71

- No two groups are significantly different at the .050 level

Open Book

Variable OPBK
By Variable RG 2000

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	9.8311	3.2770	.0055	.9994
Within Groups	78	46523.1445	596.4506		
Total	81	46532.9756			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	33	74.7576	26.5578	4.6231	65.3406	TO	84.1745
Grp 2	31	74.8710	22.8572	4.1053	66.4869	TO	83.2550
Grp 3	15	74.0667	23.7110	6.1221	60.9360	TO	87.1974
Grp 4	3	75.6667	14.2945	8.2529	40.1567	TO	111.1766
Total	82	74.7073	23.9683	2.6469	69.4409	TO	79.9737

GROUP	MINIMUM	MAXIMUM
Grp 1	2.0000	100.0000
Grp 2	15.0000	100.0000
Grp 3	1.0000	98.0000
Grp 4	60.0000	88.0000
TOTAL	1.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
.7030	3	78	.553

Variable OPBK
By Variable RG 2000

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 17.2692 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4
RANGE	2.83	3.38	3.71

- No two groups are significantly different at the .050 level

Variable OPBK
By Variable RG 2000

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 17.2692 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 3.71

- No two groups are significantly different at the .050 level

Asanuma Classification

Variable ASAN
By Variable RG 2000

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	34.0837	11.3612	4.8310	.0040
Within Groups	72	169.3242	2.3517		
Total	75	203.4079			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	31	4.6774	1.4694	.2639	4.1384	TO	5.2164
Grp 2	30	4.0333	1.4735	.2690	3.4831	TO	4.5836
Grp 3	12	5.5833	1.9287	.5568	4.3579	TO	6.8087
Grp 4	3	6.6667	.5774	.3333	5.2324	TO	8.1009
Total	76	4.6447	1.6468	.1889	4.2684	TO	5.0211

GROUP	MINIMUM	MAXIMUM
Grp 1	2.0000	7.0000
Grp 2	2.0000	6.0000
Grp 3	2.0000	7.0000
Grp 4	6.0000	7.0000
TOTAL	2.0000	7.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
1.5964	3	72	.198

Variable ASAN
By Variable RG 2000

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 1.0844 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4
RANGE	2.83	3.38	3.72

(*) Indicates significant differences which are shown in the lower triangle

```
                                   G G G G
                                   r r r r
                                   p p p p

                                   2 1 3 4
     Mean        RG 2000

     4.0333      Grp 2
     4.6774      Grp 1
     5.5833      Grp 3             *
     6.6667      Grp 4             *


      Variable  ASAN
   By Variable  RG 2000

Multiple Range Tests:  Tukey-HSD test with significance level .050

The difference between two means is significant if
  MEAN(J)-MEAN(I)  >= 1.0844 * RANGE * SQRT(1/N(I) + 1/N(J))
  with the following value(s) for RANGE: 3.72

    (*) Indicates significant differences which are shown in the lower triangle

                                   G G G G
                                   r r r r
                                   p p p p

                                   2 1 3 4
     Mean        RG 2000

     4.0333      Grp 2
     4.6774      Grp 1
     5.5833      Grp 3             *
     6.6667      Grp 4             *


Fewer than two non-empty groups.
```

Communication

Variable COMMUN
By Variable RG 2000

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	8416.9172	2805.6391	3.8280	.0131
Within Groups	75	54969.7917	732.9306		
Total	78	63386.7089			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	32	67.8125	23.3120	4.1210	59.4076	TO	76.2174
Grp 2	32	62.5000	24.7243	4.3707	53.5859	TO	71.4141
Grp 3	12	37.0833	38.8153	11.2050	12.4213	TO	61.7454
Grp 4	3	60.0000	36.0555	20.8167	-29.5678	TO	149.5678
Total	79	60.6962	28.5070	3.2073	54.3110	TO	67.0814

GROUP	MINIMUM	MAXIMUM
Grp 1	10.0000	100.0000
Grp 2	10.0000	95.0000
Grp 3	.0000	95.0000
Grp 4	20.0000	90.0000
TOTAL	.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
5.1364	3	75	.003

Variable COMMUN
By Variable RG 2000

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 19.1433 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4
RANGE	2.83	3.38	3.72

(*) Indicates significant differences which are shown in the lower triangle

```
                          G G G G
                          r r r r
                          p p p p

                          3 4 2 1
    Mean        RG 2000

   37.0833     Grp 3
   60.0000     Grp 4
   62.5000     Grp 2      *
   67.8125     Grp 1      *
```

```
     Variable  COMMUN
  By Variable  RG 2000

Multiple Range Tests:  Tukey-HSD test with significance level .050

The difference between two means is significant if
  MEAN(J)-MEAN(I)  >= 19.1433 * RANGE * SQRT(1/N(I) + 1/N(J))
  with the following value(s) for RANGE: 3.72

    (*) Indicates significant differences which are shown in the lower triangle

                          G G G G
                          r r r r
                          p p p p

                          3 4 2 1
    Mean        RG 2000

   37.0833     Grp 3
   60.0000     Grp 4
   62.5000     Grp 2      *
   67.8125     Grp 1      *
```

Input

Variable INPUT
By Variable RG 2000

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	20751.0752	6917.0251	6.9271	.0004
Within Groups	72	71895.7011	998.5514		
Total	75	92646.7763			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	29	67.4138	28.9279	5.3718	56.4102	TO	78.4174
Grp 2	32	41.2500	34.0303	6.0158	28.9808	TO	53.5192
Grp 3	12	29.6667	33.5270	9.6784	8.3646	TO	50.9687
Grp 4	3	10.0000	10.0000	5.7735	-14.8417	TO	34.8417
Total	76	48.1711	35.1467	4.0316	40.1397	TO	56.2024

GROUP	MINIMUM	MAXIMUM
Grp 1	.0000	100.0000
Grp 2	.0000	100.0000
Grp 3	.0000	90.0000
Grp 4	.0000	20.0000
TOTAL	.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
2.7653	3	72	.048

Variable INPUT
By Variable RG 2000

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 22.3445 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4
RANGE	2.83	3.38	3.72

(*) Indicates significant differences which are shown in the lower triangle

```
                         G G G G
                         r r r r
                         p p p p

                         4 3 2 1
    Mean        RG 2000

   10.0000      Grp 4
   29.6667      Grp 3
   41.2500      Grp 2
   67.4138      Grp 1    * * *


     Variable  INPUT
  By Variable  RG 2000

Multiple Range Tests:  Tukey-HSD test with significance level .050

The difference between two means is significant if
  MEAN(J)-MEAN(I)  >= 22.3445 * RANGE * SQRT(1/N(I) + 1/N(J))
  with the following value(s) for RANGE: 3.72

   (*) Indicates significant differences which are shown in the lower triangle

                         G G G G
                         r r r r
                         p p p p

                         4 3 2 1
    Mean        RG 2000

   10.0000      Grp 4
   29.6667      Grp 3
   41.2500      Grp 2
   67.4138      Grp 1    * * *
```

Integration

Variable INTEGRAT
By Variable RG 2000

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	16625.7596	5541.9199	5.9571	.0011
Within Groups	73	67912.5521	930.3089		
Total	76	84538.3117			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	30	72.0000	24.8652	4.5397	62.7152	TO	81.2848
Grp 2	32	52.9688	33.1628	5.8624	41.0123	TO	64.9252
Grp 3	12	39.5833	37.9269	10.9485	15.4858	TO	63.6809
Grp 4	3	13.3333	5.7735	3.3333	-1.0090	TO	27.6757
Total	77	56.7532	33.3519	3.8008	49.1833	TO	64.3232

GROUP	MINIMUM	MAXIMUM
Grp 1	.0000	100.0000
Grp 2	.0000	95.0000
Grp 3	.0000	90.0000
Grp 4	10.0000	20.0000
TOTAL	.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
6.2302	3	73	.001

Variable INTEGRAT
By Variable RG 2000

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 21.5674 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4
RANGE	2.83	3.38	3.72

(*) Indicates significant differences which are shown in the lower triangle

```
                        G G G G
                        r r r r
                        p p p p

                        4 3 2 1
   Mean       RG 2000

  13.3333     Grp 4
  39.5833     Grp 3
  52.9688     Grp 2
  72.0000     Grp 1     * * *


    Variable  INTEGRAT
 By Variable  RG 2000

Multiple Range Tests:  Tukey-HSD test with significance level .050

The difference between two means is significant if
  MEAN(J)-MEAN(I)  >= 21.5674 * RANGE * SQRT(1/N(I) + 1/N(J))
  with the following value(s) for RANGE: 3.72

    (*) Indicates significant differences which are shown in the lower triangle


                        G G G G
                        r r r r
                        p p p p
                        4 3 2 1
   Mean       RG 2000

  13.3333     Grp 4
  39.5833     Grp 3
  52.9688     Grp 2
  72.0000     Grp 1     * *
```

Lock-In

Variable LOCKIN
By Variable RG 2000

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	6061.7291	2020.5764	2.7819	.0462
Within Groups	81	58832.2709	726.3243		
Total	84	64894.0000			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	34	62.7059	28.9603	4.9666	52.6012	TO	72.8106
Grp 2	33	71.9394	22.1894	3.8627	64.0714	TO	79.8074
Grp 3	15	55.6667	32.6686	8.4350	37.5754	TO	73.7579
Grp 4	3	33.0000	15.1327	8.7369	-4.5922	TO	70.5922
Total	85	64.0000	27.7947	3.0148	58.0048	TO	69.9952

GROUP	MINIMUM	MAXIMUM
Grp 1	9.0000	97.0000
Grp 2	23.0000	100.0000
Grp 3	4.0000	94.0000
Grp 4	21.0000	50.0000
TOTAL	4.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
4.3706	3	81	.007

Variable LOCKIN
By Variable RG 2000

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 19.0568 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4
RANGE	2.83	3.38	3.71

- No two groups are significantly different at the .050 level

Variable LOCKIN
By Variable RG 2000

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 19.0568 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 3.71

- No two groups are significantly different at the .050 level

Business Performance

Variable OBPERF
By Variable RG 2000

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	14930.7039	7465.3520	5.2386	.0092
Within Groups	43	61277.9048	1425.0676		
Total	45	76208.6087			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean
Grp 1	21	239.1429	35.7159	7.7939	222.8852 TO 255.4006
Grp 2	24	214.8333	39.4337	8.0494	198.1820 TO231.4847
Grp 3	1	134.0000			
Total	46	224.1739	41.1525	6.0676	211.9531 TO 236.3947

GROUP	MINIMUM	MAXIMUM
Grp 1	170.0000	315.0000
Grp 2	143.0000	311.0000
Grp 3	134.0000	134.0000
TOTAL	134.0000	315.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
.7244	2	43	.490

Variable OBPERF
By Variable RG 2000

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 26.6933 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3
RANGE	2.86	3.43

(*) Indicates significant differences which are shown in the lower triangle

```
                         G G G
                         r r r
                         p p p

                         3 2 1
   Mean      RG 2000

  134.0000   Grp 3
  214.8333   Grp 2       *
  239.1429   Grp 1       * *


     Variable  OBPERF
  By Variable  RG 2000

Multiple Range Tests:  Tukey-HSD test with significance level .050

The difference between two means is significant if
  MEAN(J)-MEAN(I)  >= 26.6933 * RANGE * SQRT(1/N(I) + 1/N(J))
  with the following value(s) for RANGE: 3.43

   (*) Indicates significant differences which are shown in the lower triangle

                         G G G
                         r r r
                         p p p

                         3 2 1
   Mean      RG 2000

  134.0000   Grp 3
  214.8333   Grp 2
  239.1429   Grp 1       *
```

Project Management

Variable OPM
By Variable RG 2000

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	3469.9285	1734.9643	1.1954	.3122
Within Groups	44	63861.7311	1451.4030		
Total	46	67331.6596			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	22	193.6818	36.4161	7.7639	177.5358	TO	209.8278
Grp 2	24	184.7083	39.5699	8.0772	167.9994	TO	201.4173
Grp 3	1	138.0000					
Total	47	187.9149	38.2587	5.5806	176.6817	TO	199.1481

GROUP	MINIMUM	MAXIMUM
Grp 1	120.0000	249.0000
Grp 2	95.0000	258.0000
Grp 3	138.0000	138.0000
TOTAL	95.0000	258.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
.9342	2	44	.401

Variable OPM
By Variable RG 2000

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 26.9388 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3
RANGE	2.86	3.43

- No two groups are significantly different at the .050 level

Variable OPM
By Variable RG 2000

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 26.9388 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 3.43

- No two groups are significantly different at the .050 level

Product Group

Variable G
By Variable RG 2000

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	10.3751	3.4584	1.1942	.3181
Within Groups	72	208.5065	2.8959		
Total	75	218.8816			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	34	3.3529	1.5741	.2700	2.8037	TO	3.9022
Grp 2	26	3.3462	1.6719	.3279	2.6708	TO	4.0215
Grp 3	14	4.2143	2.0821	.5565	3.0121	TO	5.4165
Grp 4	2	4.5000	.7071	.5000	-1.8531	TO	10.8531
Total	76	3.5395	1.7083	.1960	3.1491	TO	3.9298

GROUP	MINIMUM	MAXIMUM
Grp 1	1.0000	7.0000
Grp 2	1.0000	6.0000
Grp 3	1.0000	7.0000
Grp 4	4.0000	5.0000
TOTAL	1.0000	7.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
2.7130	3	72	.051

Variable G
By Variable RG 2000

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 1.2033 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4
RANGE	2.83	3.38	3.72

- No two groups are significantly different at the .050 level

Variable G
By Variable RG 2000

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 1.2033 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 3.72

- No two groups are significantly different at the .050 level

Analysis by Asanuma Classification

Ability

```
      Variable  ABILITY
   By Variable  ASAN
                                  Analysis of Variance
                                  Sum of         Mean             F      F
       Source              D.F.   Squares        Squares          Ratio  Prob.

Between Groups               5    3893.9980      778.7996        1.5050  .1994
Within Groups               70   36224.4231      517.4918
Total                       75   40118.4211

                                 Standard   Standard
Group        Count      Mean    Deviation      Error    95 Pct Conf Int for Mean

Grp 2           10   74.5000     26.5047      8.3815     55.5397  TO    93.4603
Grp 3           13   95.3846      5.1887      1.4391     92.2491  TO    98.5201
Grp 4           15   83.3333     25.2605      6.5222     69.3445  TO    97.3222
Grp 5           13   87.3077     12.6845      3.5181     79.6425  TO    94.9729
Grp 6           13   84.6154     19.8391      5.5024     72.6267  TO    96.6040
Grp 7           12   74.1667     35.6647     10.2955     51.5064  TO   96.8269

Total           76   83.6842     23.1282      2.6530     78.3992  TO    88.9692

GROUP         MINIMUM     MAXIMUM

Grp 2         20.0000    100.0000
Grp 3         85.0000    100.0000
Grp 4         10.0000    100.0000
Grp 5         70.0000    100.0000
Grp 6         30.0000    100.0000
Grp 7           .0000    100.0000

TOTAL           .0000    100.0000

Levene Test for Homogeneity of Variances

    Statistic    df1     df2        2-tail Sig.
      2.7899       5      70           .024

      Variable  ABILITY
   By Variable  ASAN

Multiple Range Tests:  Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
  MEAN(J)-MEAN(I)  >= 16.0856 * RANGE * SQRT(1/N(I) + 1/N(J))
  with the following value(s) for RANGE:

 Step       2      3      4      5      6
 RANGE    2.83   3.39   3.72   3.96   4.14

- No two groups are significantly different at the  .050 level

      Variable  ABILITY
   By Variable  ASAN

Multiple Range Tests:  Tukey-HSD test with significance level .050

The difference between two means is significant if
  MEAN(J)-MEAN(I)  >= 16.0856 * RANGE * SQRT(1/N(I) + 1/N(J))
  with the following value(s) for RANGE: 4.14
- No two groups are significantly different at the  .050 level
```

Trust

Variable TRUST
By Variable ASAN

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	2409.5984	481.9197	1.1424	.3455
Within Groups	76	32059.1456	421.8309		
Total	81	34468.7439			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 2	10	69.3000	17.2437	5.4529	56.9646	TO	81.6354
Grp 3	13	84.3077	10.6175	2.9448	77.8916	TO	90.7238
Grp 4	17	72.4706	21.7575	5.2770	61.2839	TO	83.6573
Grp 5	14	75.0000	22.3469	5.9725	62.0973	TO	87.9027
Grp 6	15	66.8667	22.2610	5.7478	54.5389	TO	79.1944
Grp 7	13	74.2308	24.1976	6.7112	59.6083	TO	88.8533
Total	82	73.6463	20.6286	2.2781	69.1137	TO	78.1789

GROUP	MINIMUM	MAXIMUM
Grp 2	40.0000	91.0000
Grp 3	67.0000	100.0000
Grp 4	24.0000	100.0000
Grp 5	15.0000	96.0000
Grp 6	26.0000	94.0000
Grp 7	8.0000	100.0000
TOTAL	8.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
1.1295	5	76	.352

Variable TRUST
By Variable ASAN

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 14.5229 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.38	3.71	3.95	4.13

- No two groups are significantly different at the .050 level

Variable TRUST
By Variable ASAN

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 14.5229 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.13

- No two groups are significantly different at the .050 level

RG 2000 category

Variable RG 2000
By Variable ASAN

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	11.4790	2.2958	2.9129	.0185
Within Groups	76	59.8990	.7881		
Total	81	71.3780			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 2	10	1.9000	.8756	.2769	1.2736	TO	2.5264
Grp 3	13	1.4615	.5189	.1439	1.1480	TO	1.7751
Grp 4	17	1.2941	.8489	.2059	.8577	TO	1.7306
Grp 5	14	1.4286	.7559	.2020	.9921	TO	1.8650
Grp 6	15	1.8667	.9904	.2557	1.3182	TO	2.4151
Grp 7	13	2.3846	1.1929	.3309	1.6637	TO	3.1055
Total	82	1.6951	.9387	.1037	1.4889	TO	1.9014

GROUP	MINIMUM	MAXIMUM
Grp 2	.0000	3.0000
Grp 3	1.0000	2.0000
Grp 4	.0000	3.0000
Grp 5	.0000	3.0000
Grp 6	.0000	4.0000
Grp 7	1.0000	4.0000
TOTAL	.0000	4.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
2.2212	5	76	.061

Variable RG 2000
By Variable ASAN

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= .6278 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.38	3.71	3.95	4.13

(*) Indicates significant differences which are shown in the lower triangle

```
                                                  G G G G G G
                                                  r r r r r r
                                                  p p p p p p

                                                  4 5 3 6 2 7
      Mean           ASAN

      1.2941         Grp 4
      1.4286         Grp 5
      1.4615         Grp 3
      1.8667         Grp 6
      1.9000         Grp 2
      2.3846         Grp 7                        * * *


       Variable  RG 2000
    By Variable  ASAN

Multiple Range Tests:  Tukey-HSD test with significance level .050

The difference between two means is significant if
  MEAN(J)-MEAN(I)  >= .6278 * RANGE * SQRT(1/N(I) + 1/N(J))
  with the following value(s) for RANGE: 4.13

    (*) Indicates significant differences which are shown in the lower triangle

                                                  G G G G G G
                                                  r r r r r r
                                                  p p p p p p

                                                  4 5 3 6 2 7
      Mean           ASAN

      1.2941         Grp 4
      1.4286         Grp 5
      1.4615         Grp 3
      1.8667         Grp 6
      1.9000         Grp 2
      2.3846         Grp 7                        *
```

Supplier Product Design

Variable PDTDES
By Variable ASAN

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	14893.4484	2978.6897	2.3373	.0497
Within Groups	77	98128.9612	1274.4021		
Total	82	113022.4096			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 2	11	28.0909	26.5159	7.9948	10.2773	TO	45.9045
Grp 3	13	69.6154	26.4498	7.3358	53.6320	TO	85.5988
Grp 4	17	53.4706	38.6428	9.3723	33.6023	TO	73.3389
Grp 5	14	59.8571	36.6813	9.8035	38.6780	TO	81.0363
Grp 6	15	55.3333	39.5685	10.2165	33.4210	TO	77.2456
Grp 7	13	72.8462	40.2075	11.1515	48.5490	TO	97.1433
Total	83	57.0843	37.1258	4.0751	48.9777	TO	65.1910

GROUP	MINIMUM	MAXIMUM
Grp 2	2.0000	90.0000
Grp 3	10.0000	100.0000
Grp 4	.0000	98.0000
Grp 5	.0000	100.0000
Grp 6	1.0000	100.0000
Grp 7	.0000	100.0000
TOTAL	.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
2.9685	5	77	.017

Variable PDTDES
By Variable ASAN

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 25.2428 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.38	3.71	3.95	4.13

(*) Indicates significant differences which are shown in the lower triangle

```
                              G G G G G G
                              r r r r r r
                              p p p p p p

                              2 4 6 5 3 7
     Mean        ASAN

   28.0909       Grp 2
   53.4706       Grp 4
   55.3333       Grp 6
   59.8571       Grp 5
   69.6154       Grp 3        *
   72.8462       Grp 7        *


      Variable  PDTDES
   By Variable  ASAN

Multiple Range Tests:  Tukey-HSD test with significance level .050

The difference between two means is significant if
  MEAN(J)-MEAN(I)  >= 25.2428 * RANGE * SQRT(1/N(I) + 1/N(J))
  with the following value(s) for RANGE: 4.13

    (*) Indicates significant differences which are shown in the lower triangle

                              G G G G G G
                              r r r r r r
                              p p p p p p

                              2 4 6 5 3 7
     Mean        ASAN

   28.0909       Grp 2
   53.4706       Grp 4
   55.3333       Grp 6
   59.8571       Grp 5
   69.6154       Grp 3
   72.8462       Grp 7
```

Rover Process Knowledge

Variable PCSKNOW
By Variable ASAN

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	10872.4036	2174.4807	3.4833	.0069
Within Groups	76	47443.2183	624.2529		
Total	81	58315.6220			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 2	11	43.2727	24.8559	7.4944	26.5743	TO	59.9712
Grp 3	13	52.3077	24.4792	6.7893	37.5151	TO	67.1003
Grp 4	17	74.8824	15.1364	3.6711	67.0999	TO	82.6648
Grp 5	13	52.1538	22.6563	6.2837	38.4628	TO	65.8449
Grp 6	15	42.1333	27.9818	7.2249	26.6375	TO	57.6291
Grp 7	13	54.6154	33.2755	9.2290	34.5072	TO	74.7235
Total	82	54.2561	26.8318	2.9631	48.3605	TO	60.1517

GROUP	MINIMUM	MAXIMUM
Grp 2	8.0000	97.0000
Grp 3	20.0000	90.0000
Grp 4	46.0000	96.0000
Grp 5	10.0000	78.0000
Grp 6	3.0000	80.0000
Grp 7	1.0000	89.0000
TOTAL	1.0000	97.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
3.4962	5	76	.007

Variable PCSKNOW
By Variable ASAN

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 17.6671 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.38	3.71	3.95	4.13

(*) Indicates significant differences which are shown in the lower triangle

```
                          G G G G G G
                          r r r r r r
                          p p p p p p

                          6 2 5 3 7 4
     Mean      ASAN

    42.1333    Grp 6
    43.2727    Grp 2
    52.1538    Grp 5
    52.3077    Grp 3
    54.6154    Grp 7
    74.8824    Grp 4      * *   * *


      Variable  PCSKNOW
   By Variable  ASAN

Multiple Range Tests:  Tukey-HSD test with significance level .050

The difference between two means is significant if
  MEAN(J)-MEAN(I)  >= 17.6671 * RANGE * SQRT(1/N(I) + 1/N(J))
  with the following value(s) for RANGE: 4.13

   (*) Indicates significant differences which are shown in the lower triangle

                          G G G G G G
                          r r r r r r
                          p p p p p p

                          6 2 5 3 7 4
     Mean      ASAN

    42.1333    Grp 6
    43.2727    Grp 2
    52.1538    Grp 5
    52.3077    Grp 3
    54.6154    Grp 7
    74.8824    Grp 4      * *
```

Rover Product Knowledge

Variable PRTKNOW
By Variable ASAN

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	4504.8453	900.9691	1.7494	.1336
Within Groups	76	39140.3742	515.0049		
Total	81	43645.2195			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 2	11	74.1818	13.4523	4.0560	65.1445	TO	83.2192
Grp 3	13	76.9231	23.1461	6.4196	62.9360	TO	90.9101
Grp 4	17	82.5294	15.6250	3.7896	74.4958	TO	90.5630
Grp 5	13	74.3077	23.4712	6.5097	60.1242	TO	88.4912
Grp 6	15	67.8667	18.6428	4.8135	57.5427	TO	78.1907
Grp 7	13	59.6154	35.9619	9.9740	37.8838	TO	81.3469
Total	82	72.9024	23.2127	2.5634	67.8020	TO	78.0028

GROUP	MINIMUM	MAXIMUM
Grp 2	50.0000	98.0000
Grp 3	33.0000	100.0000
Grp 4	54.0000	100.0000
Grp 5	10.0000	96.0000
Grp 6	24.0000	100.0000
Grp 7	.0000	97.0000
TOTAL	.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
3.7709	5	76	.004

Variable PRTKNOW
By Variable ASAN

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 16.0469 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.38	3.71	3.95	4.13

- No two groups are significantly different at the .050 level

Variable PRTKNOW
By Variable ASAN

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 16.0469 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.13

- No two groups are significantly different at the .050 level

Supplier Process Design

Variable PCSDES
By Variable ASAN

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	1132.0268	226.4054	.6095	.6928
Within Groups	76	28230.9123	371.4594		
Total	81	29362.9390			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean
Grp 2	11	92.3636	9.3303	2.8132	86.0955 TO 98.6318
Grp 3	13	96.2308	7.5736	2.1005	91.6541 TO 100.8074
Grp 4	17	86.9412	24.7499	6.0027	74.2159 TO 99.6664
Grp 5	13	89.6154	27.2963	7.5706	73.1204 TO 106.1104
Grp 6	15	90.4667	23.0771	5.9585	77.6870 TO 103.2463
Grp 7	13	97.2308	6.2869	1.7437	93.4316 TO 101.0299
Total	82	91.8415	19.0396	2.1026	87.6580 TO 96.0249

GROUP	MINIMUM	MAXIMUM
Grp 2	70.0000	100.0000
Grp 3	78.0000	100.0000
Grp 4	.0000	100.0000
Grp 5	.0000	100.0000
Grp 6	10.0000	100.0000
Grp 7	78.0000	100.0000
TOTAL	.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
1.4704	5	76	.209

Variable PCSDES
By Variable ASAN

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 13.6283 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.38	3.71	3.95	4.13

- No two groups are significantly different at the .050 level

Variable PCSDES
By Variable ASAN

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 13.6283 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.13

- No two groups are significantly different at the .050 level

Total Quality Improvement

Variable OTQI
By Variable ASAN

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	1862.0975	372.4195	1.4616	.2239
Within Groups	40	10192.0112	254.8003		
Total	45	12054.1087			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 2	7	64.7143	18.3822	6.9478	47.7137	TO	81.7149
Grp 3	7	58.2857	13.1620	4.9748	46.1130	TO	70.4585
Grp 4	11	51.7273	18.4937	5.5761	39.3030	TO	64.1515
Grp 5	8	61.0000	15.4735	5.4707	48.0639	TO	73.9361
Grp 6	9	49.5556	13.8484	4.6161	38.9108	TO	60.2004
Grp 7	4	68.2500	12.8420	6.4210	47.8158	TO	88.6842
Total	46	57.3261	16.3667	2.4131	52.4658	TO	62.1864

GROUP	MINIMUM	MAXIMUM
Grp 2	30.0000	81.0000
Grp 3	48.0000	79.0000
Grp 4	21.0000	77.0000
Grp 5	43.0000	91.0000
Grp 6	29.0000	76.0000
Grp 7	59.0000	87.0000
TOTAL	21.0000	91.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
.4247	5	40	.829

Variable OTQI
By Variable ASAN

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 11.2872 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.86	3.44	3.79	4.04	4.23

- No two groups are significantly different at the .050 level

Variable OTQI
By Variable ASAN

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 11.2872 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.23

- No two groups are significantly different at the .050 level

Openness

Variable OPEN
By Variable ASAN

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	3425.1526	685.0305	1.9974	.0885
Within Groups	76	26065.2377	342.9637		
Total	81	29490.3902			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 2	10	64.1000	19.5644	6.1868	50.1045	TO	78.0955
Grp 3	13	83.3846	11.3177	3.1390	76.5454	TO	90.2238
Grp 4	17	68.6471	24.3694	5.9104	56.1175	TO	81.1766
Grp 5	14	76.3571	15.6874	4.1926	67.2995	TO	85.4148
Grp 6	15	69.0667	19.1627	4.9478	58.4547	TO	79.6786
Grp 7	13	79.4615	16.4348	4.5582	69.5301	TO	89.3930
Total	82	73.5366	19.0809	2.1071	69.3441	TO	77.7291

GROUP	MINIMUM	MAXIMUM
Grp 2	34.0000	90.0000
Grp 3	66.0000	100.0000
Grp 4	21.0000	100.0000
Grp 5	49.0000	97.0000
Grp 6	30.0000	95.0000
Grp 7	44.0000	100.0000
TOTAL	21.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
1.6816	5	76	.149

Variable OPEN
By Variable ASAN

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 13.0951 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.38	3.71	3.95	4.13

- No two groups are significantly different at the .050 level

Variable OPEN
By Variable ASAN

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 13.0951 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.13

- No two groups are significantly different at the .050 level

Open Book

Variable OPBK
By Variable ASAN

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	3817.2764	763.4553	1.2995	.2736
Within Groups	73	42887.6603	587.5022		
Total	78	46704.9367			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 2	11	67.7273	28.5940	8.6214	48.5176	TO	86.9370
Grp 3	12	81.5833	21.3731	6.1699	68.0035	TO	95.1632
Grp 4	16	78.0625	22.9273	5.7318	65.8454	TO	90.2796
Grp 5	12	75.9167	30.0044	8.6615	56.8528	TO	94.9806
Grp 6	15	64.8000	28.0056	7.2310	49.2910	TO	80.3090
Grp 7	13	83.7692	8.7479	2.4262	78.4829	TO	89.0555
Total	79	75.2532	24.4700	2.7531	69.7722	TO	80.7341

GROUP	MINIMUM	MAXIMUM
Grp 2	11.0000	100.0000
Grp 3	34.0000	100.0000
Grp 4	22.0000	100.0000
Grp 5	1.0000	100.0000
Grp 6	2.0000	92.0000
Grp 7	65.0000	100.0000
TOTAL	1.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
2.2782	5	73	.056

Variable OPBK
By Variable ASAN

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 17.1392 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.38	3.72	3.96	4.14

- No two groups are significantly different at the .050 level

Variable OPBK
By Variable ASAN

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 17.1392 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.14

- No two groups are significantly different at the .050 level

Communication

Variable COMMUN
By Variable ASAN

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	8049.6273	1609.9255	1.9386	.0986
Within Groups	71	58962.5026	830.4578		
Total	76	67012.1299			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 2	10	51.0000	33.8953	10.7186	26.7528	TO	75.2472
Grp 3	13	79.2308	21.2961	5.9065	66.3616	TO	92.0999
Grp 4	15	58.5333	28.3369	7.3166	42.8409	TO	74.2258
Grp 5	13	57.6923	20.3731	5.6505	45.3810	TO	70.0037
Grp 6	13	47.6923	30.0427	8.3323	29.5377	TO	65.8469
Grp 7	13	53.0769	36.6594	10.1675	30.9239	TO	75.2300
Total	77	58.1558	29.6941	3.3840	51.4161	TO	64.8956

GROUP	MINIMUM	MAXIMUM
Grp 2	5.0000	95.0000
Grp 3	25.0000	100.0000
Grp 4	3.0000	90.0000
Grp 5	10.0000	95.0000
Grp 6	.0000	100.0000
Grp 7	.0000	90.0000
TOTAL	.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
3.0765	5	71	.014

Variable COMMUN
By Variable ASAN

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 20.3772 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.38	3.72	3.96	4.14

- No two groups are significantly different at the .050 level

Variable COMMUN
By Variable ASAN

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 20.3772 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.14

- No two groups are significantly different at the .050 level

Input

Variable INPUT
By Variable ASAN

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	13535.1317	2707.0263	2.3728	.0479
Within Groups	69	78717.5883	1140.8346		
Total	74	92252.7200			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 2	10	35.1000	31.7646	10.0448	12.3770	TO	57.8230
Grp 3	11	68.6364	30.5034	9.1971	48.1439	TO	89.1288
Grp 4	14	45.3571	32.2529	8.6199	26.7349	TO	63.9794
Grp 5	13	66.5385	31.8450	8.8322	47.2947	TO	85.7822
Grp 6	14	38.9286	37.8346	10.1117	17.0835	TO	60.7736
Grp 7	13	37.3077	36.5499	10.1371	15.2208	TO	59.3946
Total	75	48.4800	35.3080	4.0770	40.3564	TO	56.6036

GROUP	MINIMUM	MAXIMUM
Grp 2	1.0000	100.0000
Grp 3	10.0000	100.0000
Grp 4	.0000	90.0000
Grp 5	.0000	100.0000
Grp 6	.0000	100.0000
Grp 7	.0000	90.0000
TOTAL	.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
.6954	5	69	.629

Variable INPUT
By Variable ASAN

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 23.8834 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.39	3.72	3.96	4.15

- No two groups are significantly different at the .050 level

Variable INPUT
By Variable ASAN

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 23.8834 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.15

- No two groups are significantly different at the .050 level

Integration

Variable INTEGRAT
By Variable ASAN

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	7951.5625	1590.3125	1.4745	.2092
Within Groups	70	75497.1744	1078.5311		
Total	75	83448.7368			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 2	10	46.8000	33.5850	10.6205	22.7747	TO	70.8253
Grp 3	12	74.1667	24.2930	7.0128	58.7316	TO	89.6017
Grp 4	15	56.4000	30.0732	7.7649	39.7460	TO	73.0540
Grp 5	13	57.6923	28.4030	7.8776	40.5285	TO	74.8561
Grp 6	13	42.3077	38.9773	10.8104	18.7539	TO	65.8614
Grp 7	13	47.6923	39.0307	10.8252	24.1063	TO	71.2783
Total	76	54.2632	33.3564	3.8262	46.6409	TO	61.8854

GROUP	MINIMUM	MAXIMUM
Grp 2	5.0000	98.0000
Grp 3	25.0000	100.0000
Grp 4	.0000	100.0000
Grp 5	.0000	85.0000
Grp 6	.0000	100.0000
Grp 7	.0000	90.0000
TOTAL	.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
2.9686	5	70	.017

Variable INTEGRAT
By Variable ASAN

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 23.2221 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.39	3.72	3.96	4.14

- No two groups are significantly different at the .050 level

Variable INTEGRAT
By Variable ASAN

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 23.2221 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.14

- No two groups are significantly different at the .050 level

Lock-In

Variable LOCKIN
By Variable ASAN

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	7545.1979	1509.0396	1.8791	.1079
Within Groups	76	61034.5582	803.0863		
Total	81	68579.7561			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 2	10	55.3000	28.2294	8.9269	35.1059	TO	75.4941
Grp 3	13	56.1538	34.2390	9.4962	35.4634	TO	76.8443
Grp 4	17	58.3529	31.2269	7.5736	42.2976	TO	74.4083
Grp 5	14	81.1429	10.1516	2.7131	75.2815	TO	87.0042
Grp 6	15	53.2000	29.1454	7.5253	37.0598	TO	69.3402
Grp 7	13	65.3077	30.2225	8.3822	47.0444	TO	83.5709
Total	82	61.6829	29.0975	3.2133	55.2895	TO	68.0763

GROUP	MINIMUM	MAXIMUM
Grp 2	13.0000	100.0000
Grp 3	9.0000	100.0000
Grp 4	4.0000	89.0000
Grp 5	65.0000	97.0000
Grp 6	16.0000	96.0000
Grp 7	15.0000	97.0000
TOTAL	4.0000	100.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
4.9146	5	76	.001

Variable LOCKIN
By Variable ASAN

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 20.0385 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.38	3.71	3.95	4.13

- No two groups are significantly different at the .050 level

Variable LOCKIN
By Variable ASAN

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 20.0385 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.13

- No two groups are significantly different at the .050 level

Business Performance

Variable OBPERF
By Variable ASAN

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	16088.4436	3217.6887	1.9671	.1052
Within Groups	39	63793.4675	1635.7299		
Total	44	79881.9111			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean
Grp 2	7	229.1429	35.1019	13.2673	196.6792 TO 261.6065
Grp 3	7	227.5714	59.0052	22.3019	173.0010 TO 282.1419
Grp 4	11	205.2727	51.0805	15.4014	170.9564 TO 239.5891
Grp 5	7	251.4286	19.4838	7.3642	233.4091 TO 269.4480
Grp 6	9	219.6667	19.2484	6.4161	204.8711 TO 234.4623
Grp 7	4	266.5000	37.3140	18.6570	207.1260 TO 325.8740
Total	45	227.9556	42.6087	6.3517	215.1545 TO 240.7566

GROUP	MINIMUM	MAXIMUM
Grp 2	196.0000	288.0000
Grp 3	144.0000	311.0000
Grp 4	102.0000	279.0000
Grp 5	225.0000	276.0000
Grp 6	193.0000	263.0000
Grp 7	230.0000	315.0000
TOTAL	102.0000	315.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
3.1583	5	39	.017

Variable OBPERF
By Variable ASAN

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 28.5983 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.86	3.44	3.79	4.04	4.24

- No two groups are significantly different at the .050 level

Variable OBPERF
By Variable ASAN

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 28.5983 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.24

- No two groups are significantly different at the .050 level

Project Management

Variable OPM
By Variable ASAN

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	10643.0169	2128.6034	1.8523	.1246
Within Groups	40	45967.3526	1149.1838		
Total	45	56610.3696			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean
Grp 2	7	176.2857	25.8051	9.7534	152.4201 TO 200.1514
Grp 3	7	200.1429	44.9979	17.0076	158.5270 TO 241.7587
Grp 4	11	178.1818	40.7598	12.2896	150.7990 TO 205.5646
Grp 5	8	198.8750	20.9383	7.4028	181.3702 TO 216.3798
Grp 6	9	177.2222	32.7635	10.9212	152.0380 TO 202.4064
Grp 7	4	225.5000	22.7523	11.3761	189.2966 TO 261.7034
Total	46	188.7609	35.4684	5.2295	178.2281 TO 199.2937

GROUP	MINIMUM	MAXIMUM
Grp 2	133.0000	205.0000
Grp 3	122.0000	258.0000
Grp 4	120.0000	237.0000
Grp 5	156.0000	229.0000
Grp 6	136.0000	245.0000
Grp 7	196.0000	249.0000
TOTAL	120.0000	258.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
1.0239	5	40	.417

Variable OPM
By Variable ASAN

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 23.9706 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.86	3.44	3.79	4.04	4.23

- No two groups are significantly different at the .050 level

Variable OPM
By Variable ASAN

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 23.9706 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.23

- No two groups are significantly different at the .050 level

Product Groups

Variable G
By Variable ASAN

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	4.6385	.9277	.3087	.9061
Within Groups	67	201.3341	3.0050		
Total	72	205.9726			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 2	10	3.4000	1.8974	.6000	2.0427	TO	4.7573
Grp 3	12	3.4167	1.1645	.3362	2.6768	TO	4.1566
Grp 4	14	3.7857	2.1547	.5759	2.5416	TO	5.0298
Grp 5	12	3.9167	1.5643	.4516	2.9228	TO	4.9106
Grp 6	12	3.1667	1.1146	.3218	2.4585	TO	3.8749
Grp 7	13	3.6154	2.1031	.5833	2.3445	TO	4.8863
Total	73	3.5616	1.6914	.1980	3.1670	TO	3.9563

GROUP	MINIMUM	MAXIMUM
Grp 2	1.0000	6.0000
Grp 3	2.0000	6.0000
Grp 4	1.0000	6.0000
Grp 5	1.0000	7.0000
Grp 6	2.0000	5.0000
Grp 7	1.0000	7.0000
TOTAL	1.0000	7.0000

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
4.0964	5	67	.003

Variable G
By Variable ASAN

Multiple Range Tests: Student-Newman-Keuls test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 1.2258 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE:

Step	2	3	4	5	6
RANGE	2.83	3.39	3.73	3.96	4.15

- No two groups are significantly different at the .050 level

Variable G
By Variable ASAN

Multiple Range Tests: Tukey-HSD test with significance level .050

The difference between two means is significant if
MEAN(J)-MEAN(I) >= 1.2258 * RANGE * SQRT(1/N(I) + 1/N(J))
with the following value(s) for RANGE: 4.15

- No two groups are significantly different at the .050 level

APPENDIX 6: Database

Appendix 6.0: Database

NAME	GROUP	G	A10	A20	A30	A40	C10	C20	C30	C40	E10	E20	E30	E50	G10	G20	G30
1	e50	3												1			
2	C40	2								1							
3	a20	1		1													
5	l20	6															
9																	3
17	g20	5														1	
19				3													
27	a40	1				1		2	2								
28	a40	1				1											
49	c20	2						1									
51	j20	4															
60	G40	5	2						2				2				
61	g30	5															1
80																	
81																	
82	A20			1													
83	c30	2							1								
92	c20	2	2				2	1	2				2			2	
99	G30	5															1
101	A40					1											
103	l20	6															
107	c40	2								1							
108	l10	6															
111	G20	5														1	
202	J60	4															
205	g20	5														1	
221	e30	3											1				
226	j60	4															
230	e30	3											1				
231	a40	1				1											
238	l30	6															
242													3				3
245	e30	3											1				
257	a10	1	1														
270	a20	1		1													
273	r30	7															
274	g20	5														1	
275	e50	3												1			
280	e20	3										1					
281	a10	1	1	2													
290	j20	4															
294	C40	2								1							
302	e50	3												1			
303													3				
308	l20	6															
311	c10	2					1										
314	R30	7															
322	l30	6															
328	e50	3												1			
331	e10	3									1						
338	c10	2					1										
341	e50	3												1			
349	j20	4															
355	e10	3									1						
357	e10	3									1						
359	g40	5															

NAME	GROUP	G	A10	A20	A30	A40	C10	C20	C30	C40	E10	E20	E30	E50	G10	G20	G30
360	e50	3												1			
364	E10	3									1						
374	G40	5															
375	j20	4															
383	g10	5													1		
391	l30	6															
397	c10	2					1										
401	a10	1	1														
405	a10	1	1														
411	e50	3												1			
412	J20	4															
414	a10	1	1														3
434	e50	3												1			
450	J10	4															
452	J10	4															
470	g30	5															1
472	J20	4															
475	A30				1												
476	J20	4															
480	A10		1														
483	c10	2					1										
484	c10	2					1										
486	A10		1														
489	E50	3												1			
490	G30	5															1
496	g30	5															1
505	G10	5													1		
511	l20	6															
531	c40	2								1							
544	l10	6															
551	A40					1											
552	J60	4															
555	a40	1				1											
559	l20	6															
568	L10	6															
573	C30	2							1								
611	C10	2					1										
616	c40	2								1							
666	g10	5										3			1		
COUNT		**83**	**9**	**5**	**1**	**6**	**7**	**3**	**5**	**5**	**4**	**2**	**7**	**9**	**3**	**5**	**8**
AVERAGE		**3.6**	**1.2**	**1.6**	**1.0**	**1.0**	**1.1**	**1.3**	**1.6**	**1.0**	**1.0**	**2.0**	**1.9**	**1.0**	**1.0**	**1.2**	**1.8**
SD		**1.5**	**0.3**	**0.7**	**0.0**	**0.0**	**0.2**	**0.4**	**0.5**	**0.0**	**0.0**	**1.0**	**0.7**	**0.0**	**0.0**	**0.3**	**0.9**
VAR		**2.1**	**0.1**	**0.5**	**0.0**	**0.0**	**0.1**	**0.2**	**0.2**	**0.0**	**0.0**	**1.0**	**0.5**	**0.0**	**0.0**	**0.1**	**0.9**

NAME	G40	J10	J20	J30	J60	L10	L20	L30	L40	L60	R30	RCAT	CAT	DIF	C1	C2	C3
1												1	1	0	1	0	0
2			2	2								1	1	0	1	0	0
3												2	2	0	0	1	0
5							1					3	3	0	0	0	1
9									3			2	3		0	0	1
17												0		9			
19									3			2	2	0	0	1	0
27												2	2	0	0	1	0
28												2	2	0	0	1	0
49												0		9			
51			1									1	3	-2	0	0	1
60	1											2	2	0	0	1	0
61												1	1	0	1	0	0
80						3			3			0	2	9	0	1	0
81								3	3	3		2	2	0	0	1	0
82												3	3	0	0	0	1
83												2		9			
92	2											1	2		0	1	0
99												0	2	9	0	1	0
101												2	2	0	0	1	0
103							1					3	2	1	0	1	0
107												1	1	0	1	0	0
108						1						0	2	9	0	1	0
111												3	2	1	0	1	0
202										1		0	1	9	1	0	0
205												1	1	0	1	0	0
221												2	2	0	0	1	0
226					1							1	1	0	1	0	0
230												2	2	0	0	1	0
231												1	2		0	1	0
238								1				1	1	0	1	0	0
242												2	2	0	0	1	0
245												1	1	0	1	0	0
257												3	3	0	0	0	1
270												1	1	0	1	0	0
273											1	1		9			
274												1	1	0	1	0	0
275												3	3	0	0	0	1
280												2	2	0	0	1	0
281												2		9	1	0	0
290			1									2	1	1	1	0	0
294												2	1	1	1	0	0
302												1	1	0	1	0	0
303								3				2	2	0	0	1	0
308							1					3	3	0	0	0	1
311												3		9			
314											1	3		9			
322								1				2	1	1	1	0	0
328												1	1	0	1	0	0
331												1	1	0	1	0	0
338												3	3	0	0	0	1
341												1	1	0	1	0	0
349			1									4	4	1	0	0	0
355												1	1	0	1	0	0
357												1	1	0	1	0	0
359	1								2	2		2	1	1	1	0	0

NAME	G40	J10	J20	J30	J60	L10	L20	L30	L40	L60	R30	RCAT	CAT	DIF	C1	C2	C3
360												2	1	1	1	0	0
364												1	2		0	1	0
374	1											1		9			
375			1									2	1	1	1	0	0
383												2	1	1	1	0	0
391								1				3		9			
397												3		9			
401												1	1	0	1	0	0
405												1	1	0	1	0	0
411												1		9	1	1	0
412		3	1	3								2	2	0	0	1	0
414									3			2	1	1	1	0	0
434												1	1	0	1	0	0
450		1										2	1	1	1	0	0
452		1										1	2		0	1	0
470												2	2	0	0	1	0
472			1									1	1	2	1	0	0
475												2	2	0	0	1	0
476			1									2	1	1	1	0	0
480												4	3	1	0	0	1
483												2	2	0	0	1	0
484														9	0	1	1
486												0	2	9	0	1	0
489												1		9	1	1	0
490												3	2	1	0	0	1
496	2											1	1	0	1	0	0
505												4	4	0	0	0	0
511							1					2	3		0	0	1
531												1		9			
544						1						1	1	0	1	0	0
551												3	3	0	0	0	1
552					1							2	2	0	0	1	0
555												1	1	0	1	0	0
559							1					3	3	0	0	0	1
568						1						2	3		0	0	1
573												2	3		0	0	1
611												3	3	0	0	0	1
616													1	9	1	0	0
666												1		9			
COUNT	**5**	**3**	**8**	**2**	**2**	**4**	**5**	**5**	**6**	**3**	**2**	**93**	**80**	**87**	**84**	**84**	**84**
AVERAGE	**1.4**	**1.7**	**1.1**	**2.5**	**1.0**	**1.5**	**1.0**	**1.8**	**2.8**	**2.0**	**1.0**	**1.7**	**1.8**	**2.3**	**0.5**	**0.4**	**0.2**
SD	**0.5**	**0.9**	**0.2**	**0.5**	**0.0**	**0.8**	**0.0**	**1.0**	**0.3**	**0.7**	**0.0**	**0.8**	**0.7**	**3.2**	**0.5**	**0.5**	**0.3**
VAR	**0.2**	**0.8**	**0.0**	**0.3**	**0.0**	**0.6**	**0.0**	**0.9**	**0.1**	**0.4**	**0.0**	**0.6**	**0.5**	**10.3**	**0.2**	**0.2**	**0.1**

NAME	C4	MTHS	YR	CHG	PERC	STORC	R200	R400	R600	R800	MINI	METRO	MONTEGC
1	0			0		2							
2	0	0		0	28.00	2	1	1	1	1	0	1	1
3	0	25		0	40.00	0	0	0	1	0	0	0	0
5	0	1		0	15.00	2	1	1	1	1	1	1	1
9	0		1	0	30.00	2	1	1	1	1	1	1	1
17					.60	0	0	0	1	0	0	0	0
19	0		3	0	8.50	2	1	1	1	1	1	1	1
27	0			0	70.00	2	1	1	1	1	1	1	1
28	0		2	0	20.00	2	1	1	1	1	1	1	1
49				1	1.00	1	0	0	1	0	0	0	0
51	0			1	10.00	2	1	1	1	1	1	1	1
60	0				50.00	2	1	1	1	1	1	1	1
61	0	21		0	18.00	2	1	1	1	1	1	1	1
80	0	3		0	10.00	0	1	1	1	0	1	0	0
81	0			1	60.00	2	1	1	1	1	0	0	1
82	0		3		.00	1	1	1	1	1	1	1	1
83				0		0	0	0	1	0	0	0	0
92	0			1	10.00	2	1	1	1	1	1	1	1
99	0			0	3.00	1	0	0	1	1	0	0	0
101	0	11		0	75.00	2	1	1	1	1	1	1	1
103	0	18		1	3.40	2	1	1	1	1	1	1	1
107	0			0	40.00	1	1	1	1	1	1	1	1
108	0	1		0	40.00	2	1	1	1	1	1	1	1
111	0			0	80.00	2	1	1	1	1	1	1	1
202	0				20.00	2	1	1	1	1	1	1	1
205	0			0	20.00	2	0	0	1	1	1	1	0
221	0	15		0	10.00	1	1	1	0	0	0	0	0
226	0			0	24.50	2	1	1	1	1	1	1	1
230	0			0	60.00	2	1	1	1	1	1	1	1
231	0	0		0	10.00	2	1	1	0	1	0	0	0
238	0				15.00	2	1	1	1	1	1	1	1
242	0		4	0	40.00	2	1	1	1	1	0	0	0
245	0				1.00	1	1	1	0	1	0	1	1
257	0	5		0	50.00	2	1	1	0	1	1	1	1
270	0			0	25.00	1	1	0	1	1	0	0	0
273					2.50	2	1	1	1	1	1	1	1
274	0			0	.99	2	1	1	0	0	1	1	1
275	0	30		0	11.00	2							
280	0	25		0	.70	2	0	0	0	0	0	0	0
281	1				40.00	2	1	1	1	0	1	1	0
290	0												
294	0		7	0	35.00	2	1	1	1	1	1	1	1
302	0			0	6.00	2	1	1	0	1	1	1	1
303	0	22		0	50.00	2	1	1	1	1	0	0	1
308	0				25.00	2	1	1	0	0	1	1	1
311					1.00	2	1	1	1	1	1	1	1
314					.10	2	1	1	1	0	0	0	0
322	0			0	12.00	1	0	0	0	0	0	0	0
328	0	9		1	2.00	2	1	1	1	1	0	1	1
331	0		14		20.00	2	0	0	0	0	0	0	0
338	0		1	0	30.00	2	1	1	1	1	1	1	1
341	0			0		2							
349	1	49		0	2.00	1	0	0	0	0	0	0	0
355	0				14.00	2	0	0	0	0	0	0	0
357	0			0	20.00	2	0	0	0	0	0	0	0
359	0	16		9	20.00	2	0	0	0	0	0	0	0

NAME	C4	MTHS	YR	CHG	PERC	STORC	R200	R400	R600	R800	MINI	METRO	MONTEGO
360	0	22		0	15.00	2	1	1	1	1	0	1	0
364	0		14	0	3.50	2	1	1	1	1	0	1	1
374					8.00	1	0	0	0	0	0	0	0
375	0			0	27.00	2	1	1	1	1	1	1	1
383	0			0	25.00	2	1	1	1	1	0	1	1
391				0	.03	2							
397					5.00	2	0	0	0	0	0	0	0
401	0			0	40.00	2	1	1	0	1	1	1	1
405	0	83		0	35.00	2	0	0	0	1	0	0	0
411	0	12		0	4.00	2	1	1	1	0	0	0	0
412	0	29		0	15.00	1	0	0	0	0	1	1	0
414	0	27		0	1.00	1	0	1	1	1	1	1	1
434	0	47		0	.25	1	1	1	0	0	0	1	0
450	0	18		0	5.00	2	1	1	0	1	1	1	0
452	0	23		0	1.00	1	1	1	1	1	0	0	1
470	0	16		0	1.50	2	0	0	0	1	0	0	0
472	0			0	40.00	2	1	1	1	1	1	1	1
475	0			1		2	1	1	0	1	1	0	1
476	0			0	7.00	2	1	1	0	1	1	1	1
480	0			0	10.00	2	1	1	0	1	1	1	1
483	0			0	26.00	1	0	0	1	0	0	0	0
484	0	1		0	10.00	1	0	0	0	0	0	0	0
486	0	8		1	10.00	2	0	0	0	0	0	1	0
489	0				5.00	2	1	1	1	1	0	0	1
490	0	1		0	50.00	2	0	0	0	0	0	0	0
496	0	27		0	34.00	2	1	1	1	1	1	1	1
505	1	1		0	5.00	2	0	0	0	0	0	0	0
511	0			0	20.00	2	1	1	0	1	1	1	1
531				1	2.00	1	0	0	0	1	0	1	0
544	0	9		0	4.50	2	0	0	1	1	1	1	1
551	0			0	15.00	2	0	0	1	1	1	1	1
552	0			0	40.00	2	1	1	1	1	1	1	1
555	0	8		0	10.00	1	0	0	0	1	0	0	0
559	0			0	13.00	2	1	1	0	1	1	1	1
568	0	5		0	1.00	1	0	0	1	0	0	0	0
573	0	40		0	60.00	2	1	1	0	1	1	1	1
611	0				8.00	2	0	0	0	0	0	0	0
616	0				80.00	2	1	1	1	1	1	1	1
666					5.00	2	0	0	1	1	0	1	0
COUNT	**84**	**35**	**9**	**75**	**90**	**94**	**90**	**90**	**90**	**90**	**90**	**90**	**90**
AVERAGE	**0.0**	**17.9**	**5.4**	**0.2**	**20.2**	**1.7**	**0.7**	**0.7**	**0.6**	**0.7**	**0.5**	**0.6**	**0.6**
SD	**0.1**	**12.5**	**4.1**	**0.4**	**16.0**	**0.4**	**0.5**	**0.5**	**0.5**	**0.4**	**0.5**	**0.5**	**0.5**
VAR	**0.0**	**156.5**	**17.2**	**0.2**	**257.4**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**

NAME	MAESTRO	MG	DEFENDER	RR	DISCO	38A	NISSAN	TOYOTA	HONDA	FORD	RENAULT
1							1	1	1	1	1
2	1	1	0	1	1	1	1	0	1	1	1
3	0	1	0	0	0	0	0	1	1	0	0
5	1	1	1	1	1	1	1	1	1	1	0
9	1	1	0	0	1	0	0	0	1	0	0
17	0	0	0	0	0	0	1	1	1	1	1
19	1	1	1	1	1	1	0	0	1	1	0
27	1	1	1	1	1	1	1	1	1	0	0
28	1	1	0	0	1	0	1	0	1	1	0
49	0	0	0	0	0	0	1	1	1	1	0
51	1	1	1	1	1	1	0	0	1	1	1
60	1	0	1	1	1	1	0	0	1	0	0
61	1	1	1	0	0	1	1	1	1	1	0
80	0	0	0	0	0	0	0	0	1	1	0
81	0	0	1	0	1	0	0	0	1	0	0
82	1	1	1	1	1	0	0	0	0	0	0
83	0	0	0	0	0	0	0	0	1	0	0
92	1	1	1	1	1	1	1	1	1	1	0
99	0	0	0	0	0	0	0	0	1	1	0
101	1	1	1	1	1	1	0	0	1	0	0
103	1	1	1	1	1	1	1	1	1	1	1
107	1	1	0	1	0	1	0	0	1	1	0
108	1	1	0	1	1	0	0	0	1	1	0
111	1	1	1	1	1	1	0	0	1	0	0
202	1	1	1	1	1	1	1	0	0	1	1
205	0	1	1	1	1	1	0	0	0	1	1
221	0	0	0	0	0	1	0	0	0	1	0
226	1	0	1	1	1	1	1	1	0	1	1
230	1	1	1	1	1	1	0	0	1	0	0
231	0	0	1	1	1	1	1	0	0	1	1
238	1	1	1	1	1	1	1	0	0	1	0
242	0	0	1	1	1	1	0	0	0	1	1
245	1	0	0	0	0	0	1	0	0	0	1
257	1	1	1	1	1	1	1	1	0	1	0
270	0	0	1	1	1		1	1	0	1	1
273	1	1	1	1	1	1	1	1	1	1	0
274	1	1	1	1	1	1	1	1	1	1	1
275							0	0	0	1	0
280	0	1	1	1	1	1	0	0	0	1	0
281	0	0	0	1	1	0	1	0	1	1	0
290							9	9	9	9	9
294	1	1	1	1	1	1	0	0	1	0	0
302	1	0	1	1	1	1	1	0	1	1	0
303	1	1	1	1	1	1	0	0	1	0	0
308	1	0	1	1	1	1	1	1	1	1	0
311	1		1	1	1	1	1	1	1	1	1
314	0	0	0	0	0	0	1	1	1	1	1
322	0	0	1	1	1	1	0	0	0	1	0
328	1	1	1	1	1	1	1	1	1	1	1
331	0	0	1	1	1	1	1	1	0	1	1
338	1	1	1	1	1	1	1	0	1	1	0
341							1	1	1	1	1
349	0	0	1	0	0	0	0	0	0	0	0
355	0	1	1	1	1	0	0	0	0	1	0
357	0	1	1	1	1	1	0	1	0	1	0
359	0	0	1	1	1	1	1	1	0	1	0

NAME	MAESTRO	MG	DEFENDER	RR	DISCO	38A	NISSAN	TOYOTA	HONDA	FORD	RENAULT
360	0	1	1	1	1	1	0	0	0	1	0
364	1	0	0	0	0	0	0	1	1	1	1
374	0	0	0	0	0	1	0	0	0	0	0
375	1	1	1	1	1	1	1	1	1	0	0
383	1	1	1	1	1	1	1	0	1	1	1
391							0	0	0	1	1
397	0	0	1	1	1	0	0	1	1	1	0
401	1	0	0	0	1	1	1	1	1	1	0
405	0	1	0	0	0	1	1	1	0	1	0
411	0	0	1	1	1	0	1	1	0	1	1
412	0	0	1	0	0	0	0	0	0	1	0
414	1	0	0	1	1	1	0	1	1	1	0
434	0	0	1	1	1	1	0	1	0	1	1
450	0	0	0	0	1	0	0	0	1	1	1
452	0	0	0	1	1	1	1	1	1	1	1
470	0	0	0	0	0	1	0	0	0	1	0
472	1	1	1	1	1	1	0	0	0	0	0
475	1	0	1	1	1	1	1	0	1	1	0
476	1	1	1	0	1	1	0	1	0	1	0
480	1	0	1	1	1	1	0	0	0	1	0
483	0	0	0	0	0	0	0	1	1	1	1
484	0	0	1	1	1	1	0	0	0	1	1
486	0	0	0	0	0	0	1	0	1	1	0
489	1	1	1	1	1	1	1	0	0	1	1
490	0	1	1	1	1	1	1	1	0	0	0
496	1	1	1	1	1	1	0	0	1	1	0
505	0	0	1	1	1	1	0	0	0	0	0
511	1	1	1	1	1	1	1	0	0	1	0
531	0	0	0	0	0	1	0	0	0	0	1
544	1	0	1	1	1	1	1	1	0	1	1
551	1	1	1	1	1	1	1	0	0	1	0
552	1	1	1	1	1	1	0	0	0	1	0
555	0	0	0	1	1	0	0	1	1	1	1
559	1	1	1	1	1	1	1	1	1	1	1
568	0	0	0	0	0	0	1	1	1	1	0
573	1	0	1	1	1	0	1	0	0	1	0
611	0	0	1	1	1	0	0	0	0	1	1
616	1	1	0	0	0	0	0	1	1	1	0
666	0	0	0	0	0	0	0	0	0	1	0
COUNT	**90**	**89**	**90**	**90**	**90**	**89**	**95**	**95**	**95**	**95**	**95**
AVERAGE	**0.5**	**0.5**	**0.7**	**0.7**	**0.7**	**0.7**	**0.6**	**0.5**	**0.6**	**0.9**	**0.4**
SD	**0.5**	**0.5**	**0.4**	**0.4**	**0.4**	**0.4**	**0.6**	**0.6**	**0.6**	**0.4**	**0.6**
VAR	**0.2**	**0.2**	**0.2**	**0.2**	**0.1**	**0.2**	**0.3**	**0.3**	**0.3**	**0.1**	**0.3**

NAME	BMW	VAUXHALL	OTHER	INDY	MODEL	SET	NMTH	NYR	NO	S600	SRG	SINDY
1	1	1	5	1	5	£ 3.00	29		18	0	0	1
2	1	1	2	0	1		53		1	0	3	10
3	0	0	0	0	1	£ 100.00	37		1	0	2	5
5	0	1	2	1	1	£ 15.00	25			4		
9	0	0	0	0	1	£ 10.00		2	1	0		
17	0	1	24	1	1		29		5	2	4	5
19	0	0	4	1	1	£ 3.00	45		4	0	0	1
27	0	1	3	1	1	£ 32.00	40		1			4
28	0	1	1	0	1	£ 8.00		2	1	0	1	8
49	0	1	1	0	1	£ 3.00	46		1	0	2	4
51	1	1	9	0	1	£ 6.00	54		3	0	0	0
60	0	0	1	1	1	£ 11.00	45		1	0	0	2
61	0	1	6	0	1	£ 8.00	39		1	0	0	11
80	0	1	0	1	1	£ 6.00	45		1	2	4	
81	0	0	1	0	1	£ 5.00	24		1	0	1	2
82	0	0	1	1	1	£ 0.99		1	6	1	0	10
83	0	0	0	0	1				4	0	3	6
92	0	0	0	11	1	£ 3.00	43		1	0	0	2
99	0	1	1	0	1	£ 7.00	10		2	0	1	5
101	0	0	0	1	1	£ 3.00		2	1	0	1	
103	1	1	99	1	1	£ 3.14	29		131	2	1	5
107	0	1	5	0	1	£ 70.00	30		1	0	1	6
108	0	0	0	0	1	£ 28.00	37		1	0	2	4
111	0	1	0	0	1	£ 5.00	38		5	0	0	3
202	1	1	0	0	2	£ 60.00		6	1	0	3	
205	0	1	1	0	2	£ 35.00	16		5	0	1	5
221	0	1	1	1	2	£ 15.00	25		1	0	0	2
226	1	1	99	0	3	£ 20.00		3	1	1	1	4
230	0	0	1	1	4	£ 18.00	22		1	0	2	99
231	1	0	0	0	3	£ 100.00	16		1	1	2	4
238	1	1	4	0	3	£ 10.00	5		6	0	5	13
242	0	1	0	0	5	£ 2.50	66		1	0	0	0
245	0	1	2	1		£ 1.80	20		1	0	2	6
257	0	1	3	0	2	£ 2.00	18		2	0	0	0
270	0	0	1	0	4	£ 25.00	30		2	0	2	25
273	0	1	4	1	1		24		2	0	2	7
274	1	1	99	1	2	£ 100.00		7	4	0	0	3
275	0	0	2	1		£ 0.40			2	0	0	0
280	0	1	3	0	2	£ 5.00	30		1	0	2	6
281	0	1	0	1	15	£ 300.00	8		6	1	1	6
290	9	9	9		2	£ 270.00	49		1	0	2	8
294	0	0	0	1	3	£ 10.00	32		1	0	1	3
302	0	1	99	0	5	£ 5.00	36		1	0	1	4
303	0	1	1	1	7	£ 12.00	23		1	0	1	4
308	0	1	0	1	3	£ 2.00	82		16	0	0	2
311	1	1	99	1	7			1	2	0	0	
314	1	1	99	1	1			2	4	0	4	8
322	0	1	4	1	2	£ 60.00	37		1	0	1	4
328	1	1	3	1	2	£ 4.00	13		1	0	0	0
331	1	1	99	0	2	£ 33.00		4	1	0	0	2
338	0	1	1	1	1	£ 5.00		2				
341	1	1	5	1	5	£ 3.00	29		18	0	0	1
349	0	0	0	1	9	£ 20.00	49		1	0	0	0
355	0	1	1	0	13	£ 600.00		1	1	0	1	5
357	0	1	4	1	2	£ 70.00	52		2	0	1	6
359	0	0	2	0	2	£ 400.00	34		1	0	1	6

NAME	BMW	VAUXHALL	OTHER	INDY	MODEL	SET	NMTH	NYR	NO	S600	SRG	SINDY
360	0	0	2	1	7	£ 24.00	8		8	0	0	10
364	1	1	1	1	12	£ 5.50		5	1	0	2	4
374	0	0	8	0	2	£ 110.00	57		1	0		
375	0	0	4	0	1	£ 20.00	37		1	0	0	4
383	1	1	0	0	3	£ 14.00	16		2	0	0	1
391	1	0	5	1				8				
397	0	0	0	1	4				2	0		
401	0	1	0	0	3	£ 50.00		1	2	0	2	5
405	0	1	0	0	2	£ 174.00	54		1	0	2	5
411	1	1	0	0	2	£ 80.00		7	4	1	2	7
412	0	0	4	1	9	£ 130.00	12		1	0	0	4
414	0	0	0	0	2	£ 22.00	5		2	0	1	1
434	1	1	0	1	3	£ 8.50	35		1	0	1	4
450	0	0	4	1	3	£ 75.00	46		1	1	2	10
452	1	0	10	1	3	£ 9.00	23		1	0	0	1
470	1	1	8	1	2	£ 36.50	38		2	0	2	5
472	0	0	0	1	4	£ 18.00	30		2	0	3	10
475	1	1	1	1	3	£ 8.50	16	1	1	0	1	
476	0	0	99	1	14	£ 110.00	36		1	0	2	12
480	1	1	2	1	2	£ 32.00		4	2	0	0	0
483	1	1	2	1	1	£ 125.00	44		1	0	1	6
484	0	0	3	1	4	£ 14.00	37		2	0	1	5
486	0	1	0	1	11	£ 31.00	23		1	0	0	1
489	0	1	3	0	4	£ 15.00	25		1	0	1	5
490	0	0	0	1	4	£ 12.00	59		1	1	2	3
496	0	1	5	0	4	£ 20.00	34		1	0	0	1
505	0	1	0	0	4	£ 500.00		11	1	1	1	3
511	0	0	1	0	2	£ 5.00	12		2	0	1	3
531	0	0	5	1	11	£ 2.00	15		3	0	1	5
544	1	1	5	0	2	£ 40.00	11		12	0	1	10
551	0	1	0	1	2	£ 2.85	32		4	0	2	4
552	0	0	0	0	2	£ 25.00	30		1	0	2	12
555	1	0	7	0	2	£ 340.00	26		1	0	2	8
559	1	1	0	1	2	£ 7.50	29		34	1	2	4
568	1	1	0	1	1	£ 14.00	7		4	0	0	1
573	1	1	2	1	9		8		6	1	0	
611	0	0	1	1	9	£ 3.00		9	8	0	0	0
616	0	1	0	0	1	£ 280.00	57		1	0	0	1
666	0	1	5	1	1	£ 13.00	13		1	0	1	6
COUNT	**95**	**95**	**95**	**94**	**93**	**86**	**73**	**20**	**92**	**92**	**88**	**83**
AVERAGE	**0.4**	**0.7**	**10.5**	**0.7**	**5.8**	**56.9**	**31.4**	**4.0**	**4.4**	**0.2**	**1.1**	**5.9**
SD	**0.5**	**0.5**	**15.2**	**0.6**	**6.3**	**66.5**	**12.6**	**2.5**	**4.8**	**0.4**	**0.9**	**4.2**
VAR	**0.3**	**0.3**	**230.7**	**0.3**	**39.8**	**4419.7**	**158.1**	**6.5**	**22.6**	**0.1**	**0.8**	**17.4**

NAME	QUOTE	TOOLING	SOURCE	OPENBOOK	ANALYSIS	CDTS	REVIEW	AGREE	APPROACH	ROVER
1		2	2	0	0	1	12	3	24	1
2	3	1	1	1	0	1	6	2	36	
3		2	1	0	0	1	6	1	48	0
5		1	3	0	1	0	12	3	9	
9		2	3	1	1	1	12	3	24	0
17	3			0	1	0		2	43	0
19		2	1	1	0	1	12	2	30	1
27	3	1	1	1	1	1		3	36	0
28		1	2	1	1	0	12	3	18	0
49		1	2	1	1	1	12	3	30	0
51		1	1	1	0	1	12	1	36	0
60	2	2	1	1	0	0	12	1	30	
61		2	1	1	0	0	6	3		
80		1	1	1	0	1		2	30	0
81	2	1	1	1	1	0	12	3	12	
82		1	2	0	0	1	12	2	18	
83			2	0	0	1	6	2		0
92		2	1	1	0	1	12	3	36	0
99		1	1	0	1	0	6	2	12	1
101	1	2	1	1	1	0	12	2	24	0
103	5	1	1	0	0	1	12	1	24	0
107	1	1	1	1	0	1	3	2	36	0
108		1		0	0	1	2	2	40	
111	0	1	1	1	0	0	12	3		
202	2	2	1	1	0	0	6	1	24	1
205	1	2	2	1	1	1	12	1	18	1
221		2	1	0	0	1	12	2	24	1
226		2	2	1	1	1	2	2	12	1
230		2	1	1	1	1	1	2	24	1
231		1	1	1	0	0	1	2	20	1
238		2		1	1	1	12	3	18	1
242		1	1	1	0	0	12	3	24	1
245		2	2	0	1	1	0	3		1
257			1	0	0	1	12	3	24	1
270	1	3	2	1	1	1	12	2	24	1
273			1				12	1	12	
274			1	1	0	1	12	3	60	1
275			1	1	0	1		3	21	1
280		2	2	0	1	0	12	3	24	1
281		2		1	0	0	12	2	6	1
290									52	1
294	1	2	1	1	0	1	12	2	36	1
302	2	2	1	1	0	1	12	1	44	1
303		2	1	1	0	1	12	1	24	1
308		2	1	1	0	0		2	36	1
311			1							1
314	2		1				12	1	24	
322		2	2	1	0	1	12	2	48	1
328		2	1	0	1	0	12	3	60	1
331	0	2	1	0	0	1	3	2	50	1
338			1	0	1	0	12	1		
341		2	2	0	0	1	12	3	24	1
349				1	0	0	12	1		1
355		2	1	0	1	0	12	2	24	
357		2	1	1	0	1	12	2	48	1
359	3	2	2	0	0	1	12	3	72	1

NAME	QUOTE	TOOLING	SOURCE	OPENBOOK	ANALYSIS	CDTS	REVIEW	AGREE	APPROACH	ROVER
360		1	1	0	0	1	12	3	26	1
364		2	2	1	0	0	12	3	24	1
374		2	2	0	0	1	6	1	72	1
375		2	1	1	0	1	12	1	24	0
383	2	2	1	1	0	0	12	3	36	
391			2					3		1
397	0							3	0	1
401	2		1	1	1	1		2	12	1
405	2	2	2	0	0	1	6	2	40	1
411	2	1	1	0	0	1	12	1	36	1
412		2	1	1	1	1	12	2	24	1
414		2	1	0	0	1		2		1
434	2	2	1	0	1	0	12		30	
450		2	1	0	1	1	12	3	24	1
452			1				6	3	12	1
470		2	1	0	0	1	6	3	32	1
472		2	2	1	0	1	6	2	24	1
475	3	1	1	1	1	1	12	2	36	1
476		1	1	1	1	1	12	3	18	1
480	0	2	1	0	0	0			50	1
483			1	0	0	1	12	2	26	0
484	3		2	1	0	0	12	1	16	1
486		1	2	1	0	0	12	2	24	1
489		3	1	1	1	1	1	3	24	1
490	1	2	1	1	0	0		3	6	1
496		2	2	1	0	1	12	3	30	1
505							12	3	12	1
511		1	1	1	0	0	12	1	18	1
531	1	2	3	1	1	1	12	2	15	1
544		2	2	1	1	1	12	2	12	1
551		2	2	1	0	0	12	3	36	1
552		2	1	0	0	1	12	3	24	1
555		4	2	1	0	0	4	2	28	1
559	1		1	1	0	0	12	3	48	1
568		1	2	0	0	1	12		27	1
573	0	1	1	1	0	0	98	2	3	1
611		2	1		0	0	12	2		1
616		2	1	1	1	1		2	36	
666	1	2	2	0	0	1		3	13	2
COUNT	**31**	**76**	**87**	**87**	**87**	**87**	**80**	**90**	**85**	**80**
AVERAGE	**1.7**	**1.7**	**1.4**	**3.4**	**0.3**	**0.6**	**11.1**	**2.2**	**28.1**	**0.8**
SD	**0.9**	**0.5**	**0.5**	**5.5**	**0.4**	**0.5**	**3.5**	**0.6**	**10.9**	**0.3**
VAR	**0.9**	**0.2**	**0.2**	**30.6**	**0.2**	**0.2**	**12.1**	**0.4**	**118.5**	**0.1**

NAME	DEPI	ASAI	I	II	III	IV	V	VI	VII	PDTDES	PCSDES	PCSKNOW	PRTKNOW
1	7	3	0	0	1	0	0	0	0	85	100	90	100
2	7	6	0	0	0	0	0	1	0	50	100	80	100
3		5	0	0	0	0	1	0	0	10	95	66	80
5		2	0	1	0	0	0	0	0	24	70	70	79
9	7	4	0	0	0	1	0	0	0	0	0	59	99
17	7	6	0	0	0	0	0	1	0	95	95	71	65
19	7									3	98	15	64
27	7	4	0	0	0	1	0	0	0	33	71	60	54
28	7	2	0	1	0	0	0	0	0	36	91	22	78
49	7	2	0	1	0	0	0	0	0	90	100	40	70
51	7	7	0	0	0	0	0	0	1	82	100	79	97
60	7	4	0	0	0	1	0	0	0	4	93	90	89
61	8	6	0	0	0	0	0	1	0	91	100	12	60
80	7	4	0	0	0	1	0	0	0	9	96	75	95
81	7	3	0	0	1	0	0	0	0	10	100	50	69
82	7	2	0	1	0	0	0	0	0	20	96	97	98
83		6	0	0	0	0	0	1	0	16	82	36	65
92	7	4	0	0	0	1	0	0	0	22	79	46	83
99	7	4	0	0	0	1	0	0	0	79	100	94	99
101	7	6	0	0	0	0	0	1	0	1	100	3	85
103	1		0	0	1	0	0	0	1	76	91	63	63
107	1	5	0	0	0	0	1	0	0	92	100	62	85
108	7		0	0	1	1	1	1	0	76	100	78	76
111													
202	7	5	0	0	0	0	1	0	0	90	92	78	96
205	1	5	0	0	0	0	1	0	0	75	100	50	76
221	1	5	0	0	0	0	1	0	0	22	85	70	93
226	1	5	0	0	0	0	1	0	0	90	98	58	90
230	7	3	0	0	1	0	0	0	0	51	100	26	100
231	9	7	0	0	0	0	0	0	1	95	91	65	66
238	7	4	0	0	0	1	0	0	0	95	95	69	70
242	1	6	0	0	0	0	0	1	0	12	10	20	90
245	1		0	0	1	0	0	1	0	89	100	14	63
257	1	7	0	0	0	0	0	0	1	79	78	87	89
270	1	4	0	0	0	1	0	0	0	72	98	87	55
273	7	5	0	0	0	0	1	0	0	0	0	73	75
274	1	7	0	0	0	0	0	0	1	100	100	18	26
275	1	6	0	0	0	0	0	1	0	71	99	18	60
280	1	6	0	0	0	0	0	1	0	11	100	35	79
281	9		0	1	0	0	0	1	0	4	50	75	75
290	1	5	0	0	0	0	1	0	0	93			
294	7	3	0	0	1	0	0	0	0	36	83	33	33
302	1	7	0	0	0	0	0	0	1	96	99	89	96
303	7		1	1	0	1	0	0	0	39	89	72	71
308	7	7	0	0	0	0	0	0	1	0	100	22	76
311	9												
314	7	7	0	0	0	0	0	0	1	95	100	86	6
322	1	4	0	0	0	1	0	0	0	89	90	62	73
328	1		0	1	0	1	0	0	1	50	98	51	21
331	1	6	0	0	0	0	0	1	0	100	98	73	80
338	1	7	0	0	0	0	0	0	1	100	100	5	10
341	7	3	0	0	1	0	0	0	0	85	100	90	100
349	9	7	0	0	0	0	0	0	1	99	100	1	0
355		4	0	0	0	1	0	0	0	93	100	96	96
357	1	6	0	0	0	0	0	1	0	85	100	50	50
359	7	5	0	0	0	0	1	0	0	37	95	63	95

NAME	DEPI	asan	I	II	III	IV	V	VI	VII	PDTDES	PCSDES	PCSKNOW	PRTKNOW
360	1	2	0	1	0	0	0	0	0	5	90	59	80
364	1	3	0	0	1	0	0	0	0	80	100	29	72
374	1	4	0	0	0	1	0	0	0	98	100	75	95
375	1	6	0	0	0	0	0	1	0	88	100	12	50
383	1	4	0	0	0	1	0	0	0	16	100	50	77
391	7	4	0	0	0	1	0	0	0	95	92	85	89
397		7	0	0	0	0	0	0	1	0	100	37	87
401	7	7	0	0	0	0	0	0	1	10	100	62	62
405	7	4	0	0	0	1	0	0	0	84	100	80	58
411	1	3	0	0	1	0	0	0	0	90	90	20	60
412	7	3	0	0	1	0	0	0	0	81	78	86	86
414	1	2	0	1	0	0	0	0	0	22	95	50	84
434	1	3	0	0	1	0	0	0	0	70	100	33	35
450	1	2	0	1	0	0	0	0	0	19	95	8	58
452	1	5	0	0	0	0	1	0	0	100	100	15	80
470	7	3	0	0	1	0	0	0	0	50	100	50	76
472	1	3	0	0	1	0	0	0	0	100	100	50	100
475	7	5	0	0	0	0	1	0	0	10	100	40	60
476	9	6	0	0	0	0	0	1	0	92	100	59	71
480	1	6	0	0	0	0	0	1	0	92	100	74	24
483	7	6	0	0	0	0	0	1	0	2	86	75	75
484	7		0	0	1	1	0	0	0	22	96	50	78
486	9	4	0	0	0	1	0	0	0	27	100	75	100
489	1	5	0	0	0	0	1	0	0	65	100	10	10
490	1		0	1	1	0	0	0	0	37	100	79	100
496	7	5	0	0	0	0	1	0	0	94	100	25	76
505	9	7	0	0	0	0	0	0	1	93	98	76	77
511	1	2	0	1	0	0	0	0	0	15	81	32	50
531	7		0	0	1	0	0	1	0	95	100	51	42
544	7	3	0	0	1	0	0	0	0	67	100	63	89
551	1	5	0	0	0	0	1	0	0	60	100	68	50
552	1	2	0	1	0	0	0	0	0	64	98	33	64
555	7	4	0	0	0	1	0	0	0	84	98	88	88
559	7	7	0	0	0	0	0	0	1	98	98	83	83
568	7	4	0	0	0	1	0	0	0	9	66	82	83
573	1	3	0	0	1	0	0	0	0	100	100	60	80
611	7	6	0	0	0	0	0	1	0	24	87	14	64
616	7	2	0	1	0	0	0	0	0	2	100	40	84
666	1	2	0	1	0	0	0	0	0	12	100	25	71
COUNT	**89**	**83**	**92**	**92**	**92**	**92**	**92**	**92**	**92**	**93**	**92**	**92**	**92**
AVERAGE	**4.6**	**4.6**	**0.0**	**0.2**	**0.2**	**0.2**	**3.3**	**0.2**	**0.2**	**56.2**	**91.9**	**54.3**	**72.1**
SD	**3.1**	**1.4**	**0.0**	**0.3**	**0.3**	**0.4**	**2.3**	**0.3**	**0.3**	**34.0**	**10.3**	**22.6**	**17.3**
VAR	**9.5**	**2.0**	**0.0**	**0.1**	**0.1**	**0.1**	**5.1**	**0.1**	**0.1**	**1153.8**	**106.7**	**511.4**	**300.1**

NAME	EX	COMMUN	INTEGRAT	ABILITY	INPUT	GEBA	HBIAS	RSITE	HSITE	SSITE	TRUST
1	1	80	80	90	90		0	99		1	90
2	1	100	100	100	80			10	70	20	39
3	1	70	30	70	10	2		40	40	20	93
5	1	80	90	90	25	2		40	50	10	75
9	0	75	50	90	20	2		5	60	35	100
17	1	0	0	100	0	0	0	10	90	0	84
19	1	75	0	95	0	5	0	5	75	20	25
27	1	90	40	80	40	5	0	25	25	50	76
28	1	60	60	85	60		1	10	70	20	69
49	1					0		0	100	0	
51	1	75	75	75	75	6	0	30	60	10	86
60	1	90	60	100	10	20	0	10	80	10	92
61					100			15	80	5	81
80	1	3	1	10	5	0	0	0	90	10	87
81	1	25	25	95	10	2	0	10	50	40	72
82	1	5	10	100	1	0	0	100	0	0	75
83	0	20	0	100	10		0	35	50	15	50
92	1	50	50	90	50	2	0	10	70	20	48
99	0	30	30	80	60		0	0	100	0	24
101	0	50	0	100	10	1	0	0	80	20	26
103	0	80	75	65	50	2	0	20	70	10	70
107	1	10	10	90	90	1	0	5	75	20	60
108	0	10	10	70	10		0	2	78	20	71
111							0	10	70	20	87
202	1	50	50	90	90		0	90		10	82
205	0	60	60	70	80	2	0	60		40	50
221	1	70	70	75	70	5	0	70		30	77
226	1	70	80	100	100	4	0	50		50	81
230	1	75	80	100	50	5	0	60		40	80
231	1	80	70	90	80	2	0	80		20	75
238	0	80	100	100	50	99	0	80		20	66
242	1	80	20	80	5	0	0	50		50	40
245	1	80	100	100	100	1	0	80		20	87
257	1	80	70	95	90	3	0	95		5	50
270	1	50	85	90	90	2		75		25	71
273	1	50	0	100	0	0	0			10	88
274	1	50	90	100	90	0	0	90		10	83
275	1					0	0				82
280	1	60	90	90	90	1	0	100		0	40
281	1	90	90	95	0	2		75		25	84
290							0	90		10	96
294	1	80	90	90	30	10		30	30	40	95
302	1	90	90	100	30	3	0	90		10	76
303	1	80	90	90	50	3	0	80		20	85
308	1	0	0	0	0	1	0	100		0	100
311	1					0	0	40	10	50	73
314	1	0	0	0	0	0		70	15	15	8
322	1	80	95	90	90	11	0	60		40	84
328	1	100				3	0	99		1	100
331		80	90	90	80	3	0	95		5	90
338	0	10	20	75	10	0					58
341	1	80	80	90	90			99		1	90
349	0	90	20	90	20		0	100		0	97
355	1						0	60		40	82
357	1	50	30	100	20	2	0	50		50	75
359	1	50	85	90	95	10		45		55	60

NAME	EX	COMMUN	INTEGRAT	ABILITY	INPUT	GEBA	HBIAS	RSITE	HSITE	SSITE	TRUST
360	1	60	25	80	25	2		95		5	50
364	0	80	70	100	50	0	0	90		10	67
374	1	70	75	90		2	0	85		15	89
375	0	30	50	30	30	0	0	10	90	0	77
383	1	10	80	90	80	0	0	48	48	4	39
391	1					0	0	100		0	51
397	0	0	0		0		0				89
401	1	80	85	95	30	99	0	10	70	20	85
405	1	30	60	100	10	4	0	50		50	62
411	1	100		100		1	0	98		2	100
412	1	95	85	95	85		0	100		0	89
414	1	80	50	60	5	2	0	50		50	87
434	1	75	75	85	60	2	0	100		0	81
450	1	20	10	40	5	2	0	90		10	40
452	1	50	50	100	50	0	0	100		0	95
470	1	95	90	100	90	0		80	5	15	100
472	1	100	100	100	100	10	0	70		30	75
475	0	60	80	80	60	0		18	80	2	90
476	1	60	70	70	30	3	0	90	0	10	64
480	1	20	10	70	10	3	0	95		5	91
483	0	60	80	80	80	8	0	5	90	5	70
484	1	70	30	95	50			90		10	97
486	1	80	50	100	50		0	80		20	100
489	1	75	75	100	50	6	0	70		30	75
490	1	20	30	80	40	1	0	50		50	74
496	1	40	80	70	90	4	0	80		20	15
505	0	70	10	80	0	0	0	90		10	81
511	1	10	5	20	20	0	0	100		0	72
531	1	50	90	90	90	3	0	95	3	2	63
544	1	95	90	95		2		50		50	75
551	1	95	80	100	80	0	0	95		5	88
552	1	80	70	80	60	12	0	95		5	84
555	1	70	70	100	80			90		10	89
559	1	65	90	90	60	6		80		20	77
568	1	70	0	40	0		1	0	80	20	72
573	1	50	25	100	100	99	0	89	1	10	82
611	0	10	10	90	0	0		100		0	94
616	1	95	98	100	100	99		5	75	20	91
666	1	20	50	90	50	2	0	100		0	50
COUNT	**91**	**87**	**85**	**85**	**86**	**76**	**73**	**91**	**37**	**92**	**94**
AVERAGE	**0.8**	**59.0**	**54.6**	**84.0**	**0.6**	**7.8**	**0.0**	**59.3**	**57.6**	**17.2**	**74.0**
SD	**0.3**	**24.7**	**30.0**	**15.0**	**0.5**	**10.3**	**0.1**	**32.1**	**25.9**	**12.9**	**15.5**
VAR	**0.1**	**609.6**	**897.0**	**225.4**	**0.2**	**105.9**	**0.0**	**1029.6**	**670.2**	**167.0**	**241.7**

NAME	OPEN	LOCKIN	R6USE	RGUSE	QMORE	FIRST	VISITS	SPLIT	OMTHS	OYRS	OPM	OTQI
1	90	9	100	50	2		1					
2	69	90	100	90	0	1	0	1	27		155.0	50
3	93	84	98	62	2		6	1				
5	89	75	75	55	2	1	1	0				
9	100	50	96	89	2	1	2	1				
17	69	27	78	25			0	1				
19	28	91	94	94	2	1	4		12		95.0	34
27	75	78	75	86	2	1	10	1	20		217.0	77
28	71	23	76	78	2	1	1			1	192.0	71
49												
51	86	86	87	88	2	1	1	1	10			
60	92	87	92	92	2	1	3	1	21		205.0	55
61	68	16	85	84	2	1	0		21		165.0	59
80	86	76	93	92	0	1	0		4		122.0	21
81	71	52	79	78	2	1	0				122.0	49
82	50	13	57	52	0	1	2	0				
83	30	96	66	29			1		10		136.0	29
92	46	34	99	77	2	1	3	1	24		177.0	65
99	23	8	50	27	0	0	0					
101	49	25	50	50	0	1	1	0	11		208.0	44
103	62	73	83	83	2	1	0		55			
107	74	82	38	65	2	1	3	1	13		229.0	60
108	69	58	65	88	2	1	5	1				
111	87	87	68	69	2	1	0		14		138.0	37
202	91	97	69	70	0	1	2	1	18		194.0	59
205	50	75	70	50	0	0	1	1	29		156.0	43
221	77	85	83	77	2	1	0					
226	88	81	100	100	0	1	0	0	13		214.0	91
230	73	100	36	37	2	1	0		22		183.0	50
231	76	90	90	90	2	1	0		15		236.0	61
238	66	19	68	69	2	1	0		16		231.0	73
242	80	80	80	60	0	1	0					
245	87	94	82	82	2	1	0		2			
257	50	74	84	85	0	1	1					
270	92	67	92	95	0	1	8	0	15		174.0	47
273	63	85	91	89	2	1	0		10		196.0	50
274	73	71	99	94	2	1	3		8		221.0	66
275	82	30	85	81	2	1	0					
280	40	49	80	63	0	1	0		25		186.0	40
281	79	84	85	97	2	1	2		1		245.0	42
290	97	69	51	52								
294	94	90	100	100	2	1	2	1	6		198.0	48
302	90	89	89	50	1	1	20	1	12		196.0	59
303	66	95	89	95	2	1	3	0	16		155.0	40
308	100	66	70	71	2	1	0					
311	97		74	72	2	1						
314	87	86	89	63	0	0	0					
322	81	89	89	81	2	1	2	1	16		176.0	69
328	100	49	97	96	1	1	0		9			
331	90	25	98	82	2	1	1		15		153.0	39
338	44	15	96	95	0	1	0	0				
341	90	9	100	50	2		1					
349	95	50	50	50	2	1	0					
355	59	79	33	45		1	0					
357	75	25	80	80	0	1	2	1	18		171.0	76
359	61	89	84	63	0	1	2	0	26		205.0	47

NAME	OPEN	LOCKIN	R6USE	RGUSE	QMORE	FIRST	VISITS	SPLIT	OMTHS	OYRS	OPM	OTQI
360	50	72	82	78	1	1	0		22		167.0	68
364	77	50	60	60	1	1	0		10		202.0	57
374	89	80	76	57	2	1			20		120.0	25
375	50	70	73	75	2	1	0					
383	65	50	97	92	0	1	2	0	19		155.0	40
391	51	4	21	40	2	0	0					
397	73	15	100	76	2	1	0					
401	86	97	97	97	0	1	99	1	23		249.0	87
405	21	80	81	20	0	1	0		16		237.0	50
411	100	20	80	30	2	1	0		12		248.0	79
412	91	23	90	74	2	1	0					
414	69	75	94	92	0	1	1	0	26		204.0	81
434	66	50	7	9	2	0	2					
450	40	68	95	94	2	1	1	0	18		205.0	74
452	75	65	90	90	2	1	0					
470	100	100	86	49	1	1	0		16		258.0	50
472	75	50	50	50	2		2					
475	90	65	70	80	2	1	20	1	16		202.0	68
476	75	74	88	89	2	1	0		13	17	176.0	50
480	92	28	88	85	2	1	0		-9			
483	72	85	95	93	1	0	0		5		245.0	59
484	97	96	80	50	2	1						
486	50	13	90	57	1	1	3	1				
489	75	75	75	75	0	1	4				195.0	70
490	73	36	51	50	2	1	0					
496	49	90	86	87	0	1	0					
505	85	21	51	50	1	0						
511	73	37	77	67		1	0		24		165.0	30
531	96	94	94	91	2	1	0					
544	77	89	100	84	1	1	3		9		190.0	75
551	86	94	87	85	2	1	0					
552	75	62	69	69	1	1	2		5		133.0	50
555	98	89	93	39	2	1			8		146.0	47
559	88	89	76	76	0	1	0					
568	73	89	91	72	1	1						
573	80	88	88	88	0	1	10	1				
611	95	78	82	23	1	1	0					
616	90	100	50	50	1	1	6	0	24		168.0	79
666	34	28	50	50	2	0	1					
COUNT	**94**	**93**	**94**	**94**	**90**	**87**	**87**	**32**	**52**	**2**	**50**	**50**
AVERAGE	**74.2**	**63.6**	**78.7**	**70.0**	**4.1**	**0.9**	**2.9**	**0.6**	**15.6**	**9.0**	**186.3**	**55.8**
SD	**15.1**	**24.8**	**14.5**	**18.0**	**5.5**	**0.2**	**3.7**	**0.5**	**6.6**	**8.0**	**31.1**	**13.8**
VAR	**226.6**	**614.9**	**208.8**	**322.5**	**29.9**	**0.0**	**13.7**	**0.2**	**44.0**	**64.0**	**967.7**	**189.1**

NAME	OBPERF	NM	NY	NPM	NTQI	NBF	COST92	COST93	COST94	SPIMP	BPIMP	OVERH
1							.0	-1.5	99.0	1	1	1
2	210	16					.0	4.0	99.0	1	0	0
3							99.0	-1.0	-1.5	0	0	0
5							99.0	.0	.0	0	0	1
9							-3.0	-2.5	99.0	0	1	0
17							.0	.0	-.2	0	0	0
19	143						.0	-5.0	2.0	1	0	0
27	279	1		233	61	276	-4.0	-6.0	-2.0	1	1	1
28	228						-2.0	-3.0	-2.0	1	0	1
49							99.0	99.0	99.0			
51							99.0	99.0	99.0	1	0	0
60	221						-1.0	-3.0	.0	1	1	0
61	207	2		207	60	219	-1.0	-2.0	.0	1	0	0
80	102						.0	.0	.0			
81	144	10		167	64	165	.0	-5.0	-5.0	1	1	0
82							99.0	-5.2	-4.0	1	0	0
83	193						.0	.0	.0	1	0	0
92	217						99.0	99.0	-1.0	1	0	0
99							99.0	.0	.0			
101	224						99.0	99.0	99.0	0	0	0
103			3				-3.4	99.0	99.0	1	0	0
107	276						.0	.0	-5.0	0	1	1
108							.0	.0	.0			
111	134						.0	.0	-4.0	0	0	1
202	253						99.0	99.0	99.0	0	1	1
205		5		201	54	265	2.0	-1.0	.0	1	0	0
221							99.0	99.0	99.0	0	0	0
226	269						-25.0	-17.0	-2.0	1	1	1
230	173	9		196	40	173	99.0	99.0	99.0	1	1	1
231	246	3		247	59	251	-1.5	-8.0	-6.0	0	0	0
238	262	4		279	73	262	.0	-7.0	-3.0	0	0	0
242							-2.0	-3.0	99.0	1	0	0
245							.0	.0	-3.0	0	0	0
257							-3.0	-4.0	-2.0	1	0	1
270	252	1		204	58	263	1.0	-3.0	.0	1	0	1
273	242						.0	.0	5.0			
274	275						.0	-2.0	.0	1	0	1
275							99.0	99.0	99.0			
280	219	13		227	60	245	.0	.0	.0	1	0	0
281	224						99.0	99.0	-7.5	1	1	1
290							99.0	99.0	99.0	0	0	0
294	197						.0	.0	-3.0	1	0	1
302	230	5					3.0	.0	.0	1	0	0
303	196		0				.0	-8.0	-4.0	1	1	0
308							9.0	99.0	99.0	1	0	1
311							2.5	.0	.0	0	0	0
314							99.0	5.0	5.0	0	0	0
322	219						.0	.0	-2.0	1		1
328							.0	-1.5	-3.0			
331	214	9		196	59	246	99.0	99.0	99.0			
338							.0	.0	.0			
341							.0	-1.5	99.0	1	1	1
349							3.0	.0	2.0			
355							99.0	99.0	2.0			
357	263	1					4.0	.0	2.0	1	0	1
359	225	4		226	47	238	99.0	.0	.0	0	0	0

NAME	OBPERF	NM	NY	NPM	NTQI	NBF	COST92	COST93	COST94	SPIMP	BPIMP	OVERH
360	201	6		194	69	210	-4.5	-4.5	-4.5	1	0	0
364	248						.0	.0	.0	1	0	0
374	178	1		136	59	191	99.0	99.0	99.0	1	0	1
375							3.0	1.0	.0	0	0	0
383	161	7					.0	-3.0	-1.0	1	1	1
391							.0	.0	.0			
397							99.0	-99.0	99.0	1	0	1
401	315	8		263	87	323	-2.0	-15.0	99.0	1	0	0
405	170	8		241	50	172	7.5	-4.0	-1.5	1	0	1
411	276						2.4	.0	-4.0	1	0	0
412							.0	-2.0	-2.0	0	0	0
414	236	10		235	91	251	99.0	-2.0	-3.0	1	1	0
434							-5.0	-5.0	99.0	0	0	1
450	259						-28.0	-5.0	-7.0	0	0	0
452							99.0	99.0	99.0			
470	311						99.0	99.0	99.0			
472							.0	1.2	-5.0	1	1	0
475	264	2		226	68	275	.0	-4.0	-3.0	1	0	1
476	219						.0	99.0	99.0	1	0	0
480							-2.0	-3.0	.0	1	0	0
483	228						.0	-3.0	-3.0	1	0	1
484							99.0	99.0	99.0			
486							99.0	.0	.0	0	0	0
489	231			217	80	262	.0	.0	.0			
490							99.0	99.0	99.0	0	0	0
496							4.0	-4.0	.0	1	0	0
505							.0	.0	.0			
511	196						.0	-5.8	-1.9	1	0	0
531							.0	-8.0	99.0	1	0	1
544	244	1		214	75	259	99.0	-5.0	99.0	0	1	0
551							.0	-2.5	.0	1	0	1
552	196						99.0	99.0	99.0	1	0	0
555	197						99.0	-10.0	-10.0	1	0	0
559							1.0	.0	-2.5	1	0	0
568							99.0	99.0	99.0			
573							.0	.0	.0			
611							.0	80.0	-90.0	0	0	0
616	288	0		238	90	299	-3.0	-3.2	-4.0	1	0	0
666							99.0	99.0	99.0			
COUNT	**49**	**23**	**2**	**20**	**20**	**20**	**95**	**95**	**95**	**75**	**74**	**75**
AVERAGE	**223.6**	**5.5**	**1.5**	**217.4**	**65.2**	**242.3**	**31.8**	**22.0**	**29.3**	**0.7**	**0.2**	**0.4**
SD	**34.1**	**3.6**	**1.5**	**24.2**	**11.1**	**32.8**	**43.9**	**38.5**	**44.0**	**0.4**	**0.3**	**0.5**
VAR	**1162.0**	**12.8**	**2.3**	**583.2**	**124.1**	**1074.2**	**1923.4**	**1482.7**	**1936.7**	**0.2**	**0.1**	**0.2**

NAME	CD	OTH	OPBK	REPORT	HELP
1	0	9	95	1	1
2	1	0	80	1	1
3	1	2	80	1	1
5	0	0	75	1	1
9	1	0	100	1	1
17	1	0	81	1	0
19	1	3	91	1	1
27	1	4	85	1	1
28	1	0	83	1	1
49			100	1	1
51	0	0	75	1	1
60	0	0	98	1	1
61	1	0	78	1	0
80			86	1	1
81	1	0	95	1	1
82	0	0	98	1	1
83	0	0	92	1	0
92	1	0	85	1	0
99			22	1	1
101	0	5	73	1	1
103	1	6	64	1	1
107	1	0	90	1	1
108			62	1	1
111	0	7	76	1	1
202	1	0	88	1	1
205	1	8	50	1	1
221	1	0	50	1	1
226	1	0	97	1	1
230	1	0	89	1	1
231	1	5	89	1	0
238	1	0	65	1	1
242	0	0	80	1	0
245	1	0	44	1	1
257	1	0	89	1	1
270	1	0	93	1	1
273			94	1	1
274	1	0	82	1	1
275			88	1	1
280	0	0	15	1	1
281	1	0	100	1	0
290	1	0			
294	0	0	88	1	1
302	0	0	90	1	1
303	1	0	79	1	1
308	1	0	77		1
311	1	0	50	1	1
314	0	0	88	0	0
322	1	0	98	1	1
328			38	1	1
331			2	1	1
338			80	1	2
341	1	1	95	1	1
349			88	0	0
355			37	0	0
357	1	0	80	1	1
359	1	0	63	1	1

NAME	CD	OTH	OPBK	REPORT	HELP
360	0	0	80	1	1
364	1	0	75	1	1
374	0	0	77	1	1
375	1	0	23	1	0
383	1	0	69	1	0
391				1	1
397	0	0	65	1	1
401	1	1	100	1	1
405	0	0	88	1	0
411	1	0	50	1	1
412	0	10	65	1	0
414	1	0	67	1	0
434	1	0	34	1	0
450	1	11	35	1	1
452				1	1
470				1	1
472	1	0	100	1	1
475	1	0	100	1	1
476	0	0	68	1	1
480	0	0	60	0	0
483	0	0	71	1	1
484				1	1
486	0	0	100	1	1
489			100		
490	1		92	1	1
496	0	0	98	1	0
505			79	1	0
511	0	0	40	1	1
531	0	0	86	1	1
544	1	0	100	1	1
551	0	0	1	1	1
552	0	0	94	1	
555	1	0	89	1	1
559	0	0	87	1	
568			57	1	1
573			93	1	
611	0	12	81	1	1
616	1	0	62	1	1
666			11	0	0
COUNT	**75**	**74**	**90**	**92**	**90**
AVERAGE	**0.6**	**1.1**	**74.7**	**0.9**	**0.8**
SD	**0.5**	**1.8**	**18.4**	**0.1**	**0.4**
VAR	**0.2**	**3.4**	**339.7**	**0.0**	**0.1**

APPENDIX 7: COMPARISON OF R600 VS 38A SUPPLIERS

Ability

t-tests for independent samples of MODEL

Variable	Number of Cases	Mean	SD	SE of Mean
ABILITY				
MODEL 1	28	78.5714	27.212	5.143
MODEL 2	22	86.1364	18.704	3.988

Mean Difference = -7.5649

Levene's Test for Equality of Variances: F= 1.934 P= .171

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	95% CI for Diff
Equal	-1.11	48	.271	6.799	(-21.239, 6.109)
Unequal	-1.16	47.26	.251	6.507	(-20.659, 5.529)

Asanuma Classification

Variable	Number of Cases	Mean	SD	SE of Mean
ASAN				
MODEL 1	27	4.4815	1.718	.331
MODEL 2	23	4.6087	1.588	.331

Mean Difference = -.1272

Levene's Test for Equality of Variances: F= .386 P= .537

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	95% CI for Diff
Equal	-.27	48	.788	.471	(-1.074, .820)
Unequal	-.27	47.65	.787	.468	(-1.068, .814)

t-tests for independent samples of MODEL

Variable	Number of Cases	Mean	SD	SE of Mean
COMMUN				
MODEL 1	28	47.6071	33.054	6.247
MODEL 2	23	66.9565	24.760	5.163

Mean Difference = -19.3494

Levene's Test for Equality of Variances: F= 5.523 P= .023

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	95% CI for Diff
Equal	-2.32	49	.024	8.335	(-36.103, -2.596)
Unequal	-2.39	48.63	.021	8.104	(-35.639, -3.060)

t-tests for independent samples of MODEL

Geba

Variable	Number of Cases	Mean	SD	SE of Mean
GEBA				
MODEL 1	23	6.9130	20.540	4.283
MODEL 2	21	3.4286	3.558	.776

Mean Difference = 3.4845

Levene's Test for Equality of Variances: F= 2.727 P= .106

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	95% CI for Diff
Equal	.77	42	.448	4.548	(-5.695, 12.664)
Unequal	.80	23.44	.431	4.353	(-5.522, 12.491)

Lock-In

Variable	Number of Cases	Mean	SD	SE of Mean

LOCKIN

MODEL 1	30	62.3000	29.976	5.473
MODEL 2	24	68.3333	25.354	5.175

Mean Difference = -6.0333

Levene's Test for Equality of Variances: F= 2.389 P= .128

t-test for Equality of Means					95%
Variances	t-value	df	2-Tail Sig	SE of Diff	CI for Diff
Equal	-.79	52	.435	7.675	(-21.438, 9.372)
Unequal	-.80	51.81	.427	7.532	(-21.152, 9.085)

t-tests for independent samples of MODEL

Integration

Variable	Number of Cases	Mean	SD	SE of Mean
INTEGRAT				
MODEL 1	28	36.2143	33.642	6.358
MODEL 2	21	67.6190	26.154	5.707

Mean Difference = -31.4048

Levene's Test for Equality of Variances: F= 3.925 P= .053

t-test for Equality of Means					95%
Variances	t-value	df	2-Tail Sig	SE of Diff	CI for Diff
Equal	-3.55	47	.001	8.857	(-49.226, -13.584)
Unequal	-3.68	46.92	.001	8.544	(-48.596, -14.213)

Input

Variable	Number of Cases	Mean	SD	SE of Mean
INPUT				
MODEL 1	29	34.0000	33.781	6.273
MODEL 2	19	63.6842	32.738	7.511

Mean Difference = -29.6842

Levene's Test for Equality of Variances: F= .179 P= .674

t-test for Equality of Means 95%

Variances	t-value	df	2-Tail Sig	SE of Diff	CI for Diff
Equal	-3.01	46	.004	9.851	(-49.518, -9.850)
Unequal	-3.03	39.51	.004	9.786	(-49.466, -9.902)

t-tests for independent samples of MODEL

Business Performance

Variable	Number of Cases	Mean	SD	SE of Mean
OBPERF				
MODEL 1	16	208.5000	54.028	13.507
MODEL 2	16	229.5000	38.967	9.742

Mean Difference = -21.0000

Levene's Test for Equality of Variances: F= .920 P= .345

t-test for Equality of Means 95%

Variances	t-value	df	2-Tail Sig	SE of Diff	CI for Diff
Equal	-1.26	30	.217	16.654	(-55.019, 13.019)
Unequal	-1.26	27.28	.218	16.654	(-55.178, 13.178)

Open Book

Variable	Number of Cases	Mean	SD	SE of Mean
OPBK				
MODEL 1	31	75.9677	22.284	4.002
MODEL 2	22	64.0000	30.168	6.432

Mean Difference = 11.9677

Levene's Test for Equality of Variances: F= 4.132 P= .047

t-test for Equality of Means 95%

Variances	t-value	df	2-Tail Sig	SE of Diff	CI for Diff
Equal	1.66	51	.103	7.199	(-2.488, 26.423)
Unequal	1.58	36.57	.123	7.575	(-3.385, 27.320)

t-tests for independent samples of MODEL

Openness

Variable	Number of Cases	Mean	SD	SE of Mean
OPEN				
MODEL 1	30	66.6667	21.147	3.861
MODEL 2	24	77.2083	20.538	4.192

Mean Difference = -10.5417

Levene's Test for Equality of Variances: F= .187 P= .667

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	95% CI for Diff
Equal	-1.84	52	.071	5.718	(-22.019, .935)
Unequal	-1.85	50.02	.070	5.699	(-21.992, .908)

Project Management

Variable	Number of Cases	Mean	SD	SE of Mean
OPM				
MODEL 1	16	173.1250	42.976	10.744
MODEL 2	17	186.0588	39.638	9.614

Mean Difference = -12.9338

Levene's Test for Equality of Variances: F= .248 P= .622

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	95% CI for Diff
Equal	-.90	31	.375	14.381	(-42.271, 16.403)
Unequal	-.90	30.38	.377	14.417	(-42.385, 16.517)

Total Quality Management

Variable	Number of Cases	Mean	SD	SE of Mean
OTQI				

MODEL 1	16	52.4375	16.677	4.169
MODEL 2	17	54.4706	17.274	4.190

Mean Difference = -2.0331

Levene's Test for Equality of Variances: F= .186 P= .669

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	95% CI for Diff
Equal	-.34	31	.733	5.917	(-14.104, 10.038)
Unequal	-.34	30.98	.733	5.911	(-14.091, 10.025)

t-tests for independent samples of MODEL

Supplier Process Design

Variable	Number of Cases	Mean	SD	SE of Mean
PCSDES				
MODEL 1	30	86.9667	25.636	4.680
MODEL 2	23	95.4783	6.515	1.358

Mean Difference = -8.5116

Levene's Test for Equality of Variances: F= 7.024 P= .011

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	95% CI for Diff
Equal	-1.55	51	.127	5.487	(-19.530, 2.507)
Unequal	-1.75	33.78	.090	4.874	(-18.418, 1.395)

Rover Process Knowledge

Variable	Number of Cases	Mean	SD	SE of Mean
PCSKNOW				
MODEL 1	30	55.5333	28.290	5.165
MODEL 2	23	58.8261	20.773	4.331

Mean Difference = -3.2928

Levene's Test for Equality of Variances: F= 3.515 P= .067

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	95% CI for Diff
Equal	-.47	51	.641	7.018	(-17.385, 10.800)
Unequal	-.49	50.93	.627	6.741	(-16.829, 10.243)

t-tests for independent samples of MODEL

Supplier Product Design

Variable	Number of Cases	Mean	SD	SE of Mean
PDTDES				
MODEL 1	30	40.9000	38.107	6.957
MODEL 2	24	68.9583	29.033	5.926

Mean Difference = -28.0583

Levene's Test for Equality of Variances: F= 7.167 P= .010

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	95% CI for Diff
Equal	-2.98	52	.004	9.418	(-46.962, -9.155)
Unequal	-3.07	51.90	.003	9.139	(-46.402, -9.715)

Rover Product Knowledge

Variable	Number of Cases	Mean	SD	SE of Mean
PRTKNOW				
MODEL 1	30	73.5667	22.440	4.097
MODEL 2	23	69.5217	23.409	4.881

Mean Difference = 4.0449

Levene's Test for Equality of Variances: F= .831 P= .366

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	95% CI for Diff
Equal	.64	51	.526	6.337	(-8.679, 16.769)
Unequal	.63	46.43	.529	6.373	(-8.786, 16.875)

t-tests for independent samples of MODEL

RG 2000 category

Variable	Number of Cases	Mean	SD	SE of Mean
RG 2000				
MODEL 1	30	1.6333	.999	.182
MODEL 2	24	1.7083	.908	.185

Mean Difference = -.0750

Levene's Test for Equality of Variances: F= .576 P= .451

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	95% CI for Diff
Equal	-.29	52	.777	.263	(-.603, .453)
Unequal	-.29	51.11	.774	.260	(-.597, .447)

t-tests for independent samples of MODEL

Tooling

Variable	Number of Cases	Mean	SD	SE of Mean
TOOLING				
MODEL 1	26	1.3462	.562	.110
MODEL 2	20	2.0000	.562	.126

Mean Difference = -.6538

Levene's Test for Equality of Variances: F= 7.015 P= .011

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	95% CI for Diff
Equal	-3.91	44	.000	.167	(-.991, -.317)
Unequal	-3.91	41.01	.000	.167	(-.991, -.316)

Trust

Variable	Number of Cases	Mean	SD	SE of Mean

TRUST

MODEL 1	30	66.8000	23.545	4.299
MODEL 2	24	79.2083	16.469	3.362

Mean Difference = -12.4083

Levene's Test for Equality of Variances: F= 2.978 P= .090

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	95% CI for Diff
Equal	-2.19	52	.033	5.673	(-23.795, -1.022)
Unequal	-2.27	51.18	.027	5.457	(-23.366, -1.450)