Innovation in teams: A qualitative and quantitative study of team behaviours

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Abstract

This thesis explores the processes of team innovation. It utilises two studies, an organisationally based pilot and an experimental study, to examine and identify aspects of teams' behaviours that are important for successful innovative outcome.

The pilot study, based in two automotive manufacturers, involved the collection of team members' experiences through semi-structured interviews, and identified a number of factors that affected teams' innovative performance. These included: the application of ideative & dissemination processes; the importance of good team relationships, especially those of a more informal nature, in facilitating information and ideative processes; the role of external linkages in enhancing quality and radicality of innovations; and the potential attenuation of innovative ideas by time deadlines. This study revealed a number key team behaviours that may be important in successful innovation outcomes. These included; goal setting, idea generation and development, external contact, task and personal information exchange, leadership, positive feedback and resource deployment. These behaviours formed the basis of a coding system used in the second part of the research.

Building on the results from the field based research, an experimental study was undertaken to examine the behavioural differences between three groups of sixteen teams undertaking innovative an task to produce an anti-drugs poster. They were randomly assigned to one of three innovation category conditions suggested by King and Anderson (1990), *emergent, imported* and *imposed.* These conditions determined the teams level of access to additional information on previously successful campaigns and the degree of freedom they had with regarding to the design of the poster. In addition, a further experimental condition was imposed on half of the teams per category which involved a formal time deadline for task completion. The teams were video taped for the duration of their innovation and their behaviours analysed and coded in five main aspects including; ideation, external focus, goal setting, interpersonal, directive and resource related activities. A panel of experts, utilising five scales developed from West and Anderson's (1996) innovation outcome measures, assessed the teams' outputs.

ANOVAs and repeated measure ANOVAs were deployed to identify whether there were significant differences between the different conditions. The results indicated that there were some behavioural differences between the categories and that over the duration of the task behavioural changes were identified. The results, however, revealed a complex picture and suggested limited support for three distinctive innovation categories. There were many differences in behaviours, but rarely between more than two of the categories. A main finding was the impact that different levels of constraint had in changing teams' focus of attention. For example, *emergent* teams were found to use both their own team and external resources, whilst those who could *import* information about other successful campaigns were likely to concentrate outside the team and pay limited attention to the internal resources available within the team. In contrast, those operating under task constraints with aspects of the task *imposed* onto them were more likely to attend to internal team resources and pay limited attention to the external world. As indicated by the earlier field study, time deadlines did significantly change teams' behaviour, reducing ideative and information exchange behaviours.

A second analysis assessed the impact of the teams' behaviours on the resultant innovation outcome levels. Statistical regression analysis indicated the importance of some of the behaviours for the achievement of highly innovative outcomes. The analysis revealed a complex pattern of teams' behaviours over the duration of the task, which indicated the changeable impact of behaviours on innovation levels over time. A model was developed indicating a temporal pattern of activity for innovative teams. This revealed how potentially negative activities, like time sensitivity, could be counteracted by more positive aspects, like positive feedback and personal disclosure.

The model shows an important behavioural progression related to innovate teams. This progression involved the teams' openness initially to external sources, and then to the intra-team environment. Premature closure on the final idea before their mid-point was found to have a detrimental impact on team's innovation. Ideative behaviour *per se* was not significant for innovation outcome, instead the development of intra-team support and trust emerged as crucial. Analysis of variance revealed some limited differentiation between the behaviours of teams operating under the aforementioned three innovation categories. There were also distinct detrimental differences in the behaviour of those operating under a time deadline. Overall, the study identified the complex interrelationships of team behaviours and outcomes, and between teams and their context.

Chapter 1
Introduction

1.1 Introduction to thesis

Interest in innovations has mushroomed over the last few years in response to its association with economic prosperity (Freeman and Soefe, 1997). Most research has concentrated on the individual or organisational level of analysis, with limited research concentrating on innovation at a team level. The most neglected area has been studies examining teams' processes and behaviours. This thesis concerns innovation processes in teams. The research aims to identify behaviours of teams that are important in successful innovation. In particular, the focus is on how time influences teams behaviour, to see whether the impact of behaviour varies during the performance of innovative tasks.

To date there has been much attention given separately to the topics of "innovation" and "teams". As a combined topic of study there has been relatively little work. For the purposes of this research two terms require definition. The first term is "innovation", which is define as being:

> *"the intentional introduction and application within a role, group or organisation of ideas, processes, products or procedures, new to the relevant unit of adoption designed specifically to benefit the individual, group, organisation or wider society"* (West and Farr, 1990: 9).

The definition of a team is developed from Weingart's (1997: 192) notion of "*co-acting work groups*" and defined for this thesis as being:

> "*a set of three or more individuals, who are interdependent in their activities necessary to achieve an innovative outcome for the unit of adoption*".

This thesis will review the salient research on the separate topics of innovation and teams, and explore the combined research on team innovation. Research will be discussed which involved an initial study of innovation teams in two automotive manufacturers as a means of identifying and confirming behavioural features of innovation in teams. These behaviours were then examined in a longitudinal experimental study of teams undertaking an innovative activity.

The research began with a pilot study of team innovation within an automotive organisation. This pilot study served two purposes. First, it identified the salient team behaviours and organisational context that impact on innovation teams. Second, it showed which behaviours are important to observe through the course of teams' innovation.

The second component of the research extended the pilot study, and built on the work of Gersick (1988, 1989). Her research involved an experimental simulation examining teams' behaviour. She identified changes over time of teams' focus of activity. She suggested that time deadlines appeared to play an important role in altering teams' behaviours. She also indicated the considerable interaction between the team and those outside it at specific times during the task's performance. Her work was, however, somewhat limited in the range of behaviours she studied. Nor, did she attempt to examine the statistical significance of any of the teams' behaviours in the achievement of more innovative outcomes.

Therefore, the second part of this research examined the behaviour of teams throughout performance of an innovative task. This longitudinal study of innovating teams investigated five types of innovative outcome and five main categories of behaviour, which included codes for twenty specific types of activity. The research expanded, as noted beforehand, Gersick's (ibid.) original range of codes for behaviours, to include aspects like teams' goal setting and a wider range of innovative actions. The study explored the impact of time deadlines on teams' behaviour and innovative outcomes.

Previous studies, and the pilot research, had suggested that the imposition of innovation, in terms of what the outcome should be, as opposed to the teams being free to decide the best result, altered the teams' behaviour. This study investigated this latter issue through the utilisation of King and Anderson's (1990) three categories of team innovation. They distinguish between the team being free to develop an idea (*emergent*), having the outcome imposed on them (*imposed*), or adopting it from another source (*imported*). The research compared the behaviours and innovative outcome levels of six experimental conditions. The six experimental conditions comprised the random allocation of individuals to a team operating under one of King and Anderson's (ibid.) three categories. In addition, half of each of the teams per category were given a time deadline for completion of their innovative task. In total forty-eight teams were examined, eight per experimental treatment.

The research findings indicated different patterns of behaviour for the six distinct types of teams. It did not show, however, discernible differences in the innovation levels the distinct types of teams achieved. A significant impact on innovation levels was found for those operating under a time deadline. Like Gersick (1988, 1989), it did indicate changes in behaviour over the progression of the task, but more importantly, the study revealed that the impact of these teams' behaviours on innovation levels varies over the course of the task. Based on these findings, a model showing this complex interaction between task progression, behaviours, and innovation outcome has been developed.

This thesis, in concordance with Gersick (1989) also revealed the importance of looking outside, rather than just within the team, when studying innovation and behaviour. Due to the complexity of studying team phenomena, there is an ongoing problem with traditional psychological approaches to teams, in which researchers have often chosen to treat the team as the main focus, and therefore, failed to pay adequate attention to the context in which it is operating. In doing so, they have assumed that the team is somehow isolated from the rest of the organisation, and thereby unaffected by for example political activities that impact on the behaviour and motives of others in the rest of the organisation. This study identifies the importance of those relationships outside the team their activities and also the role of internal team relationships in achieving successful team innovation. It highlights aspects that deserve more attention both in the field and laboratory.

1.2 The research problem

The research aims to use qualitative and quantitative methods to examine the behaviour of innovative teams. A literature review was carried out, reviewing research on innovation at the individual, team and organisational levels. It identified many factors that are important in the study of innovation. It showed the significant contribution from the wider study of teams in assisting and informing research looking at team level innovation research. It also revealed some of the inherent conflict and contradictions that have emerged from earlier studies and have stifled progress in this area.

The prime aim of this research was to identify the behavioural factors and temporal dimensions important in team innovation. The pilot study was conducted in the motor industry. This is a sector that is known in the U.K for its innovation in processes, products, technology and administration. This is also a sector that was the first actively to utilise teams in problem solving and innovative tasks in the U.K. It is, therefore, a sector which positively links teams and innovation.

The experimental study attempted to answer three main research questions. First, are their discernible differences in the behaviours of teams operating under King and Anderson's (1990) three distinct categories (*emergent, imported, imposed)* of innovation? Second, what impact, if any, do time deadlines have on a team's activities, and innovation outcome? Third, what is the relationship between teams' behaviour and innovative outcomes, and does it change over the course of the task?

The motor industry pilot study revealed some distinctions between the behaviours of teams in King and Anderson's (1990) three innovation categories. The distinctions were, however, limited. In order to explore the distinctions between teams operating in these categories it was decided to study them in a controlled setting. In the experimental study these three categories were used as independent variables, to examine whether different innovative behaviours and/or outcomes emerged for each.

The second issue of the experimental study was to investigate a further aspect that emerged from the pilot study, namely the impact of time deadlines on innovation teams' behavioural processes. The final element was to identify which behaviours led to more innovative outcomes. This final aspect developed Gersick's (1988, 1989) work by more precisely identifying which behaviours were important for innovative teams. It also revealed whether the impact of behaviours on innovative outcome varied throughout the task. Thus, the research indicated patterns of behaviours that are associated with different levels of success for innovation teams.

1.3 Justification for the research

The study draws on earlier theoretical and practical work. First, King (1990) and Anderson (1992) have noted the relative dearth of longitudinal work exploring team innovation. They have led the call from more research in this area. In particular, they have highlighted the need for more work looking at teams as they engage in innovation activity. This is important if we are to identify patterns of behaviour that are significant in differentiating between levels of innovation. Second, Gersick's (1988,1989) studies on teams are central in suggesting the key impact of external agents and of time in shaping teams' behaviour. She did not, however, look at the impact of behaviours on teams' innovative outcome, and, therefore, this study aims to identify whether behaviour has a significant influence on teams' innovation levels. Third, we need to examine more closely links between teams and context in shaping innovation. The questions that are to be addressed in this research include: How important is external contact in shaping team processes? Does the teams' utilisation of external assistance vary throughout the task? Can innovation levels be raised by identifying for organisations when, and how, to best deploy external assistance for their teams? How far do deadlines affect different team processes in innovation? Do deadlines have a detrimental impact on innovative outcome? Are there differences between *emergent, imposed* and *imported* innovation? What impact do they have on innovation levels? Are there distinct ways organisations should assist these different types of teams? What behaviours are important in innovation processes? Are these behaviours always beneficial, or does their impact vary throughout the course of the task? Can patterns of behaviour be identified that can form the basis of training to increase teams' innovation levels?

The following section gives a brief account of each of the chapters.

Chapter 2

This chapter begins by examining the literature regarding innovation and teams. It outlines a wide range of potentially important aspects of teams and innovation. It indicates the need to look at both antecedent and processional aspects of innovation for teams if we are to prevent the contradiction and confusion that has dogged earlier work. It sets the context for the research that has gone before by reviewing and identifying important findings. This creates in more detail the theoretical basis for the current thesis.

It reveals the importance of the longitudinal study of teams. This is, however, a challenging area for study, particularly within an organisation, as it becomes difficult to both isolate and control the different variables that may impact on a team. The review suggests the importance of the longitudinal experimental studies as a means of gaining greater insight into the complex process of how teams' antecedence and processual factors interact. A central question emerges regarding the importance of the interaction between the teams and their environment. The agenda for this research was, therefore, established.

Chapter 3

In this chapter the methodology utilised in this study of team behaviours for innovation is explored. The methodology for each of the two studies is outlined. This highlights the importance of the pilot study in identifying features to be included in the experimental research. The chapter focuses on the generation of the behavioural code-book for each of the studies. It examines the approach taken to the laboratory study's design and how the different experimental conditions were established.

An important question that is addressed is how, given the different competition times for these teams, the behavioural data is standardised into percentiles based on quartiles of activity to enable statistical analysis. There is also a discussion of the measurement of innovation outcomes. The five categories rating tool, as developed by West and Anderson (1996), is identified for application in the experimental study. The link between the two studies and the research agenda is made.

Chapter 4

This chapter begins with a brief introduction to the two organisations in which the initial study was conducted. Both organisations are U.K. based, one Japanese owned and the other American. It describes the working practices found in each in more detail. Then, the application of teams for innovation within the two contexts is explored.

The data collection is by qualitative techniques involving semi-structured interviews. Teams operating within the Japanese automotive organisation are examined first, followed by the American organisation. The reliability of the code-book for each of the organisations is reported. There is a discussion of the themes generated from each organisation, and then a comparison on an intra-organisational basis of these issues. The emergent themes are also considered in the light of the literature.

The pilot reveals a number of important aspects. This includes the different use of procedures, both for facilitating and disseminating innovations. The potential impact of procedures on innovative output is identified. Challenges are made to Pascale's (1990) assertion that double loop learning is more common in Japanese rather than American firms. Organisational and team influences in shaping innovation within the two contexts are debated, in particular the differences in climates. The study indicates limited distinctions between King and Anderson's (1990) three innovation categories. The pilot also identifies the importance of looking at multiple, and not unitary, activities of innovative teams in order to gain a greater understanding of innovation processes in teams.

The issues from the organisations studied of team innovation, which are to be explored further in the experimental study are outlined. These include design considerations for the laboratory based study. Part of the experimental design is to examine behavioural and outcome differences of King and Anderson's (1990) three types of innovation, so these aspects are experimental conditions. Further issues are the inclusion of an external information source for the teams to utilise, and the imposition of a time deadline to assess the impact on innovative activity. In addition to design elements, items of behaviour to be observed are highlighted including, general and specific ideative behaviours, objective setting, leadership, boundary spanning, relationship building, humour and information exchanges. This leads into the next two chapters, which focus on the experimental study.

Chapter 5

In this chapter the experimental research is discussed. The generation of the code-book is reviewed and the reliability of the coding is established. This chapter provides more detail on the independent variables in the study (type of innovation and time deadlines). The experimental teams' behavioural outputs are compared on the basis of the King and Anderson's (1990) three types of innovation and of the importance of time deadlines. No attention is given at this point to the impact of teams' behaviour on innovation outcome, which will be undertaken in the next chapter.

Given the different finishing times of the distinct categories of teams the behavioural data is prepared for analysis into a standardised unit of percentiles of activity per quartile. This identifies the proportion of time a team spends in performing one behaviour in relation to the others. This unit is expressed as a percentage of activity for a set temporal unit.

The analysis undertaken uses analysis of variance technique to examine the behavioural differences between the distinct teams. The analysis is used to identify whether there are differences in the proportion of time the different type of teams spend on different behavioural activities. Finally, comparing teams' behaviour across all of the quartiles, a repeated measure analysis of variance is used to identify changes in behaviour across the distinct categories of teams.

The chapter indicates the statistically significant differences across the distinct types of teams. Overall, although variations exist between the King and Anderson's (1990) three categories of team, they are limited. There are some significant distinctions in the different foci of attention between the three team categories is identified. *Imposed* teams' show a more marked external focus, whilst *imported* tend to be more internal in their attention. *External* teams, in contrast, show attention towards both.

Five distinct change patterns for the coded behaviours are found revealing different trends over time. In addition, some particularly important codes emerge, which require further attention in field based studies. These include external interaction, some ideational aspects, directive, processual, information sharing (task and personal) and time sensitivity. Finally, confirmation is found for the pilot observation of the significant role of external time constraints in changing teams' behavioural patterns.

Chapter 6

This chapter describes the second part of the analysis of the experimental study. This examines, through stepwise regression, the link between teams' behaviour and innovation outcomes. The five innovation outcome ratings made by expert raters of the teams' posters are used as the dependent variables to test whether highly innovative teams have different patterns of behaviour than less innovative teams. The analysis investigates the relationships between innovation outcome and overall frequency of behaviour, within specific phases of time and over the entire duration of the task.

The study reveals that between thirty-eight and seventy-three percent of the variance in the five innovation outcome ratings is explained by the behavioural aspects of teams. Innovative behaviour *per se* is not found to be of major import, instead a changing combination of behaviours that emerges at different times is found to be associated with highly innovative team outcomes. Thus, the study identifies different types of behaviour that are important at different times in the innovative task.

The findings suggest the important role of three types of openness in fostering innovation. These aspects include openness, to ideas, to support from external sources, or the resources from team itself. To concur with this, behaviour focusing on closure, like final idea contributions, which occurs early on in the task, reduces innovative outcome. Thus, there is a balance between excessive openness and premature closure to be developed.

Chapter 7

In the final chapter the two studies are drawn together. The findings from both the quantitative and qualitative parts of the research are discussed. A model reflecting the complex interactions of different behaviours at different stages in the innovative task is identified as emerging from this work.

The model indicates at the on-set of the task the importance of external help for innovative teams, assisting them to clarify their goals, providing specific information and indicating previously successful ideas. In addition to external assistance, the research clearly highlights the role of intra-team support in creating the best atmosphere for innovation to occur. Of particular consequence are two aspects of behaviour generated from within the team; positive feedback between members and the disclosure of personal information. These are identified as making a valuable contribution to the development of trust within the group, which can be seen as an antecedent for ideation. There is a discussion of the research and practical implications of the model.

Linkages are made between the present findings and the previous literature. Corroboration of, and challenges to, the existing research are identified and discussed in detail. Suggestions are made with regard to possible improvements to the present study and some proposals as to how further study into team innovation might be pursued. The use of on-going experimental work is suggested, and also an exploration of the current findings within an organisational setting.

Chapter 2

Literature review

2.1 Introduction

The study of innovation is quintessentially eclectic in nature, covering a diversity of fields including amongst others psychology, management science, technology and engineering. It is possible to divide the current interest into popular prescriptive texts, focusing on how the processes should be managed, through to the more burgeoning academic focus. Innovation at its simplest can be viewed as a critical strategic business response to environmental changes, with an emphasis on best practices. Governments increasingly regard innovation in terms of its wealth creating potential and they have sponsored initiatives like "Technology Foresight" in this country (Slappendel, 1996).

Over the last two decades the research examining innovation has mostly considered the topic from either an organisational or an individual perspective. This has been in stark contrast to the relative paucity of work examining the role of group innovation in organisations. There has been renewed interest, however, in teams at work, including the topic of innovation in teams.

This chapter examines the literature that informs the current research. The review will begin by exploring work pertaining to innovation, focusing first on definitions of innovation. We will then consider the aims of this research, before providing an overview of the three levels at which innovation study is conducted, namely the individual, organisational and the team. We shall then look in detail at the team level, identifying two main aspects of research exploring the innovation antecedent and processes issues. We shall then turn our attention to more psychologically based research on teams, looking at features such as communication, and examine the links between team effectiveness and behaviour.

2.2 INNOVATION

Research into the topic of innovation has enjoyed a long history since it first came to prominence in the Victorian era with Goulton's (and others') interest

(Henry and Walker, 1991). Guildford (1959) revived it this century. Recent work (Slappendel, 1996:107) highlights the tendency to "objectify" the concept of innovation, for example, to describe the latest car or microcomputer. Despite this, Slappendel (1996) notes the agreement from researchers as to wide range of forms that innovation can take. Anderson and King (1993), in their review, describe innovation as elusive to define. The many definitions innovation has acquired are often dependent on the level of analysis deployed (West and Farr, 1990). To compound this complexity, some authors have used the term innovation interchangeably with an other "creativity". Ford (1995:16) regards each term as separate elements and argues that "reviewing these studies together is like comparing apples and oranges". We shall now explore the differences between the two terms in more detail before going on to look at the links between innovation and learning.

2.2.1 Distinctions between innovation and creativity

There have been many attempts at defining innovation. At the simplest level, innovation can be regarded as a more relative concept, whilst creativity tends to be defined in terms of absolutes. Both terms, however, have been ill defined and are, Rickards (1991:97) argues, in danger of collapsing into " a single blurred catch-all concept".

Rickards (1991) goes on to challenge the simplistic linear taxonomy of a "dual process", that incorporates an initial creative phase followed by a reduction in creative input during the implementation phases. He notes how evidence for such a unitary process, which we shall examine later, is limited, but continually reinforced by implication in a range of models (e.g. Amabile, 1988; Majaro, 1988). A more valuable taxonomy is attributed to Rhodes (1961) who proposed four overlapping dimensions of "person, product, process and press (by which he means environment). Each of these concerns a different aspects of creativity, be it in terms of creative people, products, processes and systems or a creative environment. Although he argues each is distinct conceptually, they are functionally interwoven.

King (1995:82) regards the two terms as "clearly associated" and "overlapping concepts", but importantly argues that they are "not interchangeable", and that their connection is neither "straightforward" nor "linear". Kanter (1988:205) highlights that the two terms are inextricably linked, as "kaleidoscope thinking", with the cross fertilisation of creativity activating innovative thinking. Staw (1990:295) defines innovation as "the summation of the creativity of the individuals making up the organisation". Rickards (1991: 105) argues that there are important "practical and theoretical" advantages in clarifying and recognising the distinctions between the two terms. He highlights important distinctions between the two that when overlooked will prevent new insights and understandings being achieved. In line with this Rickards (1996: 14) suggests the need to look afresh at innovation from a "interpretive" perspective, challenging simple linear assumptions and instead exploring a "socially embedded reality". By adopting this new paradigm, he argues we have to re-consider our understanding of "creativity, planning and the nature of the innovation process." How then can we differentiate between the two?

In reviewing the literature five distinctions between innovation and creativity emerge. These include what aspects of the process are included, degree of novelty, impact, type of process, and mutual exclusivity. Although King (1995:83) considers both to be a process, the first difference between the two can be found in examining where the process begins. Most researchers concur that creativity is about the development of ideas, whilst innovation is far more concerned with their application (Amabile, 1983; West, 1990,1995; King, 1990). However, many researchers have blurred this distinction. For example, West (1995: 71) argues that creativity is the "development and application", whilst innovation is "application".

In reviewing the research, the second most evident divergence concerns the degree of novelty. Most researchers concur with Slappendel (1996) who considers creativity to be primarily concerned with the new and completely original, whereas innovation is more focused on the novelty of the application.

In looking in more detail at the issue of novelty, one of the central difficulties can be found in attempts at its assessment. Ford (1995: 17) argues that creativity is not a quality that can not necessarily be "measured like height or weight" instead, it is a subjective judgement. Part of the difficulty with measurement is the identification of acceptable judges, who do not bring their incumbent biases and value-laden judgements to their assessment. He suggests that the meaningfulness of calculations of creativity increase when others share them. In turning our attention towards innovation, we find it is similarly beset with problems concerning the adequacy of measurement (Rickards, 1996), however, this in part is resolved by the next distinction between the two. [The question of innovation assessment will be discussed in more detail later in the chapter.]

A third differentiating feature between the two lies in the potential level of impact. King (1995:83) indicates that innovation "is introduced into an organisation with the intention of changing or challenging the status quo" and, therefore, its impact may result in a transformation that radiates over a large area and to more than one person. In contrast, creativity has a far more variable impact. It may in some cases have a minute impact by affecting only the creator, or, like innovation, its outcome may be felt by a far wider group. Thus, the distinction between the two may sometimes become blurred when creative ideas have a large impact.

The fourth area of difference resides in the type of process each involves. As noted earlier Rickards, (1991; 1996:22) indicated the inherent danger of reducing the process to simplistic linear models. Instead, he proposed that a "baton passing" paradigm, which commences with creativity, and is followed by the more routine aspects of innovation, is less than helpful. Such approaches, he suggests are "deeply flawed" with their tendency to over focus on "eureka" moments, with the result that the process is not seen as unified, in which ideas and actions are continually inter-connected .

The distinction in terms of process can be divided into two further features. One important distinctive characteristic of process type emerges from identifying who is involved. King (1995:83) distinguishes between creativity as being an individual process which is confined to the individual's internal world, whereas, innovation is defined as being an organisational activity.

A second sub-element of process is the form deployed. Research on creativity has tended to regard it as a cognitive process. Majaro (1988:6), for example, defines creativity as being a "thinking process used to generate ideas", whilst innovation is seen as "the practical application of such ideas towards achieving management objectives". Innovation is, thus, defined as a more pragmatic process, occurring to fulfil a specific function, or need.

What is striking on closer examination of the literature on the type of process is the lack of cognitive based psychological interest in creativity, perhaps in response to the problems of researching a process that is itself difficult to access (Ford, 1995; Kaufmann, 1988). Csikszentmihalyi (1988, 1990:205) suggests that part of this inherent complication lies in attempts to study the role of incubation, or unconscious processes of creativity which occur during idle time. Isaksen (1988), however, warns of the temptation to define the creative processes in mystical or magical terms, thus, as Rickards (1991: 102), points out placing them solely in the preserve of "exceptional people". Despite that warning, the dearth of work examining unconscious creative processes is unfortunate given creativity's integral role in problem solving (Kaufmann, 1988; Cyert and March, 1963).

In contrast the processes of innovation, as noted before is a more social one (Rickards, 1991; King, 1995). As such it does not presuppose cognitive attributes, and instead concerns itself more with external and group focused activity. Thus, as Rickards (1996: 21) notes, interest in innovation includes examination of the different roles individuals play in the process, particularly the "hybrid" part of boundary spanners, which will be examined in more detail later. However, a universally acceptable distinction between creativity as a solo activity and innovation as a collective one is far from being achieved, but as Rickards (1991) argued it may a promising theoretical distinction. Many authors (West, 1990; Ford, 1995; King, 1995) have identified creativity as extending outside the bounds of the individual to incorporate the result of group activity as well. Thus, we can not argue that creativity is irrefutably a solo activity.

A fifth area of difference between the two is found in the work of Amabile (1983, 1984). Amabile argued that creativity is facilitated by intrinsic motivation, in which activity is undertaken for its own sake. In contrast, innovation is, she suggested, extrinsically motivated. Her work indicates that factors associated with extrinsic motivation, in the forms of trying to avoid punishment or gain reward, actually inhibit individual creativity. Some tangential support is found in work at the organisational level, which has identified that different factors are associated with either creativity or innovation (Damanpour, 1995; Nystrom, 1979). Nystrom (1979) found in his study of a Swedish organisation, that climates that were conducive towards creativity were not necessarily those that resulted in innovative outcomes.

Although these five broad areas of difference between creativity and innovation have been identified, the two concepts are far from discrete. There are often indistinct boundaries between the two. In part this is a product of the wider, more all encompassing process of creativity, which for some authors includes both the development and also the practical application of ideas. More commonly, however, the reason the two are indistinguishable is caused by researchers who persist in blurring the distinctions by using the terms interchangeably. As Rickards (1996) notes this failure to adequately demarcate the two issues has a potentially profound impact on both theory and practice. This is especially the case if we break with existing paradigms and start to explore creativity, innovation and planning as distinctive aspects which have a meaning constructed from social actions. For some researchers a central limitation of work focused on creativity is its failure to consider creativity within an organisational setting (Ford, 1995), whilst the link between innovation and organisations is far more apparent.

This research takes as its focus the application of ideas by teams, and is more concerned with looking at the innovation process than creativity *per se*. In this literature review creativity will be discussed again in an appraisal of individual level research. We shall now go on to look at definitions of innovation.

2.2.2 Defining innovation

West and Farr (1990) offer the most in-depth definition of innovation, building on Zaltman *et al's* (1973:10) definition of innovation as "any idea, practice, or material artefact perceived to be new to the unit of adoption. Rickards (1991: 105) offers a simpler definition in regarding innovation " as a social process of a non-routine kind". Through this definition he identifies the importance of interrelationships between participants and divergence from the status quo as important features of innovations. West and Farr, choosing to avoid any debate regarding improvement verses innovation, take a more purposive and relativistic stance. They argue that innovation is an intentional introduction of ideas, products or procedures which are new insofar as they are novel to the unit of adoption. ." As Rickards (1996) notes, this purposive activity may be wholly, or partially planned. Thus, they define innovation as:

> *"the intentional introduction and application within a role, group or organisation of ideas, processes, products or procedures, new to the relevant unit of adoption designed specifically to benefit the individual, group, organisation or wider society" (p. 9).*

If we examine this definition in more detail, it is clear they have deliberately restricted innovation to include only intentional developments, thereby precluding any chance or accidental evolutions. They have highlighted its deliberate and purposeful function, and emphasised the positive intent of the innovator. The definition includes a wide array of potential beneficiaries, both within and outside the organisation. West and Farr (1990) emphasised an idea's novelty and originality as important only to the unit adopting it. Thus, through highlighting the issue of novelty the definition makes an important distinction between innovation and creativity. For innovation, novelty is defined in relation to its context and the potential importance of novelty imported from a different context emerges. Drucker (1985) uses the phrase "creative swiping" to describe this, by which he means "stealing" creative ideas. West and Farr's (ibid.) definition incorporates both tangible and less concrete consequences of innovation, leaving the scope of outcomes deliberately wide. This definition widens the scope of ideas of what constitutes an innovation, such that it is not a term confined to new technology. The definition encompasses only the positive intentions and the applications of the innovation, excludes malicious or destructive ideas. Finally, it does not require actual benefits, successes or otherwise of the venture.

This definition of innovation eschews mention of creativity, although as Rickards (1996: 105) suggests creativity is "associated" throughout the innovation process in complex ways. As indicated, however, in the previous section, the adaptive and social elements of innovation are the primary foci of this thesis. Therefore, attention will be paid to trying to understand the dynamic role of social relationships in generating and implementing innovation. Thus, we will explore how behaviour between people in teams, and characteristics of the context, influence the development and application of innovations. The complex conceptual puzzles about the interconnected meanings of creativity and innovation are not directly related to this exploration.

2.2.3 Types of innovation

There have been several attempts to classify types of innovation in terms of distinctive factors. Anderson and King's (1993) review highlights three main typologies. The first of these are sociotechnical systems typologies, as developed by Dampanour (1984, 1990), Evan (1966) and King and West (1992), who distinguished between technical and administrative innovations. Kanter (1988) broadened this by linking different types of innovation to distinctive types of organisation, rather than sociotechnical based differences, including product, process, technical, administrative, evolutionary and revolutionary innovations. She identifies product innovations as being associated with new market entrants and the earlier stages of a product, whereas process innovation, she argues, is more commonly found in established organisations and mature markets. Further distinctions are made regarding technical innovation within organisations, which are associated with abundant resources, and administrative innovations, which occur when there are scarce resources. Finally, evolutionary innovation, Kanter argues, is more common in formalised and centralised organisations, whilst complex and decentralised organisations are more likely to generate revolutionary innovations.

The second set of dimensions are those described by researchers who are concerned with defining the characteristics of innovation. The most prominent is Zaltman *et al* (1973) who developed the categories of "programmed and non-programmed", this distinguishes between those that have been planed in advance. The second distinctions were made between "slack and distressed innovation", which highlights differences in the availability of resources and the necessity for innovation. The final distinction is between "instrumental and ultimate", which distinguishes between those innovations that facilitate subsequent innovations and those that are an end in themselves. West and Anderson (1992), in their work on innovation in the N.H.S., categorise innovations in terms of their magnitude, novelty, radicalness, and effectiveness. These differentiate the impact of the innovation in terms of the level of impact on the status quo, the source, the level of departure from what is know and the subsequent positive impact on the organisation. The third type of categorisation involves looking at innovation in terms of its source. This includes King and Anderson (1990), who identified three distinct sources: those that emerge from within, and two that come from outside the unit, including those that are voluntarily adopted, and those that are imposed. We shall now look in a little more detail at the scope of the innovation process.

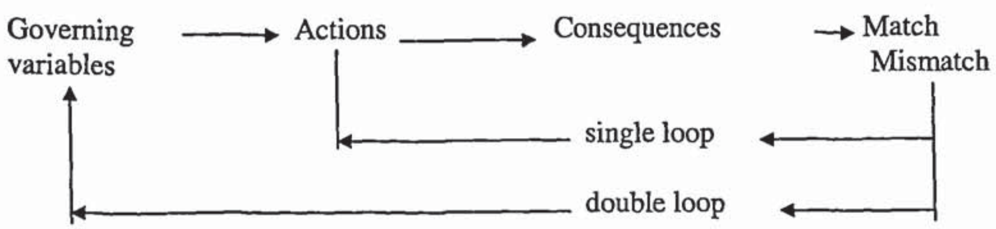
2.2.4 Innovation as change and learning

Some researchers have suggested that innovation processes can be considered as synonymous with organisational change (e.g. Pennings 1998; Tidd *et al*, 1997). These researchers have explicitly linked innovation with invention and organisational change, thus, placing the locus of innovation outside the intentions of organisational actors and as part of a wider change initiative. This links strongly into the sources of innovation categorisation.

Tidd *et al* (1997) argues for two dimensions of innovation. These include level of change and the degree of novelty involved. Eschewing intention and creativity, von Hippel (1988) highlights the link with the external. He considers innovation to be an incremental process in which organisations learn (or fail to learn) from triggers in their external environment. Both of these highlight the importance of innovation as altering the organisation, it is the source of this transformation that is of particular importance.

Interest in how organisations change and learn has increased over the 1980s (Argyris, 1982). Argyris identified two distinct types of learning. The first, defined as single loop learning, involves the rectification of a mismatch between desired and actual states. A far more profound level of learning is achieved through a double loop process. In this, although a mismatch again is identified, a closer questioning of underlying values is possible. This provides the basis for the double loop.

Figure 2.1:Argyris (1982) Model of learning



Argyris (1982) argued for a link between innovation and learning, pointing out that in organisations, learning, effectiveness and innovation capability were positively linked. He is also highlighting the need to assess the impact, or level, of change that innovation produces.

His idea of linking innovation, effectiveness with levels of learning has received some support from research in the automotive sector by Pascale (1990), who established a similar dichotomy regarding learning, relating each learning type to an innovation outcome. The first category called "small l", focused on incremental improvements in baseline performance and was found in a U.S. organisation. By contrast, the second type of learning, "big L" was identified within a Japanese organisation. A further issue that emerges from this dichotomy of learning is the possibility of a similar distinction in terms of innovation. Pascale's final big "L" type of learning encompassed radical shifts in what constituted the base line of organisational performance.

A similar classification can also be found in the innovation literature, which distinguishes between different forms of change makes a distinction between incremental and radical innovation. Bessant (1992) highlighted the importance of incremental improvements in producing competitive success. Colewell (1996) suggested a link between competitive advantage and type of innovation strategy. He proposed that the more radical the innovation, the higher the strategic risk. He described how more radical ideas cross an "innovation boundary", which break the continuity in the organisation, thereby increasing the risk incurred. The dilemma for the organisation, he argued, was that the greater the competitive advantage produced from the innovation, the larger the degree of risk associated with it. Through this model he distinguished between "improvements", which do not pass the innovation boundary, from more radical and risky initiatives which he labelled "innovation".

Linked to Colewell's (1996) findings and those relating to learning, Bouwen *et al* (1992) identified the problem of continuity created by innovation. They present a model showing the tensions between innovation, change and learning. Learning is a form of change. They suggest that the more radical that change, the more profound its impact, and the more the organisation resists. Changes to the organisation's baseline, or fundamental values, which they identify as "dominant logic", are accompanied by breaks in the continuity for any organism, as it seeks to accommodate or assimilate the new information into its existing knowledge. This creates an inherent tension. Through their model Bouwen *et al* identify how incremental innovations are more easily accepted by organisations as there is less required in terms changing the way organisation members think. Thus, the dominant logic remains intact. This concurs with Colewell's suggestion of the boundary that is cross during innovation.

Figure 2.2: Bouwen *et al* (1992:123) model of innovation management

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We shall now go on to summarise the focus of the research before reviewing the literature in more detail.

2.3 Aims of the current research

This review of the literature will demonstrate that sparse attention has been paid to the whole process of group innovation, despite the obvious commercial and organisational benefits. Part of the reason behind this is the failure of researchers in innovation to understand the complex nature of groups themselves. The current study will look at this kaleidoscope of influences in more detail. In the past, there have been limited attempts to understand the literature surrounding team effectiveness, communication and conflict in its own right. This situation has not been helped by the myopia of researchers who have not treated team investigation as a stand-alone category of study. Instead, they have attempted to look at teams as either an extension of individual innovation findings, or as the basis for reducing organisational level research (for example, Slappendel, 1996). This merely serves to overlook the complexities of studying team levels of analysis. It does teams and their organisations a great disservice and, in some cases, confuses already complex issues. The current research aims to look at the innovation at the group level and, therefore, a later part of this review (see 2.6) will examine team level literature that is necessary in researching teams and innovation in their own right.

This research aims to examine the behavioural processes of innovation within teams. Two important works stand out in this review. The following literature will support Gersick's (1988, 1989) approach to team processes, which explored teams by using an experimentally based study. Her work, however, focused on a narrow range of behaviours, whereas West (1990) identified many more behaviours important for team innovation. In this study, through the use of a pilot study based within organisations, important features of teams' behaviour will be confirmed and included in an experimental study.

The aim of the experimental study will be to explore the behaviours of teams as they innovate. This second aspect of the study will also draw on the second main theory of King and Anderson's (1990) and examine whether there is evidence of distinctive differences in the behaviours for three categories of team innovation, *emergent, imported* and *imposed.*

Through combining these aspects it is hoped to gain a better understanding of teams' innovative processes, by identifying realistic contextual aspects and behavioural dimensions. The following section examines the literature, which has informed the approach taken in this work from both innovation and team perspectives.

2.4 Researching innovation

In examining research into innovation two broad categories can be identified; first, attempts to identify antecedent determinants, and second, endeavours at understanding the innovation process. Staw (1984) suggested a classification, which can be superimposed onto innovation, identifying three levels of study, from individual, to groups and the organisational. This provides a useful framework for this overview. Brief attention will be paid to individual and organisational aspects in order to give a context, before we look in more detail at research regarding teams.

2.4.1 Individual innovation studies

A central problem, as noted earlier with research focusing at the individual level, is the inter-changeability between the terms "creativity" and "innovation". This inevitably shifts the emphasis, away from the social towards the individual's cognitive processes. Much of the earliest work concentrating on the individual has been dismissed as "narrow and trivial"

(Sternberg, 1985:132). The study of innovation has increasingly been viewed as a multi-faceted phenomenon, with the development of the field being viewed through the antecedent/ process dichotomy (King, 1990).

2.4.1.1 Antecedent studies

Research seeking to identify antecedent determinants at an individual level, has tended to focus on the term "creativity". This review will initially highlight particular aspects of the more abundant research on creativity, before going to examine individual innovation studies in more detail.

Early efforts within this field were often devoid of theory as they concentrated on studying the exceptions, by focusing on a few selective creative geniuses such as great painter, artists, etc. This trend has led directly to attempts to identify specific personality traits, situational and social factors. This approach has not, however, been without its critics, Ford (1995:14) considers the "myopic" interest that seeks to identify the individual differences that underlie creativity as a serious limitation to research in this area. He argues that the focus on the individual and their creativity has been at the expense of the context in which it occurs.

Sternberg (1988) proposed a three factor approach for the analysis of creativity as personality dimensions, incorporating intelligence, intellectual style and personality attributes. The personality traits he emphasised were those of tolerance of ambiguity, tenacity, risk taking and desire for recognition. Traits suggested by other researchers have included: desire for autonomy (McCarney and Edwards, 1973), social independence (Kaplan, 1963), and anxiety (Wallach and Kogan, 1965).

In turning our attention now towards specific work that has been concerned specifically with innovation, many scales have been developed which are designed to measure individual innovation levels; for example, Kirton's (1976) Adaptation-Innovation inventory (KAI), which distinguishes between adaptors, who are "doing things better" and innovators, who are "doing things differently"; or the Jackson's Personality Inventory (JPI) (1976) with an

Innovation sub-scale (JI) focusing on identifying both individual creativity and innovation. Much debate surrounds the psychometric robustness of these tools, particularly the KAI, especially in terms of its factorial structure (Goldsmith, 1985; Kirton, 1978; Foxall and Hackett, 1992) and its failure to include the impact that social and organisational factors may have on innovating individuals (Goldsmith, 1986). A recent addition to these measurements by Patterson (1999) has switched to targeting a practical application for a tool, most notably for selection, in which recruiting those with a higher propensity to innovate is seen as part of the organisation's competitive advantage. Her four factor model builds on Sternberg's aforementioned ideas about creativity and includes "motivation to change" and "challenging behaviour", "consistency of work style" and "adaptation".

Aside from personality aspects, a range of situational factors have been identified affecting individual innovation. These include managerial support and freedom (Farris, 1973; Pelz and Andrews, 1976), "positive affect" in terms of participative leadership (Isen *et al*, 1987; Kanter, 1983, 1989; Peters and Waterman, 1982), communication (Payne and Pheysey, 1971), feedback and recognition (Amabile, 1984; Glassman, 1986) and non-hierarchical organisation structure (Kanter, 1983; Lovelace, 1986). Helson's (1988) review emphasises the importance of the context in which individual creativity and social aspects of innovation.

2.4.1.2 Process studies

There have been limited attempts at developing a process framework for individual innovation and creativity. Notable exceptions have included Jones' (1987) information processing model which indicates potential blocks to creativity in the form of values, strategy, perceptions and self-image; Lovelace's (1986) attempt which was based on Maslow's hierarchy of needs, and which hence has some application limitations in real life (Steers, Porter and Bigley, 1996:12); and Amabile's (1983) social psychology model of creativity, which concentrates on differentiating motives for creative action in terms of the components of *"task motivation", "domain-relevant skills" and "creative-relevant skills"*, whose roles vary at different stages. All of the attempts to model individual process have neglected social factors. This includes the attempt by Amabile, who only included external motivation as a creativity inhibitor.

King (1990), in his review, charts the five determined attempts, spanning 70 years, to model individual processes (Wallas,1926; Basadur *et al*, 1982; Amabile, 1983; Rogers, 1983; Farr and Ford, 1990). All offer a different perspective. It could be argued, however, that Walla's model's chief contribution to the field of innovation research is as a starting point for the work of others. As the chief concern of this research is with team processes we will not examine these models in any depth and refer readers instead to King's aforementioned excellent review.

The most recent attempt to model individual innovation is based on four factors (Farr and Ford, 1990). They proposed that innovation was a function of these factors, which are shown in figure 2.3.

Figure 2.3: Farr and Ford (1990:65) Model of individual motivation for innovation

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They asserted that for innovation to occur the individual must recognise a necessity for change. This is linked to problem recognition. Efficacy (Bandura, 1977, 1982, 1986) is seen as a powerful initiator of change. Efficacy concerns the individual's self-perception of their ability to "produce or regulate events" in their lives (Farr and Ford, 1990:66). Farr and Ford (1990) link it to the question of role competence. Hence, for innovation to occur, the individual must be confident that a positive outcome can be achieved, through their own self-efficacy. This efficacy, they argue, will be affected by factors such as previous relevant job experiences, educational attainment, personal explanatory style and the availability of information systems offered by proximal others (peers, superior and subordinates). They highlight the importance of a positive pay-back from any innovation, arguing that without this the motivation to innovate will be reduced. Pay-off, they define, in terms of promotion, formal or informal recognition, improved self worth or decreased boredom. Negative pay-offs would, therefore, include the obverse of these, plus either domination or ridicule from within the organisation. The model also draws on other studies through its emphasis of elements that will affect the generation of ideas, including problem recognition and idea generation (Zaltman *et al*, 1973; Amabile 1984; Kanter, 1988), utilisation of past experience (Mintzberg, 1979), previous training (Simon, 1986), use of "sounding boards" (McCall and Kaplan, 1985), adoption of existing solutions (Rogers and Shoemaker, 1971) or through talking to customers (Waterman, 1988).

Overall, however, the contribution from research focused on the individual has been weakened by the sheer diversity of studies and the paucity of clear purposes and aims. Slappendel (1996) highlighted the dangers of assuming that innovation necessarily involves solitary activity from studies of individuals. Twiss (1986:69) argued that the research has largely failed, as it has not produced a "convincing or practical guide for managers".

In addition, there has been a dearth of corroborative studies in the field. This may have occurred through the sheer breadth of the field and as such, as King (1990:26) argued, it is "suffering from an identity crisis". King (1995) concurring with Kanter (1988), however, ascribes this failure to a lack of appreciation of the role of the organisational context in ensuring that either creative, or innovative abilities can be exercised by individuals. Ford (1995) agrees, arguing that the concentration on the individual level of creativity has been over simplistic, by failing to consider the context in which it occurs.

2.4.2 Organisational innovation studies

Interest in organisational innovation has increased since the 1980s, with equal enthusiasm exhibited by both psychologists and management researchers. The reason for this upsurge may be as a result of the competitive advantage innovation is regarded as being able to offer companies. Research in this area can again be divided into that which examines antecedent factors and that which focuses on the innovation process. Within antecedent research, a further distinction can be made between those studies concerned with characteristics of the organisation itself, and those emphasising the characteristics and behaviour of management involved in the innovation process.

2.4.2.1 Antecedent studies

Work examining the impact of organisational characteristics on innovation covers a number of issues. Early work by Kaplan (1963) identified five characteristics of organisations necessary for innovation. These included a receptivity to new ideas and a pressure to produce, which appears at odds with the rest of the research. He also suggested the toleration of the highly creative people or "odd-ball" by superiors, the freedom to choose problems and change direction, and incentives for innovation. This highlights the importance of autonomy and toleration within organisations.

Some work has examined the organisation's structure and linked this to innovation. Stein (1988) argued for the importance of the link between the characteristics of the organisation and the creativity of its members. One much debated influence on innovation, is that of organisation size (Kimberly and Evanisko, 1981; Mohr, 1969; Rogers, 1983). Research in this area, however, has been hampered first, by a failure to agree the definition of size and, therefore, how it is operationalised; and second, through the possibility that size may be a surrogate measure for several dimensions that lead to innovation (Rogers, 1983). Much of the work in this area, it can be argued, is merely the continuation of earlier research (Cummings, 1965) examining the relationship between creativity and the reward and control systems an organisation used. Kanter (1988), in her aforementioned typology of innovation (see page 19) firmly links different types of innovation with different types of organisation. Research regarding a utopian structure of innovative firms has debated centralisation (Zaltman *et al*, 1973); decentralisation (Stinchcombe, 1988); against centralisation (Kimberly and Evanisko, 1981; Pierce and Delbecq, 1977); formulisation (Rogers, 1983; Pierce and Delbecq, 1977); flatter stratification (Kanter, 1983; Peters and Waterman, 1982; Cummings, 1965) and complexity (Zaltman *et al*, 1973; Kimberly and Evanisko, 1981). The final considered outcome is, however, a far from coherent picture, in which longitudinal studies may offer some further insights.

More recently, research has identified organisational culture and climate as potential antecedent factors (Kanter, 1983; Handy, 1985; Fischer and Farr, 1985). The issue is, however, confused by a considerable overlap and inconsistency in terms of the usage of definitions of the two terms. Duncan (1972) identified three important climatic dimensions: openness to change, need to change, and potential for change. He found that the higher the need for change, the lower the perceived openness and potential thereof. According to Pillinger and West (1995), climates in innovative organisations place an emphasis on quality, good communications, teamwork, interdepartmental co-operation, reflexivity, and support for innovation.

Antecedent factors are not merely confined within the organisation, research has identified external conditions that may have a mediated impact for innovation. These include the city or community size (Kimberly and Evanisho, 1981; Mohr, 1969), competition from rival companies (Walton, 1987; Cooper, 1984; Milo, 1971; Kimberly 1978) and environmental turbulence and complexity (Kimberly, 1981; Aiken and Alford, 1970). Although these influences are frequently cited, there are very limited empirical studies to substantiate them.

In examining organisational members' characteristics and behaviours, it has been noticed that much attention has been paid to different roles within the organisation. Most notable is that of leadership within organisations (Mohr,1969; Kanter, 1983; 1993; Nystrom, 1979; Peters and Waterman, 1982), with much consensus in support of the "democratic-participative" style. Recent work, however, has indicated a more complex picture of leadership, with the emergence of multiple leading roles each playing distinct and equally important parts in the innovation process. "ideas champions" and "change agents" are some of the various names given to the individuals who develop ideas in different ways (Bouwen and Fry, 1988; Rosenfield and Servo, 1990). Rosenfield and Servo's study identified six different roles necessary for the success of innovations. These range from "ideator", as someone who generates ideas; to "inventors", reducing ideas to solutions; "technology- gatekeepers", "reality checking" new suggestions; "idea champions", with the status in the organisation to push ideas; "sponsors", who have the higher status and resources to actually adopt ideas; and finally "entrepreneurs" who take the risk. The expansion of these innovation roles, however, could be more a product of different stages in the innovation process within an organisation, rather than different roles per se.

Research, which examines organisational members, has tended to concentrate on the negative, focusing on resistance to change behaviour. Some have identified "individual psychological factors" (King, 1990:30) in relation to the resistance. These have included selective perception (Watson, 1973; Zaltman and Duncan, 1977) and perceptual blocks to creativity (Jones, 1987). By contrast, there is very little research examining the facilitation of innovation by members of organisations in terms of their attitudes and behaviour. Singularly, Rogers (1983) challenges the often proffered "resistance to change" explanation for innovation failure, arguing that there are two pervasive biases that mar the research. The first of these, he calls the "individual blame bias" which revolves around the notion that "if the shoe doesn't fit, then there is something wrong with your foot" and second, "pro-innovation bias" in which he argues, innovations are seen as being an unqualified good regardless of setting. King (1990) supports this by arguing that the conception that resistance to innovation is irrational and unjustified must be challenged.

2.4.2.2 Process studies

In contrast to the literature regarding individual innovation, considerably more attention has been paid to process research for organisations. King (1990) argues that a large proportion in terms of quantity, and arguably not quality, has been aimed at managers. It has concentrated in the simplest of terms on how to make the creative process easier. Typically, organisational innovation has been treated as a process focusing on a discrete sequence of stages or events. An example of these process models is Roger's (1983) two stage model; *initiation*, which incorporates agenda setting, gap identification and environmental scanning and matching of innovations to provide solutions; and *implementation*, where ideas are first re-defined/restructured, clarified, and finally routinised. King (1990) presents a review of these in more detail.

Overall, organisational innovation research, however, has been marred by a lack of clear and sophisticated attempts at conceptualisation (Nicholson, 1990). Wolfe (1994) and later Dougherty (1997), lament the continuing dearth of theory building in this area. Studies, they argue, have been undertaken with simplistic and unsophisticated applications of variables such as organisational size, resources and age. These have failed to consider, as Dougherty (1997) and Twiss (1986) argue, the complexities that have to be successfully managed for innovation in organisations and which have utilised completely inappropriate measurement like, slack resources in terms of profit. They highlight a range of difficult aspects to be balanced in organisations between the individual and organisational requirements of innovation. Wolfe (1994:405) argues that, in part, this is due to the "inconclusive, inconsistent and ... low levels of explanation that have characterised this area of study". King (1990) strongly advocates the re-appraisal of some studies, with the re-examination of inappropriate and simplistic applications of one-dimensional measures. As an example of this, many researchers have failed to investigate the different frequencies, outcomes and antecedents of internally and externally generated ideas, instead confining their interest merely to imported innovations.

A recent addition from Rothwell (1992:222) in his "coupling" model attempts to show the internal and external linkages that result in ideas reaching the market place. He highlights the synergy between technology and needs that should occur at the idea generation phase. He also links the rest of the innovation process to the wider society and market place, and the level of technology and production skills. Thus, he can be regarded as including Schumpeter's (1934; 1943) notions of the pushing out of innovation, and Schmookler's (1966) ideas of "market-pull".

Overall, however, both a breadth of conceptualisation regarding what qualifies as an innovation and increased sophistication in study design are required in this area. The limited perspective of organisational studies in this area is exemplified by Majora (1988:6), who points out that, despite all the interest in innovation, few companies bother to audit their own creativity and innovation.

2.4.3 Group innovation studies

The focus of work on group innovation has changed over the last twenty years. Early work at the team level tended to concentrate on emphasising the end-product of the process (Nystrom, 1979; Kimberly, 1981), whereas more recent work has concentrated on a social constructionist perspective (Bouwen *et al*, 1992). The constructionist approach does not consider innovation as a given social reality that is awaiting discovery, rather it is conceived as being continuously ongoing and emerging (Weick, 1979).

In an attempt to clarify the area, King and Anderson (1990) proposed a classification for team innovation. They outlined three specific types of innovation within groups based on the original idea source.

> *Emergent* (i.e. developed entirely by the group)
>
> *Imported* (i.e. adopted and/or adapted by the group from established practices elsewhere)
>
> *Imposed* (i.e. imposed upon the group by senior management)
>
> (King and Anderson 1990:82)

These definitions were later altered and expanded by Anderson introducing significant changes in the categories. He outlined the same three types, with major alternations:

> *Emergent* "Where novel, unproved ideas and proposals are developed and implemented uniquely to a particular group or organisational sub-unit (e.g. the implementation of original information technology systems unique to the organisation)."
>
> *Imported* "Where systems and procedures already in use within comparator organisations are replicated and introduced into the organisation by the group (e.g. replicating production processes used by competitors)."

> *Imposed* "Where environmental changes force the group to modify its procedures or work practices (e.g. shifts in customer demand or changes in industrial regulatory framework)."
>
> (Anderson 1992:151)

In the new formulation of the definition, the category of *imported* innovations has been significantly changed, away from any established practice that could exist within the same organisation, but occur within a different department, towards comparator organisations. As a result, this blurs the distinction between two levels of analysis and places the group innovation within an inter-organisational framework. The *imposed* definition is also shifted to a dominant external organisational focus. The original definition contained elements of the external, but only to the group and, therefore, not necessarily from outside the organisation. This thesis has adopted the earlier definition, which included intra-organisational aspects of imported innovation, and inter-group focus of imposed innovation.

Both of the definitions focus not only on the source of the idea, but also on its implementation by the group. In each of these categories both the antecedents and process factors are assumed to be different (King and Anderson, 1990). A feature common to all of their categories, they argue, is the process of intra-group negotiation and "remoulding" that that entails. A distinguishing aspect between each innovation, however, will be the flexibility and discretion open to the groups. Staw (1990:295) noted the importance of the context in which innovation occurs. He asserts that "innovation is something that does not spring naturally from the interaction of individuals in organisational settings". He comments on the dual facilitation of consensus in interpreting and organising the team's environment and in establishing norms. Thus, the role of socialisation is highlighted in the establishment of common frames of reference that become institutionalised over time.

In considering the existing research at the group level we shall now examine antecedents and procedural influences on innovation. As will be seen later from the pilot and experimental study, it is important to look at both of these aspects of group innovation. The features highlighted within the rest of this review have some link into the later studies.

2.4.3.1 Antecedents

This section will identify a number of themes found in the earlier work. These include aspects of composition, including size, diversity, roles, external interface and tenure.

2.4.3.1.1 Team size

One of the central antecedent determinants of innovation at the group level concerns attempts to identify the ideal composition of teams. Geschika (1983) identified the ideal size for innovative teams as being between six and eight members. In terms of composition he highlighted the need for diversity in terms of background. He also included the necessity of opinion leaders in this group to assist in idea dissemination. This is linked to the organisational work on change agents, mentioned earlier.

West and Anderson (1996) hypothesise a curvilinear relationship between team size and innovation outcome. Poulton (1995) suggests that large teams, with greater than twelve team members, prevent effective group participation and communication. In contrast very small teams of only two or three members may not be sufficiently diverse for innovative tasks (Jackson, 1996). Hackman (1987) offers a less prescriptive number and instead offers the guideline of "the smallest number possible" as the optimum for teams. This relates to Ringlemann (1913) who noted the detrimental impact on performance of additional group members on performance and the phenomena of "social loafing" (Latane, Williams and Harkins, 1979) in larger groups.

2.4.3.1.2 Roles

In considering the characteristics of group members, popular prescriptive texts have focused on roles and advocated the building of the optimum teams (Belbin,1981; McCann and Margerison, 1989). There has, however, been little published research in support of this and a recent paper called into question the whole basis of the factor structure for Belbin's questionnaire (Furnham, Steel and Pendleton, 1993). The on-going nature of this debate and the lack of an accepted role measurement tool is such that this is not an aspect that will feature within the forthcoming study.

A more productive aspect of role, however, identified in the literature is that of role function, which is linked to team members' perceptions of group innovation. Much of this work is based on studies of team climates. Researchers have identified the phenomena of "functional homogeneity" that may be an important variable affecting the reporting of climate. They found that role holders in a similar function produce a consensus in climatic perception across these groups (James and Jones, 1979; Adam, Laker and Hulin, 1977). Forrester, *et al* (1995) offered some corroborating for this finding in a large study of innovation climate within a motor manufacturer. They found those who occupied different roles in a similar team context had similar views of the climate for innovation. There was one function, the maintenance function, however, which showed functional homogeneity. In which no variance in any of their climate scores was found. The impact of role type and innovation will be a feature to be explored within the pilot study.

One of the most widely examined aspects of role is that of leadership. Many studies concur with the idea, noted earlier in the organisational literature, that a collaborative democratic leadership style is beneficial for group innovation (Nystrom, 1979; Plunkett, 1990; Coopey, 1987). These findings support West and Wallace's (1988) research, which found teams with high innovation tended to have more leadership support, greater emphasis on goals and team building. Burpitt and Bigoness's (1997) recent study found that when team leaders used facilitative and empowering techniques the level of innovation in professional project teams increased significantly. Others have argued that team effectiveness is greater when leaders have control over key decisions and task allocation (Levi and Slem, 1995). Pascale (1993) has explored the role of the group leader and linked leadership to the ability to manage conflict. He highlights the link between successful and skilful conflict management and "effective breakdown and innovation" (p.39). Manz *et al* (1989) argue for a contingency approach, suggesting that multiple leadership approaches are appropriate in varying innovation contexts and at different stages of the innovation process. Whilst King and Anderson (1990) argue support for a pragmatic style, little longitudinal research has been carried out specifically looking at the role of leadership in the innovation process.

2.4.3.1.3 Diversity

Research related to roles has considered the diversity of team members and a link with innovation. The research into this issue is at face value somewhat contradictory. Studies have indicated that heterogeneity of group members in terms of, for example, values, gender, skills and abilities, is likely to foster greater innovativeness (Jackson, 1996; McGrath, 1984), whilst, homogeneity may lead to "group think" and thereby reduce innovation (Nystrom, 1979). As Payne (1990), however, points out from his studies this may be more to do with longevity of the team. He argues that heterogeneity is associated with success in the earlier stages of innovation, whilst homogeneity is more important for latter implementation success. The impact of longevity, or team tenure, on innovation appears to be related to the concept of diversity. Specifically, research suggests that the longer teams are together, the more homogenous they become. This is the reason given by Katz and Allen (1982) in their work on research and development teams for advocating temporary project teams. Evidence suggests that as longevity of teams increases there may be a reduction in communication of key information within the team, and a distancing of the team from sources of critical evaluation (Jackson, 1987; Wolf, 1987; Jackson, 1996).

A third characteristic of group members that may impact on group innovation considers the members' status. West (1987:313) argues for more research, which distinguishes between factors "whose presence is required for role innovation to occur and those, which are required to change in order to stimulate role innovation". The influence of the personality of team members has been examined in terms of individuals' "propensity to innovate" (e.g. Burningham and West, 1995; Patterson, 1999). West and Anderson (1996) found that the proportion of innovative individuals in the team predicted the quality or radicalness of innovation. This research is, however, still at an early stage and more work is needed on the measurement of individual differences in innovativeness. Research examining climate for innovation found a link between status and higher perceptions of group support for innovation (Forrester, *et al*, 1995). These factors included safety, influence, articulated support, enacted support, sharedness, excellence, appraisal ideation, clarity and both social desirability scales.

2.4.3.1.4 External interface of teams

Related to evidence of team member roles and variation is research that has looked at the importance of those in the team who have connections with the external world. Ancona and Caldwell (1992) identified four important roles, specifically related to the external part that team members can play. These include scouts, ambassadors, sentries and guards. Each is related to a different interface with the external. Clearly, some of these roles are focused on protecting the team, whilst others, like the "scout" are more akin to being open to the external. This links to Cohen and Bailey's (1997) review of teams. They highlight that behaviour around the boundary of teams is regarded by psychologists as being either scouting or defending in nature. Other attempts at identifying these roles include Kanter's (1988) work, which highlights three associated roles of team members related to innovation. These include idea generators, ideas champions, intrapeneurs.

Ancona (1990) has also highlighted the importance of those outside the team as acting as sounding boards for ideas. She, however, makes an important distinction between passive interaction or "scouting behaviour" and more active searches for information for the team.

There are a number of studies that have suggested a critical role for innovation which is enacted by a small number of key individuals, who link organisation (most frequently the laboratory) with its external environment (Allen, 1970; 1977; Chakrabarti and O'Keefe, 1977; Tushman and Scanlan, 1981; Katz and Tushman, 1979; Tushman and Katz, 1980). Pelz and Andrews (1966) found a significant correlation with scientific innovation and the number of external links. Related to this, Mansfield *et al* (1981), in their study of the pharmaceutical industry, found that between 1935 and 1962 half of all major innovations were based on discoveries from outside the firm that were later exploited. Conway and Forrester (1997), in their review of the literature surrounding teams and boundaries, suggest five different categories of boundary for innovation. These include boundary spanning as a means of getting new information into the team to help with innovation (Tushman and Scanlan, 1981).

2.4.3.1.5 Tenure

Some studies have tried more concrete membership characteristics, for example, the optimum age for innovators. West (1987) argued in his work that age was a significant factor with a normal distribution curve for innovation, peaking in the 40-50 year age group. This finding was later contradicted by Mumford, Olsen and Jones' (1989) study of patent issuing between 1929 and 1984, which found that innovations were most likely to occur in the earlier phase of people's careers, between 25 - 44 years. Evidence from Forrester *et al* (1995) may have illuminated this apparent contradiction, regarding the impact of age in their study of group climates for innovation. They found a complex picture with five sub-scales showing a statistically significant positive correlation with age (information sharing, influence, perceived value, attainability and excellence) and four negative correlations (appraisal, ideation and both social desirability elements).

There has been some work looking at dynamics of membership of teams. Katz (1982) found that newcomers into an existing team may increase innovativeness by introducing novelty into the team environment. Earlier Schon (1967), coined a term to describe this "innovation by invasion". A number of studies (Kanter, 1983; 1988; Staw, 1990, Katz and Allen, 1982) highlight the importance of variation in viewpoints and the cross fertilisation of ideas through changing team membership. Paradoxically, continuity of membership is an important consideration, as turnover of staff can jeopardise innovation by removing those with specific knowledge, or with new people deflecting the energies and attention of team. Gladstein and Caldwell (1985) argue that telling someone what happened is no substitute for them actually being there and new people may change the course of the innovation. In their review of team research Argote and McGrath (1993) note the inherent difficulties of studying the impact of team membership dynamics on team effectiveness.

As can be seen, antecedent aspects of teams have received some attention, however, the inconsistencies within the findings to date show the complexity of this area of study, and reveals the influences of underlying social psychological aspects. The literature pertaining to wider psychological research that is important when studying teams will be discussed later, following a review of the team process literature.

2.4.3.2 Processes

Studies of group development began some time ago, focusing on the psychological and emotional aspects of group life. Early research, from 1940 until 1988, can be divided into two areas: Those looking at dynamics, and those based on group problem solving.

2.4.3.2.1 Simple sequence models

The first synthesis of the literature resulted in a dynamic model, providing a sequence of group development by Tuckman (1965) with his model of "forming, storming, norming, performing" and the later addition of "adjourning" (Tuckman and Jensen, 1977). It is by far the most well known and frequently cited. In this model, group development is regarded as a unitary sequence of activities. Subsequent models followed a very similar pattern from Hare's (1976) sequence of situation definition, new skill development, development of appropriate roles to carrying out the work; to the "orientation, dissatisfaction, resolution, production and termination phases of La Coursiere (1980) up to McGrath in 1984. Even problem solving models suggested a unitary sequence (Bales and Strodtbeck, 1951) including the elements of orientation, evaluation and control.

In assessing thirty years of study in this area, Poole (1981:341) argued that the similarity in these models was due to the fact that researchers were "conducting the same experiment with minor alterations". All of these models contain a paradigm of the development of groups as an "inevitable progression" (Gersick, 1988:11) with each stage being passed through before continuing on to the next. In this paradigm, the environment in which the group is based is a constraining force only, unable to alter the sequence of the inevitable stages. The validity of these models has been challenged (Fisher, 1970; Scheidel and Cronwell, 1964; Poole 1981, 1983a, 1983b) in terms of the linear ordering of sequences and the possibility of multiple sequences not just one. Kanter (1988:172) supports this, arguing for the lack of credibility for "the usual process models of innovation that posit discrete stages through which an innovative idea progresses". Little is offered in any of these models to explain what triggers change. A further criticism from the work by Sundstrom *et al* (1990) and Gladstein (1984) has emphasised the important role of those outside the group on its performance, its ability to gain resources and on providing assignments in the first place. In this way groups should not be considered as closed systems.

2.4.3.2.2 Gersick's model

Gersick (1988) began looking at team processes by studying task forces and asking why their behaviour changed. As a result, she became interested in two aspects: first, the interplay between the team and those outside, and, second, the importance of time. Through an inductive method she began to monitor real life groups' performance. Her study suggested a biologically derived model of team activity, called "punctuated equilibrium". She argued that the equilibrium of the groups' development was punctuated at the mid-point with a brief and revolutionary period of activity.

Figure 2.4:Summary of Gersick's model (1988,1989)

Beginning		Mid-point		End
Phase one	**Punctuated equilibrium**	**Phase two**	**Completion**	
Relative inactivity	Rapid Transition activity	Relative inactivity	Rapid activity	

The "punctuated equilibrium" model identified that, following a long period of relative inertia (*phase one*), a rapid *transition* would occur. During this transition, the group would reframe their situation, dropping their previous patterns of activity, re-engaging with external contacts and adopting a new perspective. Then a second period of inertia (*phase two*) would follow, with the execution of the plan made in the transition, and a final burst of activity to gain *completion*. The progress that teams made was dynamic in comparison with the previous stage, with teams agreeing their direction, regardless of how much debate had occurred before. This transition phase was found to occur exactly half way through the assignment's life span, regardless of the number and length of the meetings prior or subsequent to that.

Gersick argued that time awareness played an important role in triggering change. It is not, however, time *per se*, as there were wide variations in the actual duration of the phases across teams, but time in relation to a deadline, which was important. She argued that time awareness was used by the team as a means of pacing, and thus time was treated as a resource of the group, as "an alarm clock" (1988:35)

In looking at the transitionary phase, Gersick found that this phase did not ensure success in terms of outcome, nor did it address internal disputes. Two critical points were identified for the success of external influences; first at the commencement of the team's activity, where influence on the basic approach and clarification of the project's goals can be inferred, and second, at the transition phase, where groups may actively seek outside information and are more willing to change direction. At this mid-point the team appear to have "dropped old patterns, re-engaged with outside supervision, adopted new perspectives on their work and made dramatic progress" (1988:23). Gersick also found that the final ideas executed by the team emerged after the transition.

Gersick's studies were conducted both with real task groups (1988) and with laboratory based groups (1989). Both produced the same results as regards the phases and the role of time. The laboratory studies focused much more on the role of pacing and the transition phase for the groups. In the second set of studies she found that the transition phase was necessary for ultimate success for the groups. Those that did not change in the transition phase failed, and groups who had struggled in phase one were able to make a new start with the transition. Bounded rationality (March and Simon, 1958) was suggested to have limited the groups' ability to pick up fresh approaches before the transition phase. Gersick suggested both cognitive and motivational barriers regulated group activity prior to this.

Gersick's work is important because of the focus on triggers for change. She, however, did not attempt to look at innovation in the wider sense. Her focus was only on final ideation. Although she looked at changes in team process, she did not examine in detail the range of ideation, therefore, she did not consider any link between general ideation and final ideation. She has also not explored the relationships within the team and any connection with innovation. She was concerned only with external contact. Gersick did criticise the unitary models of others, yet her own model more or less reduces the team process to a simple sequence. The meeting map approach she used to chart the progress of the teams was important as a means of assessing changes within the team, but she did not utilise statistical analysis of the data. Her assertions, however, are based on only a few cases.

Studies of group development have moved from the unitary sequence models to proposing a more fluid state, paced through a number of phases, each characterised by different behavioural patterns. Research has attempted to examine habitual routines in groups (Gersick and Hackman, 1990), and assess the progression from team work to task work (Morgan *et al*, 1993). There has been some work looking at the interaction between time interaction and performance (T.I.P.) (McGrath and Greunfeld, 1993), however, no further work has looked at the temporal patterns of innovation teams, to see if the same "punctuated equilibrium" is found.

2.4.3.2.3 West's (1990) model

The most productive work, to date, seeking to identify the process of team innovation behaviours has been produced by West with others (West and Anderson, 1996; West and Anderson, 1994; West and Farr, 1990; West and Wallace, 1988; West, 1987; 1990). In 1990 West developed a model, derived from the literature, identifying four dimensions associated with both antecedent and processes factors necessary for group innovation. The dimensions build into a cycle (see figure 2.5) for innovation within teams, commencing with *recognition* of the need to innovate, then *initiation* of ideas, followed by *implementation* and finally, *stabilisation.* At each of the stages West identified behaviours that are associated with innovation. The model will now be examined in detail with particular attention to the team behaviour that links to each dimension.

Figure 2.5: West's (1990:326) Team climate antecedent factors

At the onset of team innovation researchers have identified the need for goals. West (1990) termed this *Vision,* and went on to identify the four dimensions that comprise it. The factor called *clarity*, builds on work examining involvement in goal setting (Wall and Lischeron, 1977; Lawler and Hackman, 1969). He included *sharing* and *valuing* of these goals as a second and third factor. The valuing dimension incorporates Cumming's (1965) work on extra-organisational values. Peters and Waterman (1982) provide the evidence for the final dimension of *attainability,* in which the objective is seen as achievable.

During the *initiation* phase West advocates a climatic construct of *Participative safety* as being important. This, he suggests, is characterised by "involvement in decision making which is motivated and reinforced by occurring in an environment that is perceived as interpersonally non-threatening" (p.311). This main construct, therefore, pays attention to the team context. As before, the construct has a number of dimensions. The work of Wall and Lischeron (1977) again provides the research basis for a number of dimensions beginning with *influence*, in which the group members feel they have some involvement and ability to influence decisions. A second dimension of *information sharing* draws attention to the frequency of information being passed amongst the group. *Interaction*, the third dimension, focuses on the frequencies of interpersonal interaction amongst the team members. The final dimension, *safety,* draws on the work of psychological researchers on trust in groups (Ainsworth and Bell, 1974; Kanter,1983, 1988; Peters and Waterman, 1982; Nystrom, 1979; and Coopey, 1987). West regards *safety* as a perception which is likely to increase the risks people are willing to take, making them more amenable to state their ideas without fear of reprisals or ridicule.

In considering the *Implementation* phase, West outlines two dimensions for the construct *norms for support of innovation.* He defines *norms for support of innovation* as "the expectation, approval or practical support of attempts to introduce new and improved ways of doing things in the work environment" (p.315). Drawing on previous research (Kanter, 1988; Mumford and Gustafson, 1985; Abbey and Dickenson, 1983; Kimberly 1981; Cummings, 1965; Hage and Dewar, 1973; Schroeder *et al*, 1987), he argues that support for innovation exists in an *articulated* form through management verbally indicating their acceptance of innovation as a norm in the work place. It also exists in another *enacted* format, in which resources like time, money, equipment, and expert advice are devoted by managers to allow innovations to be tested and tried out at work. The idea of support is related to Kanter's (1988) notion of coalition building.

The final phase of the model is *Stabilisation,* which West concludes needs to be accompanied by a construct focusing on creating a *Climate for excellence.* This he argues is a "shared concern with excellence of quality of task performance in relation to shared vision or outcome, characterised by evaluation, modification, control systems and critical appraisals" (p.313). In line with other evidence (Moscovici *et al*, 1985; Tjosvold 1982; 1984; 1985; Peters and Waterman, 1982; Nemeth and Wachtler, 1983) he proposes three dimensions which create "a demanding group environment in which new and existing practices are appraised and challenged in a constructive way" (p.314). Precursors for stabilisation include *ideation,* which focuses on the number of ideas produced; *appraisal,* concerning the critical assessment of ideas; and *excellence,* incorporating an acceptance within the group of the highest performance standards.

The model, however, does have limitations, as it does not attend to extra-organisational factors, which may provide the initial impetus and reason for innovation, e.g. economic and social change, technical advances. It fails to examine the impact of individual differences on group innovation. There are conceptual problems with the underlying psychometric properties behind the instrument derived from West's (1990) model. Traditional psychometric measurement approaches have attempted to assess relatively stable dimensions, yet Anderson and West (1994) have argued that the concept which they are seeking to measure is a relatively unstable, constantly evolving and changing set of dimensions, when compared with fairly stable dispositional characteristics like individual personality. Evidence also suggests that this instrument is asking respondents to make too fine cognitive differentiations (Forrester, 1994). Finally, the model is in direct contrast to findings from organisational research (King, 1992; Angle and Van de Ven, 1989) and related studies (Gersick, 1989;1988) of group processes, that suggest the process is far from linear, with neat progressions. They suggest a more haphazard progression veering between quantum leaps forward and regressions back to previous phases. West (1990:329) himself describes it as a "far from complete theory". Despite this it provides a basis for enquiry into a hitherto neglected area.

The next section will move on to look at aspects of the team literature that require further examination and have influenced the design of the present study

2.5 TEAMS

The application of work teams has increased in popularity across all types of organisations (Guzzo and Shea, 1992). Sundstrom, *et al*, (1990:120) define teams as an "interdependent collection of individuals who share responsibility for specific outcomes in their organisation". By examining this definition in more detail, it can be incorporated into an analysis of group innovation, with its specific emphasis on the interdependence that exists between group members and their shared responsibilities. Anderson (1990:4) highlights the interactive and dynamic iterative process of team innovation when he described it as "the emergence, import or imposition of new ideas, which are pursued towards their implementation by the group through interpersonal discussion and successive remoulding of the original proposal over time".

Putting the current interest in teams in some kind of context, changes in organisations, since the 1980s have revived interest in the applications of teams. Twiss (1986) firmly links this growth in the application of teams directly to the leaps in scientific and technical knowledge. He argues that one person is no longer able to be master of all. This results in inevitable specialisation, which can result in the "self-stultification" of problems as each expert limits their focus on the issues. Teams are described as occupying a pivotal role in this transformation (Walton, 1987; Ketchum, 1984), with some proclaiming them as a pre-requisite for modern "renaissance" firms (Reich, 1987; Kanter, 1983), in which they provide the "building blocks" (Sundstrom, *et al*, 1990:120).

Sundstrom, *et al* (1990), in reviewing the application and effectiveness of teams, have devised a useful "ecological" framework to show the interrelationships between different area of theory (see figure 2.6).

Figure 2.6: An ecological framework for analysing work team effectiveness Sundstrom, De Meuse and Futrell (1990:122)

In this framework of team effectiveness Sundstrom *et al* (1990) proposed that the organisational context in which a team functions is regarded as a key factor, with features such as reward systems and training courses playing important roles.

Boundaries are a second key feature of teams that Sundstrom *et al* (ibid.) highlight, however, they exist not just between organisations. They differentiate between groups, separating goods, information and people, but also in an external sense serving as interchange points with customers, peers, competitors, companies. They argue that boundaries contribute to the operating context of the team, and require a careful balance between the team becoming swamped or indistinct in the organisation. There is a delicate balance between clear boundaries and those so distinct as to isolate the team from the rest of the organisation. Team territory provides a significant physical identity for a team that is particularly important for externally integrated teams. Sundstrom *et al* (ibid.) maintain that the team develops and changes over time and propose that the success of teams with longer life spans may be an impact more of interpersonal not temporal elements. There is, however, as noted earlier, little research examining temporal factors. There is evidence that, in simple terms, effectiveness tends to improve over time, but, eventually decline. An exception is the work of Ancona (1990) and her colleague, Caldwell (1992). They found that the extent to which teams engage in externally focused activities is a better predictor of team performance than internal team processes. Of particular importance are 'ambassador' activities involving frequent communication with managers above the team to in order to lobby for resources, support, and protection for the project.

The Sundstrom *et al* (1990) study highlights the difficulty for those researching teams in defining and measuring the effectiveness of performance. They suggest various attempts made by other studies to assess performance, in terms of organisation outcomes such as; quality, quantity, downtime, satisfaction etc.

Bolman and Deal's (1992) work on team effectiveness links into some of the previously mentioned approaches to analysing team innovation. They too highlight structural aspects, but go on to distinguish, like Sundstrom *et al* above, a "human resources" approach which looks at the match between individual and organisational needs, the political and finally the symbolic, or stories of successes and failures. This work has links to Gersick's (1988,1989) in emphasising the importance of clear deadlines for team effectiveness. Bolman and Deals' paper is eclectic in linking a wide range of different aspects together. It shows in more detail the importance of team specific language, which Sundstrom *et al* would consider as norm development. In particular it highlights the role of team specific humour in creativity and of the significance of more informal non-task focused roles like "priest" (p. 42) in improving team performance.

2.5.1 Decision making in groups

Research studying group processes should include an understanding of the important topic of decision-making. Decision making studies cover a wide range of topics, from the processes adopted by groups through reaching decisions, to their social interactions. Research has sought to examine the processes groups go through. Poole (1983a, b) attempted to study the sequences teams went through by assessing the unitary sequence model with a multiple sequence model. He argued that the development of decision making in groups is a complex process. His model portrays the process as a set of parallel tracks of activity evolving simultaneously and interlocking in different ways over time, with breakpoints signalling changes in activity. He proposed three types of "activity tracks": "task processes" which tracks necessary to manage the task; "relational activities", which reflects the attempts in the groups to manage their inter-relations; and "topical focus" which includes substantive issues and debates the group have through the process (p. 326-327). Task process activities can be further sub-divided into problem activity, including analysis, executive activities, covering orientation and reflection and finally solution activities which incorporates the generation of guidelines for the design, evaluation and selection of solutions. Similarly relational activities can be sub-divided into four classes. First, work-focused relationships, including non-critical "focused work" and critical work, in which criticism and re-framing of the problem occur; second, four types of conflict relationship, from all out opposition to smoothing and bargaining type behaviour; third, integration activities and finally ambiguity expression.

Recent research on decision making has begun by examining the role of minorities in groups. This topic is also important in linking into our understanding of team innovation. For example, it serves to explain the importance of minorities, who comprise Payne's (1990) heterogeneous research and development teams and their high innovation levels. The topic of minorities has a considerable history since social psychologists became interested in the 1920s in the achievement of conformity and compliance within groups. Many studies have examined the role of majorities in achieving conformity (Sherif, 1935; Ash, 1956; Milgram, 1974). Moscovici and Nemeth (1974) argued that provided minorities maintained consistent arguments, over time decisions within the group could change. Minority views appear to impact first on private views of group members before conversion (or public agreement) is produced. Moscovici *et al* (1985) identified the heavy price in terms of conflict and unpopularity attached to being a minority influencer. In the field of creativity minorities do have an important role to play. The work of Nemeth and others in the 1980s identified a link with team's minorities and creativity leading to increased independence, divergence and creativity of thinking (Nemeth and Wachtler, 1983; Nemeth, 1986; Nemeth and Kwan, 1987; Nemeth and Chiles, 1988).

2.5.2 Cohesion, controversy and communication

Linked to any research into innovation is the study of the role of controversy and cohesion in decision-making. Poole (1983) highlights three types of coherence amongst groups in decision making. These include "pseudomutuality" (p.335) in which solidarity is maintained by never testing or pushing the relatively weak bond of trust that exists, through to "dominance" where the precedence and hierarchy maintain solidarity, and finally "mutuality", in which there is high interdependence and feeling of ownership amongst the group. West's (1990) incorporation of participative safety in his model (p. 62) is in direct response to this area of the innovation literature. One of the most important researchers in this area is Tjosvold (1982, and Tjosvold and Field,1983). Both studies investigate the impact of controversy on group decision making. Tjosvold found that, provided the context of the specific controversy is co-operative, the outcome showed increased "curiosity, understanding, incorporation and an integrated decision" (p.189). Kanter (1983) corroborates the necessity for a non-critical environment in gaining a positive outcome from controversy. She later (1988) asserts that innovation and conflict are inevitable. This constructive use of controversy has been actively utilised by some companies, most notably Honda with their use of "Waigayas", which are a group of problem solvers, deliberately designed to bring out different views from all participants, regardless of organisational level, in a situation (Pascale, 1993:39).

The cohesion of groups can be considered as another potential antecedent factor within group innovation, although the research has been far from conclusive. Nystrom (1979) suggested that innovations can be improved provided individual group members feel they can achieve self-actualisation and that they are safe within the group. This can be contrasted with Crosby (1968) who identified high group homogeneity or cohesiveness as an inhibitor to the questioning of group decisions, and which has had a negative impact on innovation. At its most extreme cohesiveness does appear to reduce the range of ideas groups consider, as illustrated by the "groupthink" phenomena (Janis, 1972).

In exploring more closely these apparent contradictions with the cohesiveness research, Nystrom (1979) has attempted to resolve the situation by proposing that the level of cohesiveness within groups is dynamic, and changes through the innovation process. He suggests that in the initial idea generation stages limited cohesion was required, so that ideas are freely generated, compared with the implementation phase, in which a cohesive homogeneous team was more likely to succeed. This view is corroborated in recent findings by Ancona and Caldwell (1992), who discovered that whilst lack of cohesion resulting from functional and tenure diverse teams assisted in creativity, by contrast it impeded implementation. Cohesiveness may be linked with the longevity of a group, as Payne (1990) noted. Again, however, researchers appear divided here with Lovelace (1986) asserting the positive impact of changing group membership for innovative research science teams, and Katz (1982) disputing this finding with his work on the performance levels of research and development teams. One difficulty in translating team performance findings to innovation is that we can not necessarily assume their equivalence, as many of these group studies have done.

In considering teams and cohesion attention must be paid to the role of communication. Limited studies by management theorists have discussed the importance of open communication amongst team members for innovation (Majora, 1988; Kanter, 1983,1989), whilst others have highlighted the role of common objectives amongst members (Tjosvold and McNeely, 1988; Peiro *et al*, 1992). Quinn (1986) points out that the importance of communication in sharing information and learning is vital in creating and implementing innovation. Communication is, however, not just of importance within the group, as other research has shown, communication with those external to the team is also important in shaping innovation. Links can be made to work relating to boundaries and communication. Kanter (1988) notes the role of communication with customers in helping to shape innovation agendas. She argues "contact with those who see the world differently is a logical prerequisite" (p.175). The literature regarding teams and cohesion or conflict serve to illustrate the complexities of the study of innovation. The research appears to suggest that some of each is necessary for innovation, but too much is detrimental (Forsyth, 1990; West, 1990).

2.5.3 Team effectiveness measures

Part of the problem with synthesising the research in this area lies in the conception of effectiveness. Different researchers utilise different paradigms of performance. Many in this area, (for example, Guzzo and Shea, 1992; West and Anderson, 1996) focus on a model of teams in terms of "inputs - process - outputs". This approach considers teams to have tangible outputs that can be satisfactorily measured. These include productivity, innovation, mental health, job satisfaction, growth and development and viability. The problems, however, of the viability of these measures appear when you attempt to operationalise many of them. As Cohen and Bailey (1996) and Argote and McGrath (1993) note, many of these outcomes are interrelated in complex and often conflicting ways. For example, Tannenbaum *et al* (1992) found that satisfaction and performance were not related in their study of the impact of team building on effectiveness.

Cohen and Bailey's (1996) review of the team effectiveness literature identified three dimensions. First, those which consider performance effectiveness through quality and quantity of outputs; second, those focusing on member attitudes, like satisfaction or commitment, and finally, behavioural outcomes, in terms of turnover or safety. This categorisation concentrates solely on output, omitting those interested in behavioural variables that focus on processual aspects like those suggested by Gersick (1988; 1989), McGrath and Greunfeld (1993) or Weingart (1997), for example, idea generation, or final idea content.

If the issue of measuring team effectiveness is fraught with problems, then the operationalisation of any measurement of team innovation serves merely to compound these problems. An overarching concern is that identified by Amabile (1983) in her study of individuals, when she highlighted the difficulty of creating one all encompassing measure of creativity. There have been a number of approaches to measuring innovation. Some have advocated judging the decisions made by groups (Maier, 1970), although this approach omits the inclusion of any implementation or application of the decisions. Others have used management-generated reports of the innovation (Burningham and West, 1995) or the views of experts from within the organisation (Argell and Gustafson, 1994). These measures may, however, be affected by the adequacy of the communication of the innovation teams regarding the successfulness of their performance to those outside the team. A central debate in this whole area is how far we can measure effectively innovation performance? One potential solution is to consider the innovativeness of an implemented decision. West and Anderson (1996) have attempted to look at final implemented innovations. They have built on Amabile's (1983) work to expand a number of distinct dimensions to measure team innovation. Their development is an assessment of teams' innovative output that draws also on the work of Wolfe (1994). It attempts to categorise successful innovative performance into a number of evaluative statements. The dimensions they suggest include clarity, novelty, radicalness and quality. Their measure has two major advantages. First, it uses a number of distinct dimensions of innovation. Second, it can be used by multiple assessors to quantify innovation through the use of an anchored scale. Thus, an aggregated outcome can be produced for innovation. There has been some attention paid, as we have reported, to attitudinal measurement. These cases have consisted largely of self-report measures of climate, like the T.C.I, however, there may be difficulties with the application of this tool.

2.6 Conclusion

The range of literature for any study of innovation and teams is both large and diverse. Much of the research to date has covered a number of levels of analysis, at the macro organisational, through to the meso team and micro individual.

A central problem of much of the research has been the contradictory findings in much of the work. It has revealed inconsistency and complexities between findings. Indeed, in many places, there are still unanswered questions. In this review two categories (antecedent and processual) of factors have been highlighted that have previously been examined in isolation. In combination, however, they will undoubtedly affect group innovation. It is the inter-relationship between these factors to which innovation researchers should turn their attention. If we just continue to look at singular aspects, research will remain full of the apparent contradictions that have dogged this area to date. This research aims to address this neglected area of innovation by looking at team behaviours within teams' process.

A second issue that emerges has been the inadequate attention paid to the identification of innovative teams' processes. Instead, research has been limited to attempts at applying individual based theories of innovation process to groups, or to focus on single dimensions that, therefore, fail to encompass a more complete exploration of the complex interactions of individuals that comprise teams. Unsurprisingly, these oversimplified models have proved incomplete in explaining team innovation. The current study will explore team processes by examining a more complete array of behaviours.

Studies of teams have also not been well served by those (for example, Argote and McGrath, 1993; Weingart, 1997) who have pointed out the inherent difficulties in studying these processes. This has merely served to compound the issue by increasing the reluctance of researchers to venture into the area.

There is a distinct need for research on innovation processes of teams to examine the longitudinal aspects. Part of the overarching problem is caused by a debate regarding the measurement of team effectiveness and especially, in terms of innovation. There are obvious contradictions and inconsistencies in our understanding of teams and innovations. Payne (1990), however, showed that by studying longitudinal aspects of teams we can begin to understand the reasons for the apparent contradictions in the research. His unravelling of the homogeneity and heterogeneity issue of teams served to show the value of studying team dynamics, which can only really be accessed by looking at them on a longitudinal basis. This study also showed that we can only begin to examine teams if we look at them in situ as they proceed along a course. This is why the present research was designed to look at terms through the duration of an innovative task, from development through to implementation.

A further complexity regarding examination of dynamic activities is that team processes are far from being neat, linear progressions. Instead, they are complex sequences with dynamic shifts (for example, King, 1992; Angle and Van de Ven, 1989 and Gersick, 1989; 1988). These studies have suggested a more haphazard progression veering between quantum leaps forward and regressions back to previous phases. There have been no attempts to look at groups' processes as more complex progressions and sequences of behaviour, despite the evident need for them. As King (1992:89), however, noted "only by examining the innovation process in depth, from the first emergence of an idea for change to its eventual outcome - be it fully absorbed or final rejection of the innovation - can we understand why particular factors in particular circumstances influence innovative activity within organisations". The present study aims to focus on understanding first the emergence and second the importance of the teams' behaviours as they proceed through an innovative task to indicate the significant interplay of behaviours over time.

The potential research agenda reveals the eclectic nature of the field and indicates a number of aspects that require further attention if we are to gain a better understanding of team innovation. As part of this, however, there needs to be more examination of specific aspects of teams' behaviour over time. The types of behaviour requiring more attention include exploring; idea development (Poole, 1981); the dynamics of idea and group development and the external (Gersick, 1988; 1989); inter-group process (Sherif *et al*, 1961) such as the role of group cohesion and the group innovation process (Seashore, 1954). These serve to illustrate the wide range of topics requiring further attention in this complex subject, which will be summarised below.

First, there needs to be more attention as Poole (1981) and others have indicated of ideative activity. Gersick's (1988; 1989) landmark studies, which examined longitudinal team innovation, were an attempt to measure behaviour in situ. Her focus, however, was on a narrow range of final ideative behaviours, not ideative behaviour per se, nor did she include other behavioural elements that this review has identified as potentially important in effective innovation. This study aims to look at idea generation, which was omitted from her analysis.

A further theme that emerges from the research is the importance of external relationships for teams. Related to ideation, the issue of the team boundary emerges as important, especially in the transfer and adoption of ideas. There have, however, been few studies of this at the team level despite West's (1990) model. This model, and Gersick (1988, 1989) have identified that boundary issues change over the course of the team's innovation, in particular a temporal component to the openness and willingness of listen and accept external ideas. This is an issue that has been mentioned at all three levels of innovation research (Robertson and Gatign, 1989; Zaltman and Wallendorf, 1979). None of these models, however, have looked, as King and Anderson (1990) suggest, at the take up of ideas from outside the team. Nor has anyone explored whether there is a temporal dimension to the team's openness to these external ideas, or whether it is the type of innovation itself that alters the team's receptivity. What role does the external, particularly those outside the organisation have in teams' innovation? Slappendel (1996) highlights four categories of 'outsider', including, customers, suppliers, inter-firm rivalry and governments in contributing towards innovation. There has, however, been no attempt to look at this at the group level. Research has also suggested the part particular roles have in facilitating this, including boundary spanning (Tushman and Scanlan, 1981), external consultants (Utterback, 1982), personal contacts (Myres and Marquis, 1969) for innovation. The idea of an externality of focus for the team is something that has received no attention. King and Anderson (1990) highlight the role those outside play in *imported* and *imposed* innovation, yet there has been little work examining the interface with those outside the team and the team's propensity to innovate. This research aims to look at externally focused behaviour and to see if different types of innovation are characterised by different innovation behavioural processes.

Next, there needs to be more attention paid to the importance of social processes and interpersonal negotiation, which appear necessary for the generation and implementation of teams' ideas. This entire area is regarded at "an embryonic stage of development" (Anderson, 1992:155). Within the research examining social processes there are apparent contradictions in terms of the quality of internal relationships and innovation, with two distinct perspectives of group processes emerging, advocating the need for either a consensus or conflict standpoint. The consensus biased perspective regards harmony in team innovation as a desirable situation, with the innovation process that accompanies it as a relatively trouble free one, in terms of group dysfunction and interpersonal conflict. This pro-innovation view is the one that dominates the literature, abounding especially within the managerial literature (Kanter, 1983; Peters and Waterman, 1982). This first perspective advocates that the innovation process can be both initiated and controlled by managers. It has not been without its critics (Kimberly, 1981; King and Anderson, 1990; Rogers, 1983). By contrast, the conflict view regards innovation as a major disruption, which encapsulates the disjunctive and iterative nature of the process. This view is much more in keeping with the "illusion of manageability" bias and notion of innovation as a continuous re-negotiation of social order (Anderson, 1992). Cheng and Van de Ven (1996:593) argue that the innovation process is manifestly a process of chaos consisting of "a non-linear dynamical system, which is neither orderly and predictable, nor stochastic and random". Part of the reason behind these contradictory findings may lie in the methodological differences of researchers as they look to identify either antecedent or process factors and conclude a variety of different dimensions as facilitative or inhibitory of innovation (West, 1990; Zaltman *et al*, 1973). This research aims to confirm, through a pilot study, the pertinence of these behaviours and then incorporate them as aspects to be observed within an experimental study to assess their role in teams' innovation processes.

Finally, there has been no previous attempt to test King and Anderson's (1990) assertion of three categories of innovation to see if, as they suggest, different types of innovation result in distinct behavioural processes. Work in this area is important as it could illuminate the complexities of team processes, indicating the need for multiple models of team innovation processes dependent on the category of innovation being undertaken. This would offer significant help for organisations as they seek to innovate more effectively and efficiently. This research aims to identify differences between the behaviours of teams operating within these categories, so that important behaviours can be indicated to organisations.

In conclusion, the issues that emerge from this review and which will be examined in this thesis centre upon behaviours in team innovation processes. The central focus is how process may alter for different variables. For example, are there different types of innovation? If so, in what way do they differ with regard to antecedent and, or, process factors which influence their success? Can we see changes in the behaviours of teams as they progress through the innovation process as a result of their context, for example deadlines, type of innovation? Are some behaviours more important for successful team innovation outcomes? Finally, how far are these behaviours dynamic in their impact, with the same category of behaviour having different effects at different times in the innovation process?

In the next chapter the methodology of the pilot and experimental studies that comprise this research will be outlined. Then, in chapter four the pilot will explore supportive evidence for the aspects, which have been shown as important for team innovation from this analysis of the literature. These will then be discussed in terms of their incorporation into the experimental study in chapter five, whilst chapter six will look at the link suggested by work cited in this chapter between processes, behaviours and innovation outcomes.

Chapter 3
Methodology

This chapter describes the methodological approach adopted in this research. It highlights the definitions and techniques that are important in the current study, paying particular attention to how issues will be tackled in the research. Finally, it explores in detail the current research outlining approaches taken in both of the studies that comprise this research.

3.1 Definitions employed by current research

The central focus of this research is the team as a vehicle for innovation, therefore, it is important to define what constitutes a team. McIntyre and Salas (1995) assert that team research involves studying an aggregation of individuals, not the individuals themselves. The distinction between a group and a team is often neither clear nor distinct (Ilgen *et al,* 1995), although for ease of writing in this research the two words, team and group, will be used interchangeably. The definition to be adopted in this work is based on Weingart's (1997) amendment of Dyer's (1987) terminology. She side-steps the team / group distinction debate through her deployment of the term "*co-acting work groups*". These she identifies as "*sets of individuals engaged in interdependent activities who must collaborate to achieve common goals*" (p.192). A definition that highlights the interdependency of teams' activities and outcomes, is offered by Morgan, *et al* (1993), who define a team as: "*a set of two or more individuals who interact interdependently and adaptively to achieve a specified, shared and valued objective.*" (p. 3)

Drawing on these prior approaches, the final definition of a team utilised in this study is developed as "*a set of three or more individuals, who are interdependent in their activities necessary to achieve an innovative outcome for the unit of adoption*".

One influence from the research that significantly shaped the approach adopted in this work was King and Anderson's (1990) work, in which three distinct forms of team innovation are suggested; *Imported, Imposed and Emergent*, (see Chapter 2, section 2.2.2 for definitions.) They raise a number of questions in this regard. First, are these three categories distinct forms of innovation? Second, are there distinctive forms of behaviour that differentiate these three categories? Third, do different team behaviours distinguish different levels of innovative outcomes? For example, are there some behaviours that teams undertake which lead to more innovative outcomes regardless of the type of innovation category? The importance of studying this area is to identify factors that may be significant for organisations seeking to be more effective in their team innovation.

3.2 Approach to current research

The research encompasses an organisational pilot study to identify and develop features for the main experimental study, which was designed to examine temporal aspects of teams' innovative behaviour. The research design evolved from two pieces of work. First, Gersick's (1989) work, which developed an experimental approach following her study of teams in situ. The current experimental study built on the Gersick's (1988 and 1989) research examining the dynamics of team innovation processes, but was specifically exploring innovation in teams. Its focus was on temporal changes in teams' behaviour, and in highlighting the important role of those external to the team in helping to shape innovation. This latter aspect challenged much psychological work, which has concentrated on a regarding the team as isolated from a wider context and reference. The second influence to this research was King and Anderson's (1990) suggestion of different behaviours dependent on the category of innovation. As a result of these two pieces of work the current research sought to explore the effect of time deadlines on teams' innovation, both in terms of the innovation outcome and the impact on a team's innovative behaviour and the importance of those outside the team in the level of innovation outcome. Also the research examines whether there are different behaviours associated with the three different types of innovation category King and Anderson (1990) suggested.

Gersick's (1989) research is very significant for this thesis as it offers a means of analysing team processes and of including the external information resources within an experimental paradigm. Her initial study (1988) looked at teams within organisational contexts and developed the behavioural coding to be used in the later study. Gersick's (1988,1989) work, however, looks at triggers for change, not teams' innovation per se. It was, therefore, decided to appropriate her approach and use two distinct parts to this study. As Gersick (1989) had done, it was felt important to establish within organisational settings the validity of the design conditions for the experimental studies and the features to be included within the behavioural code-book. This approach echoes earlier work by Strauss (1987), who proposed the need for induction, deduction and verification with research studies, and Smith's (1991) work, which argues that the essence of research should be causality and relationships. Each of the studies will now be discussed separately, with their distinctive influences and questions.

3.3 Pilot study

The first part of the research was intended to set the context for the later work, incorporating a more exploratory approach. McGrath and Grunenfeld (1993) have noted that the problem of much the literature in this area is its focus on artificially created teams. This first part of the study was based in actual organisations, to examine teams' innovations in a naturalistic setting. The literature has highlighted the importance of organisational context in shaping teams' behaviour (Sundstrom *et al* 1990). It was, therefore, decided that the first part of this study should be based within organisations, and would look at the real experiences of teams with regard to innovation. The aim of this was to reveal the complexities and multiplicity of potential influences on innovative teams. Further, it was intended to examine how distinctively the three aforementioned types of innovation (*emergent, imported* and *im*posed) emerged, and to identify aspects that were considered important for teams in their innovation.

An interview was determined as the best approach for the collection of data from a variety of sources concerning individuals' experiences of team innovation. Harris and Sutton (1986) noted the importance of corroborating evidence in using interviews. They argued that "similarities observed across a diverse sample offer firmer grounding for ... propositions (about the constant elements of a model) than constant elements observed in a homogeneous sample" (p.8). It was, therefore, decided that two organisations would be chosen as the focus for the research in order to allow comparison between the different contexts and team behaviours regarding innovation.

3.3.1 Sample

The motor industry was identified as a sector well-known as a leading innovator and one of the first industries to introduce team work into the U.K. (Mueller, 1992a, b; Forrester, 1995; Delbridge and Turnbull, 1993). The same sector was chosen to aid comparison between the organisations. The aforementioned studies indicated the importance of the idea of employee participation through innovation, operating on a team basis. In choosing which organisations to study, comparability of size and product were significant considerations. Two organisations were approached and confirmed that they used teams in their innovation. Access was given by the organisations to team members at sites building comparable small to medium sized cars in the U.K. Both organisations were operating within the U.K., with head offices in the U.S. and Japan respectively. Confidentiality was guaranteed to the organisations.

The innovation teams were chosen randomly from across the plants. The only requirements for each innovation was that they were team based and that the participants must have had direct personal experience of the project. The participants represented between sixteen and twenty-three percent of the workforce involved in innovation at the sites. The participants in the research comprised engineers, line supervisors and operators. There were differences in the context of the teams, so some teams would meet on an intensive one-off basis, others meet regularly on a project basis, whilst continuing to do other duties.

3.3.2 Method

King's (1994) review of qualitative interviews outlines the high flexibility and the depth of data they can provide. Kvale (1983:174) defined an interview as a technique, "whose purpose is to gather descriptions of the life-world of the interviewee with respect to interpretation of the meaning of the described phenomena". The goal of the qualitative interview approach is to explore innovation from the interviewees' perspectives and through these insights gain an understanding of team and organisational processes for innovation. The themes from the interviews were contrasted with those from literature. It was decided to choose a semi-structured approach (see appendix A. for interview schedule), because this allows flexibility for the researcher in responding to the interviewees' insights, whilst ensuring consistency of information gathering from across the entire group of interviewees. This confirmatory perspective is important in making comparisons between existing literature and the current findings.

One of the inherent problems with interview techniques is the accuracy of information. One way of improving the quality and accuracy of the information given by participants is to focus on their own experiences of innovation, rather than third party experience. It was, therefore, decided to ask interviewees about a recent innovation they were actually part of. As the interviews were based on retrospective activities, it was important that a recent innovation was chosen as a means of trying to ensure that memories of their activities were fairly fresh and, thus, diminish the impact of forgetting on their recall. A recent incident was also chosen to try and explore more typical team behaviour, rather than special one-off events, which might have different structures and support systems surrounding them.

The semi-structured interviews were designed to include an initial open story-telling question to help relax the participant. On arriving at the interview their reason for attending was clarified and confidentiality assured. Each person was invited to talk about a recent innovation with which they had been involved. They were asked to tell the researcher their story about it. There were a series of potential prompts, used as necessary, to gain information to help explore their experiences, draw out information regarding the type of innovation, and the process which the team followed. Where possible, outcome data, for example, the savings made from the innovation were obtained.

In most cases the interviews were recorded. In four cases, however, it was not possible to record the interview. There were two specific reasons for this. One was because of background noise at the physical location where the interview took place. In order to help the participants feel more relaxed, the interviews took place in the respondent's own environment and, therefore, for those involved in production, noise was an issue. Second, in one case, a respondent had difficulty speaking whilst the tape was on and asked for it to be turned off. In these cases detailed notes were taken during and following the interview. Each respondent was reminded at the end of the confidentiality of the information they had given and thanked for their time.

Retrospective interviews have a number of disadvantages. The approach relies on the accurate recall of past events by individuals, which may be liable to potentially incomplete or inaccurate retrieval. This may be as a result of selective, or biased recall by the interviewee, or a reinterpretation of events from the participant based on knowing the outcome. For example, elements of the innovation that seemed very important at the time, in the course of the innovation process may become less significant and, therefore, potentially more likely to be omitted by the interviewee. In one case it was possible to check the accuracy of the individuals' recall by triangulating data, through interviewing a number of team members. Steps were undertaken in order to limit some of the disadvantages of the interview process. The collection of material was from a representative sample within each of the organisations as a means of minimising bias. The interviews were assessed as a collective account so when a theme emerged from one participant, confirmation and corroboration of the same theme was sought from others involved in team innovation.

The following chapter discusses in detail the marked differences between the two organisations. In most cases it was not possible to gain confirmation by interviewing multiple team members (triangulation), either due to shift patterns changing, or problems in releasing employees during production time to be involved in the interview. These are common difficulties encountered in undertaking research in organisations in which one is relying on the goodwill of the organisation and its members (Buchan *et al,* 1988). Although the researcher did attempt to get triangulation of data for one innovation, it was not possible to achieve this across the sample. As noted above, therefore, internal support and consistency of themes was sought in each case as a means of confirming findings.

A second problem is that interviewees are the prime focus of the analysis. The interviewee can choose, if they like, to bias their responses and this can be a due to a number of reasons (King, 1994). They may be an experienced interviewee, trying to anticipate the purpose of the question and giving the answer they think the researcher requires. Alternatively, an individual may be trying deliberately to distort their answers to show the organisation, or themselves in good light. Finally, an individual may actually fail to recall accurately their experiences..

Two steps were taken to minimise adverse effects from bias. First, as noted above, themes emerged from an aggregation of interviews and as such reduced individual bias. Second, steps were taken to build a rapport with participants, such as meeting in their office and where possible trying to use their words and phrases in the questions.

At the end of an interview in moss cases the interviewee would take the researcher to see the innovation that they had talked about. This was an important part of the process as it offered the opportunity for interviewees to say things "off the record", and also a chance for the interviewer to check informally and gain confirmation of information imparted in the interview.

Field notes describing the interview itself and anything of importance that occurred were all recorded after each interview session.

Lastly, for King (1994) an interview involves the collection of a vast volume of data. If gathered from a specific sample, whose discourse offers the opportunity as Harris and Sutton (1986) and Potter and Wetherell (1987) argued, to examine aspects of differences and seek confirmation. This was the approach adopted and commented on in the proceeding chapters.

3.3.3 Data analysis

In most cases the interviews were tape recorded and transcribed verbatim. The aim of the research analysis was to follow grounded approach and then to compare the themes with the literature. This is discussed in further detail below. Using discourse analysis, common themes were identified regarding innovation in teams. The transcripts were coded using an iterative process. In line with this approach the talk was analysed, by means of both an *a priori and a posteriori* devised system coding system (Altheide, 1987). On an *a priori* basis this involved themes identified in the literature, such as codes related to ideation (Gersick, 1988), communication (Anderson, 1992) and goal setting (West, 1990). The coding scheme also allowed the emergence of themes that arose from the interview, such as discussion of feelings. Through an iterative process of continually revisiting the transcripts, a set of new codes emerged on an a *posteriori* basis. This second category of codes was more specific to the particular organisations. In this way the context and the specific issues relevant to the organisations could be gleaned, instead of relying on a predetermined series of codes emanating from more general literature.

The themes that emerge are an amalgamation of the individuals' perceptions of team innovation. Some have shown common aspects that cross both companies, others appeared to be more context specific. How far these codes reveal the "truth" about team innovation is open to debate. What we can be certain of, however, is that these individuals were involved in what their companies defined as innovations and were therefore, a company-based construction. Whilst it would be naïve to suggest that the researcher was able to isolate completely any theoretical perspective, they attempted to be open to the themes the interviewees' identified, before attempting to consider them in the light of the literature.

From the first assessment of themes, an edited document is produced, which includes all the coded "meaningful segments" (King, 1994:26) of the text. The individual meaningful segments are then re-categorised using a Q-sort technique. This permitted the identification of potential linkages, or "clusters" (Hycner,1985) of items. The Q-sort was validated by an independent coder, who confirmed all the final coding clusters. Thus, the final code-book was produced from the emergent themes for each organisation. The use of an external coder was a further control for the validation of the final codes. The coder was independent and had scant knowledge of the literature in this area.

The choice of qualitative methods should not reduce the rigour of the analysis (Stevenson and Cooper, 1997). In order to demonstrate this, the reliability and validity of this code-book were examined (Cohen, 1960). Twenty percent of the interview transcripts were re-coded by an independent rater. The results of this are included in chapter four. As part of the discussion and analysis of the transcripts quotes will be used to illustrate the emergent themes. This is in line with Sherrard's (1997:161) recommendations for adding to the reliability of the approach by including quotes within the text, so that we do not "threaten validity, by ignoring context" (p.161). For each quote two unique codes will be used. The first is a letter designating the individual speaker. These are included as they give the reader some indication of the range of people making statements. Second, the transcript line number will also be noted.

3.4 Longitudinal experimental design study

3.4.1 Method

The pilot study indicated the importance of looking at innovation as a collective activity. It confirmed some of the literature regarding team innovation and identified *a priori* behavioural codes, such as procedural aspects (Gersick, 1988; 1989), task based information sharing (West, 1990), humour (Foot, 1988) and leadership (Anderson, 1992). It also indicated two important experimental design features; first the role of time *deadlines* in potentially changing teams' behaviour (Gersick, 1988; 1989), and second, the necessity of having an external information source for teams, providing context to their activities. The pilot study had indicated the lack of clear distinctions between the three categories of innovation King and Anderson (1990) had suggested, instead indicating a melding of imposed and emergent features in teams' innovation. Although there was a melding of the three categories, it was decided to include them as a design feature within the experiment.

Research (Arrow and McGrath, 1995; Gersick, 1989) has suggested the value of using laboratory settings for studying specific dimensions which would be difficult to manipulate effectively within a work setting. It was, therefore, decided to simulate a work setting. The second study was an attempt to reduce the complexities of the world and in doing so it must be recognised that the context for teams had been somewhat artificially removed. The study sought to build on Gersick's (1989) experimental paradigm to examine the teams' process towards an innovative goal as it actually unfolded.

Arrow and McGrath (1995) identified a number of important dimensions that arguably could improve the "reality" of a simulation. First, they argue that the task chosen has to be concrete and innovative. It has to involve co-acting groups, such that collective responsibility and action are necessary to achieving any outcome. Second, in mirroring real organisational life, the team would be simulating a task force. Task forces are set up within organisations and commonly begin, and end, with the completion of the task. Third, the objectives are clearly defined and external supervisors are available to give support and advice throughout. This ensures that the teams were not acting within a "context" vacuum. Fourth, the outcomes are assessed against others' work, and feedback is provided to individuals. Finally, a tangible bonus is given to the team who performed best overall. All of these conditions were adhered to in the task.

3.4.2 Design

The goal of this second study is to observe and record teams as they worked through a concrete task. The earlier pilot study had identified that type of innovation and time deadlines appeared to affect the team's behaviour. It was, therefore, decided to manipulate these variables experimentally. Teams would be observed in terms of the development and implementation of ideas, to see what impact type of innovation and time deadlines had on their team processes. Temporal aspects would also be examined like Gersick's (1988,1989) model of punctuated equilibrium. This suggested that team processes change markedly at particular times, like the mid-point. The role of the external in teams' innovative behaviour would also be examined.

Teams were randomly allocated into one of six categories. These included the three innovation categories, with half of each category having the extra constraint of operating under a time deadline (see table 3.2 below). In total forty-eight co-acting work teams were observed for the duration of an innovative process. The teams comprised between three and five volunteer participants. There were eight teams in each research category. Teams were requested to arrive at a specific location at a pre-set time. All of the times given to team members were designed to be less than obvious times, for example, 10 past or to the hour, in order to avoid overtly sensitising them to time. Teams were also randomly placed under one of the innovation dimensions, emergent, imported, or imposed. (These distinctions will be explained in more detail shortly.)

Table 3.1:Experimental study design

	Time deadline	
Type of innovation	No time deadline - just finish the task	Set time deadline of 1 hour
Emergent	8 teams	8 teams
Imported	8 teams	8 teams
Imposed	8 teams	8 teams

Total no of teams = 48

The participants were all students studying business and psychology courses at a university. Their ages ranged from nineteen to thirty-five years old. All of the teams' members had worked in an organisation for a period of at least one year. The session dates were set in advance, with the volunteer participants asked to attend a specified session.

Several steps were taken to simulate real task groups. First, there was varying levels of acquaintance in each team. Team members were randomly allocated on a first come basis to teams. This acquaintanceship level is what one might commonly expect in normal work situations. The teams were briefed about their task at the start of the session. In mirroring Gersick's (1989) work, they were asked to create a concrete product for an external client, with an identical and finite pool of resources. Their task was to design and produce a poster for a drugs campaign aimed at secondary school children. The team members had collective responsibility for the product and had to make interdependent decisions about how to create and proceed, they were not merely working side by side or carrying out preset orders. Finally, they were told that independent assessors would judge their completed product and the best team would receive a prize.

To assist them each team was given access, via telephone, to two external advice sources. Since, the team's innovative poster was aimed at secondary school children, these roles, played by confederates, included a medical expert, and a head teacher of the school in which the poster would be piloted. The teams' three innovation categories included; an open *emergent* condition, in which teams were entirely free to develop their own ideas; an *imposed* condition, in which teams were informed of the final poster slogan, "Only mugs do drugs", and some further details, including a confidential telephone line number, that they **must** include in their final poster. The *imported* groups were given a folder containing a range of previous drugs campaigns aimed at this age group. They were free to use, i.e. import, this information. The study builds directly on the task Gersick's (1989) teams undertook. This was a task that required interaction from the team in its achievement. It also required innovation in generating and implementing the poster. It did not require team members to have expert knowledge about drugs or advertising, but that everyone could be involved in it in some way. There may be some ceiling effect on the quality of the final project through using a student population, however, the task did include a tangible reward for successful teams and care was taken to provide adequate materials and feedback to students regarding their performance of the task.

In the room in which they were working a large clock and telephone were clearly visible to the team throughout the duration of the task. All of the materials were placed on a table in front of them. Teams were told of the condition under which they were operating at the start of their session. Free time teams were asked to indicate completion of the task by putting their poster up on a poster board at the side of the table. The teams were given an opportunity to ask questions at the start of the process. The teams' entire activities were video and audio taped. The teams' narratives were transcribed verbatim and coupled with observational data.

3.4.3 Data analysis

As with the earlier study, a code-book was established to categorise team behaviours. The code-book was generated on an *a priori* basis from the literature and the earlier pilot study. The literature review contains an extensive survey of the work on teams and innovation. Mentioned here are a number of more important studies that have contributed to the data analysis for this part of the research. Each of these codes was also confirmed by the pilot, organisation based research. A major influence on the code-book was Gersick's (1988, 1989) studies. This study expanded upon Gersick's (1988) original coding of time sensitivity, external influences and contributions to the final innovation (procedural, format content and detail). External influences were also noted by other researchers (Slappendel, 1996; Myres and Marquis, 1969, Tushman and Scanlan, 1981; Kaplan, 1963; Ancona and Caldwell, 1992; Kanter, 1988; Jewes, Sawes and Stillerman, 1969.) Also included as a code was goal setting behaviour, which had been identified by a number of studies (including Ilgen *et al*, 1995; Bolman and Deal 1992). Leadership was identified as important by Anderson and West (1996) and Bolman and Deal (1992). Wider ideation (i.e. not just final ideas) was found to be important from the work of West, (1990); Schneider *et al* (1994); Grundry *et al*, (1994). Both task and personal information sharing was another aspect of team behaviour that earlier work had identified (McIntyre & Salas, 1995; Grundry *et al,* 1994). Team feedback (Schneider *et al,* 1994; McIntyre & Salas, 1995) and "trust" categories had emerged as important in the work of Schneider *et al* (1994); McIntyre & Salas, (1995); Grundry *et al*, (1994), Bolman and Deal (1992), and West (1990). Humour was a further aspect indicated as important (Foot, 1988 and Paton, 1988). All of these features were included in the code-book. The pilot also indicated that teams' attention towards procedural, and resource aspects was important and, therefore, these too was added as codes.

The code-book was also developed in part on an *a posteriori* basis. Aspects that emerged included the personal disclosure of information, differentiating three further sub-categories of external interface and idea generation and building. There were a few finer distinctions made for codes; for example, resources were originally divided into time, materials and expertise as separate entities. However, these were later aggregated, as there were insufficient sub-categories to permit the level of analysis required. The code-book utilised in the second study is described in more detail in chapter five, (5.2) page 157 onwards.

Table 3.2: Summary of final code-book for experimental study

Main category	Sub- categories	Main category	Sub- categories
• **Ideation**	General idea suggestion	• **Goal setting & direction**	Clarification of team objective
	Idea building		Clarification of team procedure
	Imported idea		Leadership / directiveness
	Constructive criticism of ideas	• **Information sharing**	Information sharing (task related)
	Contributions to adopted idea content		Questioning to illicit task information
	Contributions to adopted idea detail	• **Interpersonal relation**	Information sharing (personal disclosure)
	Contributions to adopted idea format		Humour
• **External relations**	Articulation of need for external contact		Positive feedback
	Clarification of objectives for external interaction	• **Resources**	Resources, inc. materials, expertise
	Actual external contact		Time awareness

In order to ensure repeatability and reliability, 10% of the transcripts were randomly selected and recoded by an independent assessor. The results are reported in chapter five (5.3.1.1 page 165 - 166).

The coded data were transformed to control for the different completion times, by expressing the coding category as a proportion of the total behaviour for each team. This was done by dividing the team's activity into four quartiles, the duration of which was wholly dependent on how long they as a team had taken. Thus, a standardised measurement of activity could be gained, regardless of the temporal durations of a team in completing the task. The teams' activities were assessed first in terms of "what they did", through a relative frequency count of behaviour. This expressed the codes as a percentage of their total activity. Second, they were assessed on "how they did it" using Fisher's (1970) approach by examining in more detail the dynamics of activity through analysing the coded behaviour over four equal phases. The use of quartiles allowed the examination of Gersick's (1988, 1989) mid-point to be included in the analysis. Unlike Gersick's work that had far fewer teams and focused on changes in behaviour, this study allowed more statistical comparison of the team behaviours to be done across the duration of the task. This was considered important in answering the question, how far did behaviour affect the outcome of the team, and the impact of type and time categories.

In order to generate an outcome measure, the teams' activities had to be assessed in some valid way. In this study it was decided to use the final posters as the outcome and gain a rating from a panel of experts. A modified version of West and Anderson's scale was adopted. There were three main reasons behind the decision to use this existing scale. First, this was a scale that had been used in a number of studies, and was an improvement on previous ones. Second, the scale would allow separate comparisons to be made of the poster by a number of individual assessors. Third, the assessment could be used in an aggregated form, providing the agreement between the judges was of a statistically significant level. The reliability of the judges' assessment is discussed in detail in chapter six, (6.2.2 page 210).

In reviewing the scale and its application to this task it was evident that some modifications would be required. Poster *quality* could encompass a number of West's dimensions. For this exercise the *novelty* scale was divided into two distinct aspects, which focused firstly on the novelty of the poster's *content* and secondly on the novelty of the presentation, or *layout*. In accordance with West and Anderson (1996), an anchored seven point rating scale was also included. There were brief descriptions provided of each rating facet. These descriptions were explained to judges at the onset and they were encouraged to ask questions if they were unsure. They were also encouraged, in their introduction to the task, to use the entire scale if possible. This is similar to assessment centre rating procedures (Woodruffe, 1993). To further aid in the research, the judges were also asked to include comments after each rating to allow collection of more qualitative information as to what aspects of the poster had formed the basis in making their rating decision.

The judges were asked to make ratings on five categories of innovation and provide any comments as to why they had given that rating. The ratings included: *Radicalness, novelty of content, novelty of layout, clarity* and *quality.* [These independent variables will from now on appear in italics to assist the reader.] Care was taken to ensure that the content of each of the definitions echoed the instructions that had been given to the teams in the study. The definitions below include the exact wording and emphasis of the original. Bold and underlines were used to emphasis the differentiation between the ratings that was required from the judges. *Radicalness* was defined as, "the extent to which this poster is a **significant departure** from previous campaigns they had seen". The rating anchors ranged from "highly radical" to "not at all radical".

a.) Radicalness - the extent to which this poster is a **significant departure** from previous campaigns

highly radical radical						not at all radical
7	6	5	4	3	2	1

Novelty of content was defined as "the extent to which this poster's **<u>content</u>** is **new & innovative".** Rating anchors here were "highly original content" to "no novelty at all in content". *Novelty of layout* was defined as "the extent to which this poster **<u>lay-out</u>** is **new and innovative".** Rating anchors ranged from "very original layout" to "no novelty at all in the layout". *Clarity* of message was defined as "the extent to which the **<u>message</u>** of this poster is **clearly understood** - warning children of the dangers of drug abuse". Rating anchors included "very clear message" through to "complete lack of *clarity* for message". Finally, *quality* was defined as "the extent to which this poster is **well presented".** Rating anchors ranged from "high quality of poster" to "no attempt to produce quality".

The expert panel members were each chosen for their different areas of expertise. The panel included a graphic designer, two education experts, a secondary schoolteacher and a drugs counsellor. A graphics artist was chosen for their expertise in the artistic content of the posters. A drugs counsellor was selected for their knowledge of the area of drugs and also campaigns of this nature. A secondary school teacher was asked to judge the posters from their involvement with the supposed audience of the poster. Two educators experts were selected to provide a more general assessment about the educational content of the task.

The second process measure that could be measured was the team's behaviour. The team's behaviour was coded using the aforementioned coding system. This assessment focused on aggregated frequencies of each team's behaviour drawn from three levels of data: first, aggregated total team behaviour; second, aggregated team behaviour within a quartile and; third, aggregated team across quartile behaviour. This allowed the analysis to include Gersick's (1989:274) "deliberate attentional shift" (defined as "a burst of activity, the dropping of old patterns, re-engaging with externals, the adoption of new perspectives and dynamic progress".) This analysis could examine both intra-team activity and contact with the external information sources.

There were two specific analyses conducted. The first examined whether type of innovation and deadline affected teams' behaviour by means of an ANOVA design. This allowed the examination of whether there were differences in teams' behaviours between the different types of team. Initially ANOVAs looked at overall differences and then at differences within each quartile. A third repeated measures ANOVA was then used to examine whether the teams' behaviours varied in different ways through the duration of the task. The second set of analyses was to identify whether successful teams had different behaviour from other teams. This was done by means of stepwise regression analysis, to distinguish which behaviours, if any, were important in highly innovative team outcomes. It also allowed us to identify if the impact of any of the behaviours changed over time.

3.5 Conclusions

The method undertaken in this research involved using both qualitative and quantitative techniques. The scope of the main "experimental paradigm" was established through an organisationally based pilot study, which confirmed many aspects previously found within the literature. The pilot study indicated some important design considerations for the experimental study, such as the introduction of an external information source the teams could use and the time deadlines for the team. Also, the literature distinguished a number of team behaviours to be observed throughout the process.

The experimental study drew on relevant literature (Gersick, 1989: Arrow and McGrath, 1995) to increase the contextual aspects of the study. The emergent themes from the pilot study are discussed at length in chapter four, which clearly indicates their role in the experimental research. The experimental study is considered in two specific ways. First, the relationship between category of innovation (King and Anderson, 1990) and teams' behaviour is analysed in chapter five. This chapter also considers the role of time deadlines in shaping teams' behaviour. Second, the relationship between teams' behaviour and innovation level is assessed in chapter six. The implications of findings from both the pilot and experimental studies are discussed in detail in chapter seven, and a model for innovative teams' behaviour is identified. The research does highlight the need for further study within this area and this also is found in chapter seven.

Chapter 4

Study one - Industrial pilot study

This chapter focuses on the initial pilot which was conducted to identify the central features of the later experimental study. This pilot concentrated on the team innovation experiences of innovators within two automotive plants. The automotive sector was selected as leading U.K. industry in the introduction of teams, especially in their role as innovators. Semi-structured interviews with recent members of a team involved in an innovation form the basis of data collection in this pilot. The chapter commences with a brief introduction into each of the firms involved in the study, then the code-book developed from these interviews in first the Japanese organisation and then, the U.S. organisation will be examined. Pertinent quotes will be included and distinguished from the main text through the use of arial font. Interviewees will be distinguished through the use of a letter and the relevant line numbers for each statement. Although a large number of aspects are indicated, the subsequent discussion will focus on aspects most pertinent to the experimental study. Following each separate analysis of the organisations, a summary will contrast the findings from the organisations and then highlight the links to the experimental study.

4.1 Background to the organisations and sites

4.1.1 Japanese organisation

This site produces a small and medium sized car for the European market. The organisation uses a continuous improvement process (from henceforth known as C.I.P.) to innovate across departments. This process was introduced in 1991 in the trim and chassis area and was subsequently cascaded into every department. The objectives of the process were to improve productivity or operator "care", (an organisationally specific word for health and safety). These C.I.P.s were undertaken by each section's supervisor across the entire operation. The supervisors each undertook a training programme to teach them the techniques they would need to use. To reinforce this process, each supervisor's appraisal requires them to undertake at least four C.I.P.s a year, plus two more long term improvements.

Before an innovation is undertaken the supervisor agrees the objectives and scope with their senior supervisor. The C.I.P is supported by engineers from a central resource and a special team (Kaisen team) dedicated to developing and fabricating the outcome designs of the C.I.P. The C.I.P. takes place over a two day period led by the supervisor, with team members across both shifts in the area involved, as well as a central engineering representative. Prior to this, the supervisor produces a detailed timetable for the two days. This includes the goal or target, but does not provide pre-determined solutions as to how to achieve this.

The process involves collecting data on the pre-identified problem area, for which potential solutions are then developed and tested out. The final improvements of all C.I.P.s are conveyed across the entire department through a weekly communication session led by department managers and attended by all the supervisors.

4.1.2 American organisation

This site also produces a small and medium sized car for the European market. This research focuses on the team concerned with the small car. The American organisation's process operates differently. Instead of concentrating on improvement generated from the shop floor, they have created a specific team. This links together designers, engineers and buyers for a particular product at one European production site. These specialists occupy offices in one facility and are engaged in building the product. This team provides a central resource for all the plants across Europe that build this product. This is a new development and the first such team, comprising approximately thirty members has been in operation for two years.

Target improvement areas requiring innovation are identified through customer and product performance data, which is produced on a weekly basis. Each innovation project is delegated to one specialist, often an engineer, who is responsible for solving that specific problem. This engineer will involve other specialists both within and outside the team to help them resolve the issue.

They also liase with the production and shop floor areas as an improvement is implemented.

4.1.3 Contrast between the organisations

In contrasting the two organisations, one has a bottom up approach to innovation, the other a more top down approach. One seeks to involve and utilise the skills of those involved in production, bringing in specialists skills as needed; the other brings in specialists to take responsibility for and implement for the production solution, with very limited involvement from those involved in production.

4.1.4 Working environment

Both organisations have adopted deliberate, but very different, approaches to the working environment. At the Japanese organisation each section has its own area for break/rest time. The area has many notice boards, each with visual communication about team issues, including their performance and training levels. In the same area the supervisors have desk and filing facilities, which are separated according to their shifts. The rest of their team have shared table and chair facilities, hot water, microwave and lockers. In some areas there are soft chairs, televisions and videos. The supervisors are located within same area as their team. The supervisors from the two shifts meet every morning before production begins to exchange relevant information. The supervisors meet with their teams every morning.

At the American organisation the small vehicle team (S.V.T.) has a large open plan office for all the staff. There is a separated glass walled office for the manager of the section. The team also has a video conferencing facility for communication with colleagues in continental Europe and a team conference room. The team sits together, in groups of four desks, each arranged to face each other. Seats are allocated on the basis of similarity of specialism. There are two weekly meetings, which all the staff attend. These are held in the mornings. One is specifically to discuss cost issues, and the other for quality based problems.

4.1.5 Training skills for innovation

Both groups received training in the techniques the company determined were necessary for innovation. In the Japanese organisation this training focused on technical and process skills necessary for the two day improvement process. Whilst, in the American organisation, a new innovation and problem solving training programme was launched of which this team was the first to receive the training. The training included team building exercises. Both of the training courses were originally led by external consultants, with a view to transferring them in-house as knowledge was cascaded. Only the American programme uses "psychological" aspects as well as engineering principles. Both were process driven, but the American programme was based on Gestalt psychology. This Gestalt course paid particular attention to help team members to understand group processes, especially at the beginning and end of sessions, with trainees being required to give an account of their feelings about the course.

We shall now look at team member's experiences within first the Japanese and then the U.S. organisations. Particular attention will be paid to those aspects that will be included in the experimental study.

4.2 Japanese organisation

4.2.1 Participants in the study

Ten people participated in the interview study in this organisation. These included two engineers, one line worker and seven line supervisors. The interviews included innovations across all aspects of production: press, body, paint, final, plastics, materials handling. The innovations discussed included new line side material handling systems, fork lift lights, material binning and counting systems, parts presentation systems, line improvements, production systems, die change systems, and the implementation of new health and safety legislation. The participants covered seventeen percent of the production site staff and represented those at the forefront of innovation for the organisation.

There was one project in the study for which it was possible to interview multiple participants. These interviewees were from different parts of the organisation. One was the area's supervisor (K), one a centrally based engineer (J) and the third a production based team member (F). The latter team member was also actively involved in innovation for this area. The respondents corroborated many of the details of the innovation, but also illuminated other aspects that emerged from their unique stand point. The contribution of these participants is treated as separate accounts of an innovation for the purposes of this research. The coding of their transcripts was congruent with themes of the others in the study. No distinctions regarding their contribution to the emergence of themes is made in the text because of the corroboration and congruence their experiences offered.

4.2.2 Final Coding of transcripts for this organisation

The coding cluster for the transcripts from the Japanese organisation emerged from both *a priori* and *a posterior* approaches to code generation. The final codes were aggregated from 96 emergent issues into a cluster of five overarching groupings, with eighteen sub-themes encompassing twenty-three areas. Table 4.1 reports the inter-rater reliability for the themes. The data were reduced and distilled across the organisation's transcripts of the interviews. The final code book is reproduced in Appendix B and includes short descriptions of each code used in the transcriptions. The researcher will indicate and pay particular attention to those codes pertinent to the experimental study.

Table 4.1: Reliability of coding for Japanese transcripts

	Code category	%	Out of
1	**Process**		
a	Goal setting	100	
b	Idea importation	88	8/9
c	Idea generation	85	6/7
d	Idea development	85	6/7
e	Progress through process	93	14/15
f	Time	100	
2	**Internal**		
a	Role	80	8/10
b	Communication	77	7/9
c	Interaction and Involvement	100	
3	**External to the team**		
a	Communication	100	
b	Prior communication and consultation	87	6/7
c	Role of external	100	
d	Japanese relationship	100	
4	**Attitudes** -		
a	Striving to improve	85	6/7
b	Openness	100	
c	Development	72	8/11
d	Feelings	50	1/2
5	**Organisational specifics**		
a	Resources - Financial	90	9/10
	Time	78	11/14
	People	87	7/8
	Materials	66	2/3
b	Organisational context	100	

4.2.3 Reliability of coding

To establish the reliability of the final code-book twenty percent of the transcripts were re-coded by one independent coder. The results can be found above in table 4.1. The results are expressed in percentage terms of agreement between the raters. They indicate high levels of agreement, in many cases at hundred percent level.

4.2.4 Analysis of themes

In reviewing the emergent themes from the Japanese transcripts five broad categories were identified, focusing on process, internal and external to the team aspects, attitudes and organisational specifics. The categories were identified by the aforementioned coding and by Q-sort approaches (as discussed earlier in Chapter three). These main categories will be discussed in the following order and include process, internal and external team behaviours, attitude and organisational specifics. In each case there are illustrations of typical comments relating to each coding category. Quotes are included to highlight points made, and these will be differentiated by the use of a box surrounding them.

4.2.4.1 PROCESS

This section relates to six aspects which all emerge from the interviews regarding some kind of process. They either involve the setting of objectives for the team's process, for example "goal setting", or the actual following of pre-set processes, for example, brainstorming. Three of the themes relate specifically to the ideation process in terms of idea generation, importation or development. The penultimate cluster concerns the progression of the team through a process and the final category to emerge is time in terms of team life span, or idea development. This can be seen to echo Gersick's (1988, 1989) model.

4.2.4.1.1 Goal setting

This code identified statements relating to the deliberate setting of objectives or targets, by the supervisor, or the members' awareness of organisational or department goals they were aiming to achieve. There were thirty-four statements relating to goals in the transcripts and it was a theme that was mentioned by all except one of the interviewees. Thus, ninety percent of those interviewed mentioned goal setting directly along side innovation. Only one did not mention goals directly, he did, however, highlight that "he had ideas beforehand" (d17), which at one level indicates goals are implicit in the speaker's planning, as he had to have ideas about something he wanted to improve.

Typical examples of statements relating to goal setting include:

f20 - To see if there was any way it could get done quicker. To see if there was any way of improving the job that would be easier for the lads in the body shop palletising and less bending down. Easier for me 'erm
s3 - There's an annual plan with objectives for the production dept and maintenance departments
c20 - Role to keep production going at all costs
h2-92 - For the right reasons we can set ourselves targets we would have continued to fail them if anything, it had a negative effect, but now that we know exactly what we need to do from one session to the next, I personally like that I'd rather have that so you know what needs to be done
k4 - The original impetus was a manual handling problem - Someone had hurt their back
pa69 - The objective is to reduce to a three-man line balance

It is evident from the interviews that goals were established prior to work commencing. In each case agreement was sought from those more senior to the innovator.

One further aspect was highlighted in the transcripts. The supervisors all stated that they worked to an agreed goal. They indicated in their interviews that the goal should be achievable. In three of the transcripts, however, there are statements indicating the contrary, that a goal was either unachievable or inappropriate. These included:

f 44 Even Kev admitted that [the goal was unachievable] at the end.
j52 We established reasons for the two day improvement, we set objectives and assigned tasks. Yes, in retrospect assigned tasks was too early
d39 Scope of work still - big problem - knew solution big one - recognised across most shop and outside (including engineering)

Innovations were seen by those in the study as boosting morale and involving the high calibre of individuals now working in repetitive line based jobs. Four individuals (forty percent of the sample) mention six comments pertaining to this need for success from a C.I.P. They suggest the importance attached to the

C.I.P. initiative of being seen to succeed both to those directly involved and those in the wider department. Many of the supervisors identified the extra work they did to ensure this success. In the 'S' statements below, the supervisor went to see engineering and told them of the need to make the outcome achievable. The supervisors were sensitive to any risk, and felt that innovations would be seen by operators merely as a means of shedding manpower, with a resultant significant negative impact on the contribution of line workers to the process. The Japanese organisation's process of innovation had chosen to make operators an integral part of the process, hence the need to produce positive outcomes from the process becomes more important. Below are statements relating to this:

k25 Overnight I drew up new sheet to resolve and get positive outcome
j128 We were worried by devising this unsatisfactory solution - we won't be able to get it opened again
j62 We actually implemented that within these two days. Umm, but for the rest of the part we haven't actually improved anything very much and it was useful only, it was useful as in raising awareness type activity rather than improving the situation.
d25 It was the first major Kaisen project in shop - it was important it succeeded
s46 I was concerned if group became disheartened - I needed this to work!
s48 There was a definite change in enthusiasm - we weren't loosing a man - The environmental factor that is very important

4.2.4.1.2 Ideas importation

Many of the ideas that are used in the Plant come from in-house sources. Engineers were predominantly responsible for those ideas imported, brought in from external locations. This external liaison/interface appears chiefly in the engineering department. This links to the findings of Tushman and Scanlan's (1981) work on boundary spanning. Ideas are also imported on an internal basis through the formal encouragement of the sharing of ideas across team boundaries by regular departmental presentations. This latter process also includes the enforced adoption of successful C.I.P.s for every team, fostering the application of the same ideas across the site. The internal transfer of solutions was a frequent aspect mentioned ten times and by forty percent of those interviewed. In some cases, as can be seen below, the idea involves taking a notion or principle, e.g. "drawbridge" and utilising this concept in a design, or the direct replication of ideas from elsewhere. Certainly walking through the plant there are a series of idiosyncratic inventions, particularly for delivering parts to the operator from line side, that showed this spread and transfer of innovation ideas.

Below are a sample of the comments made with regard to importation:

m41 - scissors lift dial was something which was adapted from basically a trailer
p99 - A lot of the things you'll see that are in most departments, all stem from the body shop. The body-shop were development leaders in 1986, 87, 88
pa29 - So things that have been done in other zones, we can give them a hand, try this over there, might work here
d15 - It was along way from initial idea - had thought of drawbridge to hold back parts - but this was over engineering - we just made it simpler.

This theme suggested that the sources of ideas may be important in team ideation. Therefore, in order to include the subtleties of the idea source the experimental study's code-book will include a code to allow this distinction to be made.

4.2.4.1.3 Idea generation

This code emerged from the focus of the interviewee on the initial stages of an idea. It is not concerned with the developmental aspects following original inception. There were fourteen comments relating to idea generation covering eighty percent of the transcripts. In considering these meaningful statements it is clear that four further sub-categories can be identified. One such sub-division can be found regarding West's (1990) conception of qualitative and quantitative categories of innovation. A cluster of qualitative statements of innovation isolates the emergence of revolutionary and novel ideas:

d38 - Radical ideas - weird and wonderful - e.g. pneumatics
m59 - it wasn't anything somebody had seen before

Whilst others concentrate on more quantitative aspects, concerning the volume of ideas generated by innovators.

J94 - I came up with ideas
c15 - Always generating new ideas - always wandering round shop-floor looking at how to improve
s25 - There were loads of ideas during analysis

A third sub-category may be seen as the deliberate focusing of ideas in terms of the final outcome or goals.

f76 - The idea for a light guard for fork lift trucks
k34 - We decided to make weighing area - originally we thought of electronic scales

The final sub-division relates to the identification of the origin of the idea. Some interviewees, as above, clearly identify themselves as the source of the ideas, others were more vague, and the one below clearly indicates the origin as being from the shop floor. The emergence of this theme suggests that idea generation can be regarded as unrestricted to particular levels; it is the preserve of all employees, not just supervisors. Such involvement of all employees is important, especially in the generation of potential ideas. It also links to the earlier comment regarding the importance of perceptions of the success of innovations, in order to encourage those from every part of the organisation that they can contribute.

pa101 - For the very, basically idea, most of them actually came from the lads.

This is a further aspect of behaviour which will be included in the experimental study's code-book.

4.2.4.1.4 Idea development

Idea development concentrates on comments relating to time spent developing and improving initial ideas. In coding the transcripts eleven comments relating to this aspect were identified in half of all the cases. Development as a coding category was defined as talk relating to the changing and improving of ideas. It can be seen in these typical comments:

d21 The racking changed 6-7 time with modifications
f104 It was a developing idea for gauge for fork lift truck

This aspect is elaborated by the next set of comments, which suggests that the development of ideas appears to be an active external process. It is a process in which those involved try out and develop their notions, not an internal passive thinking state. This mirrors the distinction in the literature regarding the difference between extroverted innovation versus internalised creativity (Staw, 1990). Those extrovert based activities clearly indicated the importance of proto-typing of ideas, linking in to the emphasis on trail and error, which we shall mention later.

f 86 I did a prototype and just kept breaking that one up and making one up again until I got it right in developing the light idea
f58 There is people in all the time trying new things out
d21 I made a pilot first

The process of developing ideas also emerges as the summation of ideas. Simply, the teams were putting together ideas from a range of different sources. This again, it could be argued, reinforces the notion of anyone being able to be involved and to contribute and, thus, that ideas are not for "grand" people. It also links directly to Sundstrom *et al*'s (1990) review and the synergy bonus of team activity.

c19 We put lots of simple ideas together - not necessarily grand ideas

Although idea inception might from some of the statements be regarded as a more solo based activity, idea development is definitely seen by the participants, as a team based activity. Ideas are canvassed from others and developed amongst the team's members, thus using their different skills. This links into Anderson's (1992) idea of the social processes of innovation.

p34 The team shared and improved the idea
c11 We're open to idea -I pulls in others expertise and views by not offering my suggestions. I deliberately pulls others into making contributions, or problem solving - I see my role to ask question, not give a view.
f122 - They might say try it this way, or it's better that way. I think about what they like a say, if it's going to be easier, or benefits me. I listen to all what they say. It's sensible.

The statements regarding innovation did not suggest a distinction in terms of Anderson and King's (1990) three categories of innovation. Instead, the participants revealed a mixing of self generated and ideas imported from different places in both the generation and development phases. In terms of differentiation of innovation the only aspect to emerge was between generation and development. This may, however, in some cases be linked, as indicated in one interview, to the process the company introduced which required specifically group effort. The importance of idea development is very apparent, and, therefore, will be included in the code-book for the experimental study.

4.2.4.1.5 Progress through process

In assessing the transcripts it was clear that a process was being adhered to. Many of the statements related to following a deliberate pre-set process. The comments occurred twenty-eight times concerning eighty percent of the interviewees, and twelve further statements indicated that the teams were using a time plan. Meaningful statements relating to externally generated processes being utilised included using the following terms; "company process guidelines, data gathering schedules, generation of causes and counter measures, conclusion sheets, activity sheets, brainstorming, flowcharts, quality story boards, risk management, setting up pilot studies" and getting "buy-off". The whole process, from the initial identification of need to innovate to the final departmental briefing on the outcome, is performed in line with a company process. Paramount to the whole process is the collection of data with a further eight statements focusing on different approaches, from observation to videoing. Each supervisor is required to follow a procedure. They receive initial training in the process and must produce supporting paperwork that reinforces the stages through which they must pass. The identification of a process by which the team can achieve their task as identified here will be an aspect of behaviour to be recorded in the experimental study.

An integral part of this process is the application of a timing plan, with seventy percent of those interviewed mentioning a schedule of times against which innovation progress is monitored. The innovation procedure is already constrained by the company into two days. This forces the supervisors into leading the process to a timetable, it also ensures time is not wasted and an outcome is achieved by teams.

Several negative statements indicate the potential problems of constraining the innovation process that are associated with the approach that the company has chosen to adopt:

m125 The way we structure it erm all the moves we do is a little bit repetitive
j124 But of course these things aren't completed.
j52 Yes, in retrospect we assigned tasks was too early

or the failure to follow procedure:

m53 It's a very tight schedule
h2-46 The idea of a deadline was probably the last thing on their mind then, it was let's get this man in and see what he has to say and, for maybe for three or four months after that as well for various reasons when we were starting to generate this, the same thing applied I think. The deadline was never actually discussed yet it was still considered to be a high priority. We never actually discussed the deadline.
h2-44 I don't think at the time there wasn't any deadline, it was a case of come back and tell us in a month how you're progressing.
d17 The supervisor had ideas before hand for potential solution

Overall, the process which the organisation has chosen to adopt is "metamising", rather than "maximising" (Pascale, 1990) and as such, as one participant notes

m33 It's not the optimum method, but the best method to achieve in the two days.

In the light of this emergent theme and its resonance with the literature, the teams' attention to process will be an aspect collected in the experimental study's code-book.

4.2.4.1.6 Time

The code 'time' divided into two aspects; first, time as Gersick (1988) uses it in terms of temporality issues of change, and second, with regard to the impact of deadlines on teams' behaviour. These will be discussed in turn. In terms of Gersick's (1988) model, seven statements (twenty percent) supported the punctuated equilibrium model, with two comments related to pre-midpoint ineffectiveness, and five indicating her significant 'midpoint transitions'. The team's transitions, Gersick argued, involved frustrations leading to deliberate change, rapid change following midpoint external intervention with new information, problems of new direction as a result of midpoint shift.

One set of comments related to time highlight the progression through the life cycle of the team. The speaker comments on the progression of the team as it changed its utilisation of team members, suggesting a shift in recognition and involvement across the team's life span. It evidently began with team members not using the skills which had been the basis of their selection on to the team!

> h2-90 We now recognise the strengths of individuals within the group and use them as a team much better, whereas before maybe we weren't using own skills and our own strengths as well as we could

This aspect, related to the teams' experience, appeared from the comments to be very important for innovation. The question however, is how did time deadlines impact on the teams' behaviour? In order to investigate the role of time it will be used as a condition in the experimental study to see more explicitly what impact time deadlines had both on teams' behaviour and their innovation outcome.

4.2.4.2. INTERNAL

Attention towards the internal organisation emerged as a major second cluster of codes. Internal included aspects that were part of the intra-team behaviour. In studying the transcripts, two significant aspects were identified that tie into Sundstrom *et al*'s (1990) work on effective teams, regarding the importance of role and communication.

4.2.4.2.1 Role

The clearest role evident from the interviews was from those at supervisor level, there were twelve comments (forty percent) regarding the supervisors' job. They focused on the role of leadership, with respondents' highlighting their vocation in leading their team, getting others to contribute, supporting their teams by their expert knowledge of where to find materials and skills they needed, providing paper work (C.I.P. paper work, timetables, holidays, etc.) and organisation for their teams in terms of rotation of jobs in the team and budgetary control. Autonomy in their domain was important to two of those interviewed. As one put it:

> p82 I'm the M.D. every section I've been in it's like my company.

What emerges from the interviews and the literature (for example, Anderson and King, 1992) are questions regarding the role leadership plays in team's innovation. To set about answering this a code focusing on directive behaviours will be included in the experimental study.

Related to the notion of roles of team members, the talk of participants indicated that the composition of the team was constructed by the organisation on a deliberate basis. Although this was a feature of the interview, it is not one that will be included within the experimental design, but discussed in terms of future research in the final chapter. The current concentration, however, is focused on identification of innovative behaviour, not individuals *per se*.

4.2.4.2.2 Communication

An important topic for all those interviewed was intra-team communication. This appears to serve a number of functions, which mirrors the findings of the literature. All of these behaviours appear to be supportive to the functioning of the team in its quest to innovate effectively. From the overall comments made on communication between team members five distinctive areas can be established (see table 4.2).

In reviewing table 4.2, it is clear that one of the most widespread types of comments were those pertaining to the exchange of information across the team. These included daily meetings, letting people know important information and sensitivity to ensure cross shift communication was good.

Table 4.2: Internal communication areas

Function	Frequency of occurrence across interviews (% of the participants)
Sharing ideas	8 (40 %)
Number of points of view	4 (30 %)
Information exchange	7 (60 %)
Clarify plans/position/roles	4 (40 %)
Warn of political activity	2 (10 %)

Most frequent of all the comments in this area were those regarding the sharing of ideas on an intra team basis. This includes the idea of a synergy bonus from sharing ideas and links to Sundstrom *et al's* (1990) work. As one participant aptly put it, their team spent time "kicking ideas on the table" (h2-16). We have the sense from the comments of giving others opportunities to contribute their ideas and an openness to consider all ideas and linking into the aforementioned idea building theme. This links to Zaltman and Wallendorf's (1979) work at the organisational level regarding openness to ideas, but in this earlier work it was on an external basis.

In terms of the quality of communication, the speakers noted the open and sympathetic nature of the teams' discussions. We can see below the appreciation from speakers of the range of views, and also that there appears to be no reluctance at this level to criticise and disagree. Individuals feel free to question and challenge other members.

p40 ..listening to my colleagues who were on it, because they had more input prior to the kit being manufactured
d27 The team's free to say things - a lot of banter goes on
h2-40 If somebody wasn't happy with something we wouldn't just let it ride.
c22 Always asking questions - whole style question focused - e.g. made racking system to replace stillages to reduce area they took up, then asked why do we need so many parts?

This corroborates the literature regarding the necessity of trust for open discussion, as Edmondson (1998) and West (1990) and others have highlighted. Trust between members appeared to produce receptivity towards the input of their team colleagues, which in turn stimulated constrictive comments.

A further sub-category that was identified was the potential benefit of openness in intra-team communication. The interviews indicated the advantage, which the team felt, from gaining a number of view points on a topic. For example:

pa29 We're looking to the operator to come and say, ah it's good that, I think if I do it this way might actually make it a little bit easier again. Let them try them out, keep an eye on them, let them try them out, if they are a good idea. Let them raise any more concerns they might have had like.

The sharing and eliciting of information has emerged as an important feature of intra-team communication. The identification of this type of behaviour will be included in the code-book for the experimental study. The interviews also suggested the importance of constructive criticism, which again will be included in the code-book. It should be mentioned that two further themes of goal clarification and information concerning political activity were mentioned, however, these are not themes that can be utilised successfully in the experimental study and, therefore, are not discussed in detail here.

A further potential negative impact of intra-team communication stems from the perceived "*safety*", in West's (1990) terms, of the group in terms of idea reception. Below we have some comments from an individual who had been removed from his normal duties to provide him with more opportunity to innovate. Note the negative impact on the individual from his colleagues, and how he still continues to listen.

> f122 There's a fear you might take the mick, OK. That's fair enough, Well you just laugh, they might say try it this way, or it's better that way. I think about what they like a say, if it's going to be easier, or benefits me. I listen to all what they say. It's sensible.

This may, however, be indicative of the use of humour in teams, which the literature suggests may be important in the development of team cohesion and relationship maintenance, and not necessarily for stifling innovation (Foot, 1988, Paton, 1988). Forty percent of those interviewed mentioned some aspect of team humour, as can be seen below:

> d27 The team's free to say things - (gives a big smile). There's always lot of banter going on
> p60 Oh yes Banter. We socialised together regularly,
> j116 I teased Kevin about thinking about work off-site

Whilst it is apparent that these latter statements are linked to other positive aspects of the team's relationships, it is also indicative of the complexity in the meaning and use of humour. Collinson (1992) and Foot (1988:8) highlight the distinctive use of humour, which can be supportive in terms of mobilising "comic relief", or negative through the use of the jokes to "scapegoat" others. It is not apparent from these interviews which it is. Only one comment definitely reveals the role humour plays in relief from the monotony of a job:

> f68 Me back side is growing into the shape of a truck. (laughs)- you've got to laugh like that, but it is no joke

The use of humour by teams appears from this to be ambiguous. In an attempt to study it in greater detail humour will be a feature within the experimental study's code-book.

4.2.4.2.3 Interaction and involvement

Perceptions of participants included comments about the team's dedication and commitment. Most apparent, however, from the seven statements, that included forty percent of those interviewed, was the time which teams spent together interacting. Again, this is an aspect prevalent in the literature with regard to relationship building and maintenance (Ainsworth and Bell, 1974; Kanter,1983, 1988; Peters and Waterman, 1982; Nystrom, 1979; and Coopey, 1987; West, 1990). For the team members in this context this is achieved through a variety of ways from work-time socialising, as seen below, or out-of-hours socialising and doing of favours for each other.

> pa64 Oh, I sit with them round a table, just like this. There could be another 6 -7 of us. We talk about the football

The interviews revealed deliberate attempts to involve the whole team in the innovation process, as noted in ten of the statements (forty percent). In order to measure the team's involvement a surrogate code based on these findings will be included in the experimental study by measuring personal questions and information sharing.

4.2.4.3 EXTERNAL TO THE TEAM

In reviewing the transcripts one of the most significant aspects to be identified was found at the boundary of the team, at its interface with the outside world. The boundary can be seen at two levels, on an intra-company basis or those actually outside the firm. Both emerged as playing a role in teams' innovation. This finding corroborates Gersick's (1988) and Sundstrom *et al*'s (1990) work on boundaries, with that of innovation by Allen (1970) and Tushman and Scanlan (1981). Those external to the team are a major source for ideas, as we saw earlier, (4.2.4.1.b idea importation). There also appears to be significant overlap with both information and idea transfer within the firm. Codes relating to communication and roles both show clearly the significance of this exchange across the team boundary. In this section we shall focus mainly on the issue of external communication, which will be an important feature of the experimental study.

4.2.4.3.1 Communication with the external

In looking for examples of statements relating to communication outside the innovation team, there are twenty-eight meaningful statements covering eighty percent of those interviewed. The data suggests there are five sub-categories that emerge with regard to external communication, including sharing of ideas, exchange of views, the gaining of prior consensus, organisational justification for projects and communication upward regarding political activity. External communication was especially important for the innovation task force team (respondent H). In these 'H' interview statements are found involving the canvassing of those outside the team, who are the ultimate enactors of the innovative procedure being formulated. This is the only example, from either organisation, of government influence on innovation, which Slappendel (1996) argued is an important environmental influence for innovation. Examples of statements regarding this theme include:

m121 Basically if you let people know what you are doing then they've got their time to have a look at it, highlight any concerns what they've got basically they would get on with it as well.
h2-50 They went away and looked at this suggestion that this whole project could be expanded and they asked questions down on the shop floor of their people, their staff and they looked at it in their day-to-day business and operations. And they said yes this is a good idea, this was gonna work.
s36 Given time plan to other affected departments to give their response and agree timing.

One of the very evident benefits of this inter-team communication, which received some comment, was the speed with which ideas can be implemented across the department. Supervisors are free to implement any innovation as soon as they see the team presentations of new ideas. One example is from the paint shop where the use of a narrower masking tape made very significant savings. The speed of the implementation of the idea across the entire shop is evident from the quote below:

pa109 Most of the improvements are carried over [from another area]. A lot of the major ones we did on cost saving over there, we reduced, we were using 2 inch adhesive tape to mask off certain areas of the car and, when we looked at it we didn't actually need 2 inch we could reduce that to one and a half inch. Somebody came up with that then we obviously, we actually took a direct 25% on that because of pro-rata which was quite good. Certainly as soon as we found that out, it was put straight across before getting to the Kaizen presentation. It was put across to the [middle sized car] line. We've got this, you want to be, you want to look at that, see if you can implement it. Rather than wait three months and let them pay too much for three months. Go straight across. Certainly if you can get a good saving like that.

A further issue regarding external communication is the perceived dearth of information being channelled back into the teams. Six statements indicate a lack of information regarding model changes that ultimately rendered teams' innovations redundant. For example:

k52 The new car being prepared will cancel out some of work - or we won't put it in as its too expensive at this time if going to be changed any way
j164 There is a lack of supervisor involvement to indicate changes in model and their impact - It leaves people feeling low,

These comments suggest a lack of valuable information being passed unto teams. This is somewhat surprising given the fact that C.I.P.s have to be approved by senior supervisors before they can commence. It is also striking given the potential negative motivational impact of this wasted energy by team members and this is at odds with the internal communication that tries to make C.I.P.s as successful as possible. There appears to be an inherent contradiction within the organisation here.

As the interviews had confirmed Gersick's (1989) finding regarding the potential role of external communication, it was decided to design the experimental study to include access to external information sources. In order, however, to understand in more detail teams' externally focused behaviour a code will be used collecting attention towards the information providing role of the external. The other features of external communication, like political activity, for example, were regarded as too complex and context bound to include in the experimental design.

4.2.4.3.2 Prior communication and consultation with others

One specific aspect of communication that emerged as important to the supervisors was the role of advanced warning. Six meaningful statements arose from forty percent of the interviewees; these included pre-warning superiors, colleagues and other departments of changes before they occurred. The reason given for this consultative activity was either to ensure discussion or support for innovations. In this way attempts were made to canvas other teams to ensure "far reaching consequences (k21)" were kept to a minimum. There were, however, some comments to the contrary. One respondent indicated internal contradictions regarding whether to tell colleague before, or during changes, the other is more indicative of risk management behaviour.

The response does not show collaboration and support for innovation across departments, in fact quite the contrary is identified.

j78 Tough, you know, find your own way as long as it doesn't affect us.

This offers some corroborates for the innovation literature looking at risk minimisation (for example, Colewell, 1996) and links into teams' autonomy.

Overall, there is a definite bias in the comments regarding external communication, with sixty percent more positive comments about it than those suggesting any negative impacts (seventeen comments) from the same number of interviewees. One of the biggest drawbacks that is indicated by participants from involving and seeking others input is the extra work it creates.

h2-36 Explaining the process we were going through. And at that point there were people who weren't on our sub-group, who were on the Safety Committee, and you can imagine what happened then. They came up with their ideas and suggestions. Some of them were good, some of them were bad. But all of them had to be looked at.

4.2.4.3.3 Role of the external

The interviews indicate two distinct roles of the external. The first is in terms of generation of good will and potential flexibility from external suppliers. One supervisor indicated that he deliberately managed and maintained relationships with a range of external firms to ensure he had extra flexibility, especially if he needed quick turnaround on jobs.

The second role of external relationships is in terms of external information exchange for innovation. A prime example was where the team had deliberately canvassed information from outside to help them in implementing a legal requirement. This is, however, the only explicit example mentioned by a participant of those outside the firm assisting them. It offers some corroboration for Slappendel's (1996) findings regarding the link between legislation and innovation.

h2-22 We explained to him what the situation was, he said he didn't think we had big problems, he said, yes there was definitely a need for some improvement there, but there's room for improvement in everything that everybody ever does. So he was more helpful than... He didn't come in and listen to what we had and then change his stance from being adviser to enforcer. He maintained the advisory role throughout and we haven't heard from him since

k36-38 We sought external advice only now to explore the detail of a final solution and soon realised it wasn't not practical for this environment

This theme which emerges regarding the role of external players within the life of teams echoes that found in the literature (Slappendel, 1996; Uttenback, 1982) regarding boundary spanners in particular (for example, Allen, 1970, Tushman and Scanlan, 1981). The role of the "external" in this context is very varied. It ranges from information and documentation provider, idea sources, technical advisors, feedback provider, supporter or discussant. The teams appear to welcome the involvement, as twenty-seven of the statements were positive, covering fifty percent of those interviewed.

The pivotal role that facilitates this external transfer of information into the teams is that of the internal engineers. These positive comments regarding the boundary spanning of engineers occurred in twelve of the statements, compared with two where this role was being played by the immediate supervisor. The role of the engineer for the firm appears to support the literature's notion of an importer of ideas (four statements) (Myres and Marquis,1969; Tushman and Scanlan,1981).

In reviewing the statements made regarding external interaction, Table 4.3 below, they suggest overall a more positive than a negative focus. One of the largest areas of difference can be found in the use of those external to the team, but within the organisation. Interviewees are forty percent more likely to use existing organisational members as resources than those outside the firm. There were some comments that suggested reluctance in going outside the organisational boundary. They are summarised in the table below.

Table 4.3:Type of interaction - external to team

Aspect of external interaction	Type and Frequency of statements	
	Positive (%)	Negative (%)
Internal to organisation	18 (40%)	11 (50%)
External to organisation	8 (30%)	1 (10%)
Japan HQ	6 (20%)	7 (20%)

As noted earlier the importance of the external to teams corroborates Gersick's (1988) findings, and thus, will be included as a design consideration in the experimental study and as a feature of the code-book.

4.2.4.3.4 Japanese Relationship

As indicated above, the participants' talk revealed that a completely different external relationship existed with the Japanese members of the organisation. The company is Japanese owned and all the car designs come from there, yet only forty percent of those interviewed mentioned the Japanese at all, which may be indicative of the poor quality of the relationship. From the comments, the Japanese appear to be regarded as the imposors of policy or procedures. The poor quality of the information received for construction of process can be seen in the following comment from a supervisor who was sent to Japan to learn more:

> p20 I'd been to Japan before; I'd been in the pilot plants and you're building every which way you can, but it's totally unlike the production line you end up with. You just get the bits together, spot weld them as per the specification and get through the trail. You do get some understanding of the kit. So basically was I was given it, the responsibility for it, I has Steve's support, who had been to the pilot plant. He couldn't really help us, there was very little input.

The interviewees, below, reveal a vital missing part of positive communication back from Japan, (four statements, twenty percent of sample):

> j84 Lack of sharing of information with Japan hampers the ideas development as it often does
> p44 Limited transfer info. about UK impact in Japan... But we would never know. They don't tell us
> f48 If it's going to come up they've kept me in the dark about that

These meaningful statements pose an interesting question about the quality of information exchange within the company and their Japanese H.Q. They suggest a one way flow of information with feedback to the U.K. teams.

Although the Japanese do send over advisors, which is mentioned six times by twenty percent of the interviewees, there is an apparent scarcity of feedback and lack of adequate information exchange between the two groups. For example, one of the interviewees, who worked near an advisor, knew that the advisor had knowledge that they needed, but yet seemed reluctant to provide it.

A further example of the low integration of cultures within the plant was evident at lunch-time, when a clear demarcation existed between the Japanese and U.K. employees with their separate tables for eating. In response to this the literature indicates the positive impact on innovation of minorities and the stifling impact of homogeneity on creativity within teams (for example, Nystrom, 1979). This aspect is of concern for the future of the organisation.

4.2.4.4 ATTITUDES

In conducting the interviews there were several distinctive attitudes that were generated by a range of speakers. These appear to be important from the literature, however, they emerged from the transcripts, rather than having been sought. They include the general striving to improve continually, openness to ideas and suggestions, attention to development and learning. The role of context in the shaping of attitudes can not be overlooked and, therefore, precludes these aspects being included in the second study.

4.2.4.4.1 Striving to improve

"Striving to improve" was an important theme evident in eleven meaningful statements covering sixty percent of the supervisors interviewed. Each recognised the need to change and develop generally a need for constant improvement. This also may be linked to an acknowledgement of high standards. This links to West's (1990) climate for excellence model. Interviewees indicated a high standard of outcome that they personally expected from themselves and others, using the phrase "right first time" for how they expected work to be done, even if that meant it took longer.

4.2.4.4.2 Openness

This attitude towards improvements is also linked to an acceptance of change. The interviews revealed much regarding the mind-set adopted by teams as they embarked on the process. Throughout their talk a range of comments indicate an open-mindedness towards a number of things. The statements reveal openness regarding idea possibilities (four statements and thirty percent, processes to achieve idea (two; and twenty percent) input from others regarding the idea (two; ten percent), and help and support to others (two; and twenty percent).

This potential openness must, however, be contrasted with negative statements pertaining to this openness. These include resistance from the innovating team and non-specified others. There are also examples of limited exploration of ideas resulting in jumping to early conclusions or solutions (four; and forty percent).

4.2.4.4.3 Development

This apparent openness may also stem from the acceptance of the value of developments and learning revealed from the participants within the firm. This is a recurrent theme across eighty percent of those interviewed, indicating the perceived importance of continual development. Table 4.4 below summaries the sources for development that were identified by the participants. This came from a number of sources:

Table 4.4: Summary of development sources

Type of development	Nature of Occurrence
	Positive (%)
Importance of training	10 (70%)
Learning by experience	3 (30%)
Learning from mistakes	5 (30%)
Gains from learning	7 (50%)
Paper qualification	1 (10%)

4.2.4.4.4 Feelings

One potentially negative attitude displayed by some was the relative paucity of emotion based comments; only twenty percent mention them. The only positive statements relate to achieving a difficult goal, however the other four are more negative, with words like "monotony", "annoyance", "unhappiness", "feeling low", "loosing direction" featuring.

4.2.4.5 ORGANISATION SPECIFICS

The final set of themes can be placed within an organisational context. These pertain to meaningful statements regarding the provision of resources and the reinforcement of behaviours through organisational procedures and processes.

4.2.4.5.1 Resources

We have identified the role of those external to the team as information providers earlier, which is a resource. There are, however, four outstanding aspects of resources raised in the transcripts. This confirms Gersick's model (1988), which identified the importance of resource requirements in teams. The features here included; time, finance, materials and people. Table 4.5 below summarises the number of comments and the breadth of their distribution across the sample.

Table 4.5: Summary of Resource comments from participants

	Nature of Occurrence	
Type of resource	Positive (%)	Negative (%)
Time	10 (50%)	7 (30%)
Finance	0	9 (50%)
Materials	2 (20%)	2 (20%)
People	1 (10%)	1 (10%)

In focusing first on time resources comments, they highlighted a number of sub-categories. The sub-categories, in order of frequency, included comments regarding the provision made for time away from normal duties to dedicate towards innovations and improvements (four and thirty percent), the use of time schedules to allow operators to manage their time better (three; twenty percent), the application of team generated time schedules specifically for innovation processes (two; twenty percent), and finally, the deliberate temporal sequencing of improvements to ensure the frequency assessment of operator care issues (one). There were a number of comments that challenged the positive aspects of time utilisation. Statements were identified relating to lack of time to develop ideas and solutions (six; twenty percent), which is contrary to the positive comments about dedicated time for innovation issues. There is also a statement relating to pressure to perform tasks within time parameters in production (one). Time is one of the major enacting support resources available to a team (Pascale, 1990; West, 1990). The respondents suggest that the temporal parameters within which the improvement process teams are operating are tight.

The interviews revealed the attention of the team towards temporal aspects and, therefore it was decided to include this aspect within the code-book for the second experimental study.

The second area of resources to emerge is financial resources, and here, all of the comments were negative. Half of all those interviewed highlight a constraint from limited financial resources. The participants show that each supervisor is given a small (two hundred pounds) budget for their improvements. The comments focused on their need to keep costs down, or try and make them non-existent.

Financial restrictions on the innovation of teams suggest that teams take the quickest and lowest cost route to solution implementation. This corroborates Pascale's (1990) study, which identified satisficing rather than an optimising of innovation behaviour. This is, however, contrary to his finding, which indicated that satisficing was more akin to the approach adopted by American than Japanese firms. Monetary considerations also appeared to impinge on material and labour resources for the teams. It was decided that, as resources were important to teams, this should be reflected in the experimental study's code-book to see what part they might play in innovation.

4.2.4.5.2 Organisational Context

A major organisational driver of the innovation process becomes apparent during the interviews with four supervisors. All supervisors reveal that they receive appraisals which are pay related and which include satisfactory innovation outcomes. In this case they feel they have to be seen to be proactive in order to receive a reward. Typical comments include:

pa111 It is appraised, it is taken into account in your appraisal
s9 [innovation] part of his annual appraisal
d43 Got to be seen to be proactive

Further context related problems have been highlighted before regarding the low integration across racial and gender barriers. Further to this, one interviewee was also open about the linguistic barrier regarding the understanding of accents for the Japanese. The participant was the only woman in the sample. In passing, it is worth noting that this reflects the low participation of women in this work force.

> j138 It's harder for me to talk to the Japanese. I'm only here for a short time and I don't get to know them really and they're, Japanese people are, some of them have a strange attitude towards women in the first place, and although I must admit that the two we've got are good. But I think Steve just had more contact with them, 'cos it's easy for him, oh by the way do you know anything about this. He's more used to how to talk to them and that 'cos language is a problem. *** It's very funny. My accent's a bit of a hindrance as well. We've got a bloke on the section as well and he's terrible nobody can understand him, and they're English so.

4.2.5 COMPANY NEWSPAPER

In looking at the broader context for innovation the researcher was able to examine the organisation's newspaper that included the period of the interviews. A simple analysis was done of the main themes found in the company's profile which is handed to visitors and of two company newspapers. They reveal many of the aspects highlighted in the interviews. The written materials of the organisation confirm the marginal dominance of coverage of internal focused activities and news over external information. They also show the importance given to publicising innovation within the firm. Although found within the internal pages, so never making the front pages, innovation did have a consistent and a high level of exposure in relation to other topics. The only area that receives a higher level of attention than innovation is that of charity events with the firm and the local community. Attention to the external in the form of rivals' products or processes receives very limited coverage. This is disappointing given Uttenback's (1982) findings for the value of rivalry for innovation.

Thus, the role that their newspaper appears to serve is to encourage and recognise those involved in innovation. A regular two page spread of news appeared. Surprisingly, there is very limited mention of customers and sales, except in terms of product, and customer appears to have been replaced by competitor! Community liaison is very significant amongst all Japanese companies and is reflected here by the number of articles indicating what the organisation is supporting. The paper has a social function as indicated by the number of sport, social and intra company competitions and offers.

Table 4.6: Summary of the themes of the newspaper

Type of article	February 1995			May 1995			
	focus	no. of articles	page nos.	focus	no. of articles	page nos.	Diff.
In-house Innovations	I	5	6-7	I	5	10-11	0
Own product	E/I	3	2-3, 4	E/I	5	2-3,4	2
Product news	E	2	4, 13	E	2	7,8	0
Charity	E	2	5, 13	E	10	6,7,13,16	8
Company news	E/I	3	1, 12	E/I	4	6,8	1
Customer news	E	2	5	0	0	0	2
Sales news	I	1	12	0	0	0	1
Competition	I	1	14	I	1	14	0
Roles in organisation	0	0	0	I	2	5	2
Incentive in firm	E/I	1	13	0	0	0	1
Sports and Social news	I	4	14, 15	I	3	13,14,15	1
Diary	I	1	15	I	1	15	0
Offers	I	1	14	I	2	14	1
Motor sport	E/I	2	16	E	2	12	0
Special event feature	E/I	10	8-11	I	2	6,9	8
External sponsorship	0	0	0	E	1	1	1

Key - (E-external) (I-internal)

4.2.6 Summary of teams in the Japanese organisation

This section provides a brief overview of the aspects that emerged from the interviews highlighting those that have gone on to inform the experiment study.

One of the most striking generic aspects of the interviews is the use of the term "innovation" to describe their activity. Innovation emerged as the researcher's term, not the participants. Interviewees talked of "ideas" and of "C.I.P." (continuous improvement process). In relating this to the literature, Colewell (1996) highlights the difference between innovation and improvement in terms of the radicalness and riskiness of the idea for the organisation. In relation to this, the interviews highlight the controls put on ideas, both through undertaking formalised process steps for innovation, and by the attempts to minimise impact by canvassing other departments and teams prior to an innovation being attempted. These are all aspects that, using Coldwell's model (1996), would be termed improvements rather than innovation. He highlights two aspects, which can clearly confirm these as improvements. First, the Japanese organisation, through the interviews, has pursued a low risk strategy, by looking for "cumulative and incremental" ideas (p.70). Second, the "innovation boundary", which is a "discontinuous movement with respect to change" (p.70), is not crossed in any of the solutions. It must be noted, however, that there has been no attempt by the researcher to challenge or test the participant's assumption that these projects for them were an innovation. Some of those interviewed did indicate the magnitude of the potential savings from the innovation as relatively low, at no point were savings over one thousand pounds mentioned.

Teams were involved in every innovation. As part of the attempt by the organisation at standardising the innovation process, virtually all of the participants talked to an identical composition of the innovation team. [The only one that differed was the pure engineering legally imposed project.] This confirmed West and Farr's (1990) definition, the team and the wider organisation was the unit of adoption in every case. In line with this finding teams will be used to innovate within the experimental study. One aspect of the composition was the engineer's role, which was suggested in the interviews as being important in the external focus of the team.

In looking at ideation, there is only one Japanese innovation that can be clearly categorised in terms of King and Anderson's (1990) distinct types; this is the only imposed category. The others develop as a mixture of emergent and imported ideas. What is striking about the imported aspects is that many emerged as internal to the organisation. The interviews suggested a reticence to contact those outside the organisation. This is in direct contrast to the work of Slappendel, (1996) and Zaltman and Wallendorf, (1979) who suggest external communication is necessary for innovative organisations. Aldrich (1979) would consider this to be indicative of the organisation having strong internal ties, in which the same ideas and opinions are merely re-circulated through tight networks within the firm and the weak cross organisation ties of these team leaders, which reduce their access to different perspectives. Far more common, however, were ideas sourced from shop floor workers, or from Japanese advisors, but there were a number of very negative comments pertaining to this last source. Overall, this suggests that the organisation through the use of advisors is attempting to by-pass the need for crossing organisational boundaries. In the short term, the organisation's approach to innovation will accelerate the adoption of new ideas, but in the long term, unless they use regular boundary spanners, the lack of external links may cause stagnation and a reduction in innovation. The major focus for ideas is myopically internal for this firm; they use employees, or existing customers, and thus, they are reducing innovation potential Slappendel (1996) and others suggest by ignoring suppliers, and their competitors. As noted earlier, the emergence of the importance of this external focus is such that the design of the experimental study will incorporate access to external information sources to examine the role played by those outside the firm in teams' innovation quality and quantity.

The interviews reveal definite steps by the organisation to create a positive climate for innovation. The themes that emerged identified organisational processes, such as, the formal two day innovation process, the presentation of the team's findings at regular departmental meetings, which included both implicit and explicit assumptions that relevant ideas should be adopted across the entire area, and the supervisors' appraisal, which deliberately focused on identifying topics of innovation and creating support from colleagues and superiors in the organisation. The interviews indicated the importance of innovation in terms of learning and development and the ready transfer of ideas and suggestions within U.K. team members. In the light of the suggested role of process within teams' innovation a specific code collecting teams' behaviour in this regard will be incorporated into the experimental study.

Opposing this view, the interviews raise the issue of whether innovation was important to the organisation as an internal public relations exercise at times; hence the work of supervisors to ensure teams had at least some positive outcome. Mixed verification has been received for the support for innovation aspects of West's (1990) model. There was, as mentioned earlier, organisation process support, but there were mixed findings regarding resources support and articulated support for teams. The interviews revealed that the ideas finally adopted were often satisficing rather than optimising solutions. It is unclear how far a restricted time framework, or inadequate resources, or political action, or inadequate support were responsible for this outcome. Financial aspects did appear to be the most detrimental in terms of resource issues, restricting what materials teams could buy and use. In order to explore the role of resources in innovation a code will be designated to identify both material and temporal resource aspects of team's behaviour. The role of the deadline in teams' ideation will also be utilised through the inclusion of an experimental condition constraining the time some teams have within the experimental design.

The interviews did show that participants had clarity in terms of what they were aiming for, corroborating West's (1990) model, however, it is in the achievement of the goal that the difficulty appears to emerge. The role of goals is a further feature that will be included within the experimental study's code-book. Another aspect to emerge, which may impact on innovation in a confounding fashion, is the role of humour. The literature (for example, Foot, 1988; West, 1990) indicates that humour may play an important role in the cohesion of a team. The interviews revealed "banter" was an important aspect in the life of these teams, however, some participants reveal the potentially detrimental impact through self censorship of ideas for fear of the team's response. The role of humour has been raised here and within the literature in a number of potentially contradictory ways, the experimental design will seek through the use of a behavioural code to collect teams' behaviour.

There is evidence in support of the importance of interaction frequency (West, 1990) as a catalyst for cohesion. There is also much talk indicating frequent and adequate communication within teams. To look at the part communication may play in teams' innovation behaviour codes designed to collect both task and social interactions will be included within the experimental study.

Overall, a number of distinctive behavioural codes will be incorporated following from this pilot study into the next research. These will include a distinction between the generation and the development of ideas, both intra-team and inter-team communication is evident, goal clarity, process, leadership and qualitative aspects of the team's relationships, such as, joking behaviour/ humour and feedback from others may be important. The impact of restrictive time frames will also be examined in more detail. The question of how far deadlines may have a detrimental impact, reducing ideative behaviours for innovation, will be explored in the second study.

We will now look at the experience of innovation for the U.S. organisation's team members.

4.3 American organisation

4.3.1 Participants in the study

There were seven people involved in the interview study for the American organisation. These included six engineers, and the team leader. The interviews included innovation projects from across most aspects of production; press, body, and final assembly. The only area in which there was no innovation for this team was paint. The innovations discussed included new press applications, body side development and final assembly material problems, such as window rattles, axles and wheel linings. The projects were typical of those handled by the team and were multi-disciplinary, covering both production and material supply issues. The participants included twenty-three percent of the site's innovation team and represented those at the forefront of innovation for the organisation.

4.3.2 Final Coding of transcripts for this organisation

The coding cluster for the transcripts from the American organisation emerged in a similar way to those generated for the Japanese study. Both *a priori* and *a posterori* approaches to code generation were deployed. The final codes were aggregated from seventy-four emergent issues into a cluster of seven overarching groupings, with twenty-one sub-themes encompassing twenty-three areas. The data were reduced and distilled in such a way across the transcripts of the interviews from this organisation. The final code-book is summarised below in 4.7, discussed in Appendix b and illustrated with short descriptions of each coding aspect that the researcher was searching for in the transcripts.

Table 4.7: American code-book and reliability

Code category	% agreement of coders	Out of
1. Recognition & focus on goals		
a. Team goals	100 %	4/4
b. Cost focus	na	
c. Customer focus	100 %	1/1
d. Quality focus	na	
e. Time	100 %	1/1
2. Ideas		
a. Idea importation	100 %	1/1
b. Idea generation	100 %	5/5
c. Idea development	100 %	8/8
3. Use of processes	100 %	3/3
4. Intra - team behaviour		
a. Team focus	na	
b. Use of roles	100 %	1/1
c. Leadership role	na	
d. Communication	100 %	3/3
5. Attitudes -		
a. Striving to improve	100 %+	2/1
b. Development and training	100 %	1/1
c. Openness	100 %	2/2
4.3. External behaviour		
a. Intra-organisational	100 %	2/2
b. Inter-organisational	100 %	8/8
7. Organisational specifics	100 %	
a. Subvention of problems	100 %	1/1
b. Barriers to ideas	100 %	2/2
c. Application of training	100 %	2/2
d. Resources		5/5

4.3.3 Reliability of code book

In order to establish the reliability of the code-book used for the American organisation's interviews an independent rater was asked to code using the themes identified in one randomly selected transcripts. This equated to fourteen percent of the transcripts being re-coded. The inter-rater agreement level can be found above in Table 4.7.

In the case of four of the coding categories they did not feature in the transcript that was re-coded. To ensure that all the codes were confirmed, extracts that included the coding categories were randomly selected from two transcripts and re-coded. In each case the original coding was confirmed as accurate. Whilst this latter re-coding was not an ideal procedure, it is one that has been utilised by others in the past to check coding reliability (Silvester, 1997). The random selection of both transcript and extract was to reduce any bias from the researcher.

4.3.4 Analysis of themes

In reviewing the emergent themes from the American transcripts seven broad categories were identified. These main categories include goal setting, ideation, use of processes, internal and external team behaviours, attitudes and organisational specifics. In each case the aspect of code is discussed in the light of the comments relating to each category. Quotes are included in the text, these will be differentiated by the use of a distinctive type face.

4.3.4.1 RECOGNITION AND FOCUS ON GOALS

4.3.4.1.1 Team goals

In reviewing the transcripts, the goal directedness of the group from its leader is clear, with a definite focus on cost and quality for customers. This emphasis is strengthened through the two weekly internal meetings which the team holds concerning either quality or cost issues. These specific aspects will be explored in more detail shortly. The goal clarity is evident from both the leader of the group and its' members, who show a clear understanding of the team's purpose.

The team's leader is specific about the approach of the team in achieving their goals. He regards it as important that the team, should be autonomous in deciding approaches to issues. He sees the team as self regulating and able to operate with the full knowledge of company procedure. He perceives a dynamic or evolutionary aspect to the goals for the team.

The theme corroborates the importance of goal clarification for innovation teams as identified in the literature (for example, West, 1990). It is, therefore, an aspect that will be included within the experimental study's code book. The objectives of the team can thus be further divided into four categories; cost, customer, quality, timeliness, which will now be discussed briefly.

4.3.4.1.2 Cost focus

The team's concern for financial aspects of innovation emerges in eighty-six percent of those interviewed and is evident from the formal meetings that are held. These include a monthly management team review and a weekly local team meeting. The team's high consideration for cost emerges either to achieve value for money, or savings on materials or manpower with the speed of financial pay-back as being regarded as a positive achievement. This focus on cost may act as a constraint to innovation, with the team talking of less than optimum solutions being imposed due to financial considerations. In a number of cases the reasons given for changing design were financial, or the reasons for not changing materials were again cost related.

fh20 - We had to get them out of a block of nylon, couldn't afford to mould it, couldn't afford the moulding tool so we had to machine it out of a block of nylon

4.3.4.1.3 Quality focus

The second main focus of the team to emerge is quality. As with costs, the emphasis on quality is reinforced by monthly management meetings and weekly team meetings. The main measure of quality was achieved from customer responses with three interviewees mentioning this. This places the arbitrator of the quality goal as outside both the team and the organisation.

4.3.4.1.4 Customer focus

Related to the previous point, the team receive feedback from customers through formal company channels, for example, customer complaints, and from direct input from external service providers. The role of customers appears to be twofold. They provide reactive quality indicators in the form of complaints and as a source of proactive quality initiatives that the team has to tackle. Below is an example of the proactive aspects.

> fh20 - One of the problems, one of the things there was, we did a customer survey some years ago, we decided they didn't want a number of handle turns to get the window up
> fo92 - So that's a problem and British Telecomm have been asking for a more secure door

The eternal focus of the team's goals indirectly links to the literature (Gersick, 1989; Marquis,1982; Utterback, 1982) suggesting the role of the external, especially customers in shaping team activity.

4.3.4.1.5 Time focus

One of the biggest dynamic factors that appears to have affected the team is the introduction of tight time deadlines set by the organisation for each innovation project. The team leader comments:

> D38 - we've got this timing constraint that says they want us to solve the problem in 90 days. Never had that before. I mean we always aspired to do it as quick as possible, but we never had someone clocking us to do it.

The team highlighted the pressure they felt under, trying to prioritise and juggle tasks to achieve time deadlines. Their statements alluded to the potentially detrimental impact of these deadlines to the quality of the task the team could perform. There is also a negative view regarding this time pressure, suggesting that "the quantity of measure has somewhat changed." A knock-on impact of this time pressure appears to affect the thoroughness of the testing and checking of solutions.

The evident importance of time on team's innovation will be examined in more detail through the experimental study with time being used as an experimental condition within the experimental study.

4.3.4.2 IDEATION

In reviewing the transcripts of the interviews for themes, it is evident that the level of ideation is significant in this group. The team leader sees it simply as the group generating new ideas. Team members appear to be more modest about their development, and regard innovation and ideas as simple and based on hunches. One of the central aspects differentiating this team from others within the firm is seen as their proactive ability to devise and implement new ideas.

In reflecting on their innovations, it can be clearly divided into two parts, generation of idea and their development. This distinction corroborates the literature regarding ideative processes, for example (Kanter, 1988, and West, 1990). In examining in more detail the US team's approach to this, idea generation can be further subdivided into three sources: team generation, self generation, and ideas imported either from other parts of the firm or from outside.

A central feature of much of this group's innovation process is the role of conversations and discussions that occur within the team. There were eleven comments from seventy-one percent of those interviewed that highlight this team involvement. One speaker noted two unique aspects of the team's innovation that are highlighted below:

> fs66 - So that the whole focus has been on the team, even if it's not only this team, but bringing other people in and gaining from their experience.

The team's innovation, therefore, is focused on the collective efforts of individuals found both within and outside the organisation. This concurs with the literature, for example, Anderson (1992) that regards innovation as a relational activity. The following comments provide more details from the team's members about the nature of innovation within this team.

> fo8 - So Sid started looking at stamping. I suggested that we do this for the riveting across.
> fa36 - It was more of a team of guys. Sitting round a table type of thing... Those were suggestions that were not made directly by me but between the three of us, when deciding what do we need to do actually make this a two-piece assembly, to fit the assembly together.

The team's approach to innovation confirms the literature, suggesting the need to differentiate between idea generation and building. These two separate aspects will be included in the experimental study's code-book. As noted earlier, the discussion of ideas also occurs with those external to the organisation, especially the suppliers of products. The team regards them as very active participants in the innovation process. Below, the comment of a team member is typical of the social innovation process for this team. This highlights boundary activities as important. This offers support for Allen (1970; 1977) and Tushman's (1977) work. It also corroborates Uttenback's (1982) research on the importance of suppliers for both increasing awareness of new ideas, and assisting in successful implementation. It is evident from the interviews that the innovation chain does not stop with one supplier, they also involve other suppliers in the re-emergence of the ideas.

fo36 - I called in a design vendor and laid down the design parameters we wanted..... They did the design investigation and they're scheming up various alternatives with us as a watching brief if you like. Saying, no we don't like it like that, you'll have to do something different, etc..... So it's a combined development of design it's never one person's design, it's the basic idea that's developed by four or five people. I mean a design vendor `will go to a gun supplier and say what do you think of a gun to do this. And they will come up with another idea,

4.3.4.2.1 Idea importation

An important feature of this group is its willingness to use external ideas and developments. Fifteen comments were made relating to direct or relatively pure adoptions of imported ideas, covering eighty-five percent of those interviewed. The importation of ideas is, therefore, significant in this group. This corroborates findings from the literature (for example, Payne and Pheysey's (1971), Allen's (1977), and Marquis's (1982) and West's (1990) studies). The participants indicate that ideas are imported into the group in five main ways; via team members' informal experiences of different products, through conversations and knowledge of internal engineers working on another product, by discussing the suppliers' experiences of different manufacturers, from formal bench-marking exercises that compare different manufacturers, and finally, from taking existing materials and processes and using them in novel ways.

As a result of the interviews and literature, the significance of idea importation to teams' innovation is such that a distinctive code will be established for use in the experimental study to examine the role of idea source in teams innovation.

4.3.4.2.2 Idea generation

The team provides examples of a wide cross-section of innovation including both new products and new processes. There emerged some reluctance to change, linking to Teger's (1980) work on the unwillingness of teams to alter aspects which they have already invested time and effort in. This contradicts, however, Patterson's (1999) findings regarding the association of high motivation to change and risk behaviour with innovators.

There appears to be limited criticism from colleagues to restrain ideas, instead they provide support. Idea generation will, therefore, be included as a behavioural code within the experimental design.

4.3.4.3 USE OF PROCESSES

This team had formal group processes they could use to help them innovate. Statements made by the team suggest that standard methods, like gathering data on problem issues and evaluating these data, were used. There are eleven comments from (seventy-two percent) of those interviewed regarding these. The team not only spend time generating data to produce solutions, but also attempted to follow up innovations as they were implemented. This final practice does appear limited, however, as only two members talked about it. In contrast with this diligence, another team member appears far more limited in his checking and follow up.

The use of process by the team does emerge as important for innovating teams and, therefore, will be an aspect of behaviour to be gathered in the experimental study.

4.3.4.4 INTRA-TEAM BEHAVIOUR

The interaction and internal behaviour of the team emerged as being of great importance in the interviews. Intra-team aspects can be sub-divided into a number of areas; the selection of the team, team focus, the use of roles, the team leader's role and internal communication. In this section we shall mainly concentrate on the final two aspects, which are included as codes in the experimental study.

4.3.4.4.1 Team focus

The importance of the team for each member can be clearly seen by the volume and constancy of positive comments made regarding the group (twelve comments, covering all of those interviewed). There appear to be positive relationships in the team between team members, with team members readily identifying the positive advantages of being in the team. The importance of co-operative relationships and good communication between team members is highlighted. They corroborate West's (1990) ideas regarding participative safety and innovation.

Team members identify the reasons for their success as the flexibility that working in the team provides, and that the team works well together. The perception of the team as being different from others is borne out by their comments from a variety of past experiences. A clear differentiation from others emerges as significant for the team, which corroborates Sundstrom *et al's* (1990) argument of the need for differentiation and distinction of the team from the rest of the organisation.

4.3.4.4.1.1 Selection of the team

The selection of team members was deliberate, with each member chosen from across the whole organisation for their contribution to the team. The team leader noted the resultant difficulties in recruiting the team. The composition of the team was an important decision, with a blend of experience being paramount. This links to Payne's (1990) assertion regarding heterogeneity of team members and innovation. Although composition may be an important consideration in the innovation of teams, it is not one that will be followed in this study. It will be commented on in the final chapter with reference to aspects for further study.

4.3.4.4.2 Roles in the team

The comments from the team reveal more complexity about roles; rather than emphasising their single skills, or knowledge, they concentrate on the cross fertilisation of roles and a flexibility amongst role holders. It is evident from the participants' comments that this is a further aspect of differentiation between the team and from other parts of the firm. The emergence of roles corroborates the literature, for example, Ancona and Caldwell (1992).

4.3.4.4.3 Leadership role

Related to team roles, one of the most specific roles mentioned in this team is that of the leader. This corroborates the literature regarding the leader's role in innovation, (for example, Anderson, 1992; West, 1990, Kanter, 1988) and is a feature that will be followed up in the experimental study. In reviewing the comments concerning this, there appears to be corroboration between both the current role holder's views and those of his team members. The leader is responsible for allocating projects, informing and up-dating the team, and giving consent to aspects of the projects. The team leader also recognises the wider team interface, his comments suggest he is keen to build on the autonomy of the team in performing day-to-day activities. He is very aware of how he manages the team to ensure he supports their autonomy and adopts an involving communication style to achieve this.

4.3.4.4.4 Communication

The internal workings of the team can be clearly seen through examining their comments regarding intra-team communication. This corroborates the findings of Quinn (1986) and Kanter (1988). The group members consistently mention, as can be seen in Table 4.8 below, the sharing of ideas with each other, providing different points of view and exchanging information. Intra team communication is, therefore, clearly an aspect of teams' behaviour to be included in the experimental study's code-book.

Table 4.8: Summary of internal communication

Communication aspect	Frequency count	No. of respondents
Sharing of ideas with team	9	86 %
Other points of view considered	6	71 %
Exchange of information	11	71 %
Political awareness	2	29 %

One element facilitating this internal communication may lie in the design of the office. The team recognises that office layout definitely promotes their interactions, creating maximum exposure and discussion amongst the team, with technical specialists being grouped together.

Exchanging information takes place both at formal bi-weekly team meetings and on a regular more informal basis. The team leader emerged as acutely aware of the need to disseminate information as rapidly as possible to aid his team. The team has tried to use a formal information process to improve information transfer. Its effectiveness, however, may be open to question.

Upon interviewing and visiting this team, it was evident that there was a high degree of interpersonal interaction between team members. The local noise environment contained constant discussion, feedback and oral information flow across the whole team. Although formal communication processes do exist, it is the informal information flow that is perhaps the most significant for this team innovation.

One evident quality of the communication as perceived within this team is its supportive and empowering nature. This adds credence to West's (1990) model. Again, this mirrors West's perceptions of roles, especially the adoption of a flexible style of leadership. In examining the communication more closely there is a specific style to the team, especially with regard to humour. The team do not appear to see humour as detrimental to their work. Rather, it is used to establish norms. Sundstrom *et al* (1990) noted the importance of the generation of internal norms for effective team performance, and as a means of differentiating the team from the rest of the organisation. The team leader corroborated this and noted generally how the team members understand and appreciate the humour.

There are parallels in the humour literature (for example Foot, 1988, Paton, 1988) with groups deliberately using it as part of their work process. In this context as described by four of the participants, humour appears to be a safety valve allowing them to relax. We must, however, question how much humour serves to censor individual's suggestions if they feel remotely uncomfortable with it. In order to examine this in more detail the role of humour will be included as an aspect of behaviour to be gathered in the experimental design.

4.3.4.5 TEAM ATTITUDES

These aspects, although identified, will only be briefly touched upon here as they have not been included in the experimental study.

4.3.4.5.1 Striving to improve

The team's internal concern appears focused on improving their innovative processes.

4.3.4.5.2 Development and training

The team's focus on development and learning appears very action orientated. Although there is some emphasis on the role of learning from the past, there is no mention of the role of mistakes as a learning opportunity. Despite the team all attending an extensive innovation-tools training programme, there appears limited focus by this organisation to utilise formal learning and embed it in to the teams procedures.

4.3.4.5.3 Openness

By contrast to their comments about those outside the team, the team perceive themselves as open to new ideas. Team members talk of their openness and questioning style, which is supported by their team leader.

4.3.4.6 EXTERNAL BEHAVIOUR

4.3.4.6.1 Intra-organisational

Whilst the team's comments indicate that communication is effective on an internal team basis, it is on an inter-team basis that problems appear to exist. One team member comments below:

fo68 - From our side it's good. From the plant side it was not very good.

On the basis of these interviews, external communication can be sub-divided into two distinct areas; those involving members of this organisation, and those from other firms. The two appear to be very different, both in terms of their effectiveness on, and for, the group. Focusing first on internal organisational communication, one aspect, which was noted by different interviewees, was the breakdown of communication between design and production departments. Some of the comments indicated that inter-team communication might be problematic between this team and Production. One reason behind communication difficulties between this team and Production may lie in the fact that Production is not involved in innovation generation, only in implementation. It is at this point that the comments about communication change indicating resistance to the team. Although the team recognises this resistance, calling it "Not Invented Here" syndrome, there also appears to be some resistance from production managers. Katz and Allen (1982:7) highlight the detrimental impact of not invented here on innovation.

4.3.4.6.2 Inter-organisational

In contrast with the internal communication, the team's inter-organisational communication emerges in a very different fashion and having a far more significant role in innovation. The team's communication style spans many organisational boundaries. In assessing the interviews, there are thirty seven statements, covering eighty five percent of those interviewed, who spend time talking with other organisations. This links into the previously mentioned literature regarding boundary spanning, (Allen, 1977; Conway and Forrester, 1997). The teamleader highlighted how team members are empowered to work "directly" with staff in other organisations. The role of suppliers is significant in idea generation and also the prototyping and developing ideas. The team members set up quasi teams, with the composition dependent on the type of issue. The communication between each party is often rapid, and at times frantic, using a variety of means.

The relationships with suppliers go far beyond the more traditional material sources they can provide. Communication appears at times to be more frequent between these quasi teams than with intra-organisational members. The interviews reveal not just about the reliance on suppliers to identify problems for the organisation itself, but also a propensity by team members to turn to them rather than another organisational member for their information needs.

The role of the wider organisation in the team's innovation supports the previous findings of the literature. It links to the Sundstrom *et al* (1990) ecology model, but expands this to highlight the extra-organisations role in shaping effective performance. The role of this wider community is often omitted within the team literature as Conway and Forrester (1997) noted. These findings suggest that through boundary spanning behaviours we need to place the team within a far wider context of multiple organisations, rather than merely locate it within one organisational context.

In the light of the emergent importance of those external to the team for innovation, the experimental design will include external information sources to emulate this feature of team behaviour and, thereby allow us to examine its part in innovation in more detail.

4.3.4.7 ORGANISATIONAL FACTORS

4.3.4.7.1 Subvention of problems

The statements regarding communication indicate a complex relationship across departments within the firm, with benefits for suppliers of this relationship. As noted before, the team may be obstructed by resistance to its ideas, which the transcripts suggest are more political in nature, resulting in the potential subvention of issues within the company. This corroborates Pascale's view (1990) of the impact of this behaviour. Also evident are organisation policies, like headcount levels and material sourcing, which have a significant impact on the team, both directly and indirectly.

4.3.4.7.2 Barriers to ideas

Despite the political protection of a vice president for this team, who knows about and supports their work, there is evidence of resistance and barriers for them. They find that, despite enthusiasm to the ideas, when implemented things are not as they were originally agreed.

4.3.4.7.3 Application of training

Despite attending a recent training programme there was no evidence of the formal utilisation of any of the skills from this course. The organisation had invested considerable money in developing a course aimed at improving problem-solving techniques across the firm, with limited, if any benefits.

4.3.4.7.4 Resources

Resource comments from the interviews fit into three broad areas, financial, time and "manpower". Although materials as a resource are mentioned, it is as a sub-set of financial considerations.

Table 4.9: Summary of Resource comments from participants

	Nature of Occurrence	
Type of resource	Neutral or positive impact (%)	Negative impact (%)
Finance (inc. purchase of materials)	8 (71 %)	8 (57 %)
Time	5 (57 %)	3 (29 %)
Manpower	2 (29 %)	1 (14 %)

The use of organisational processes, mentioned earlier in terms of a weekly meeting specifically regarding cost, focuses the team's attention towards the financial impact of their solutions. The interviews suggest attention towards resources can have a detrimental impact impeding optimisation of the team's innovative ideas. In order to test this, attention towards resource issues will be included in the experimental design.

The second important impact is that of time. The coding revealed that, as in the case of financial resources, the team is sensitised towards time deadlines for the project. Most of the neutral statements are indicative of their awareness of time as a resource, rather than positively assisting them in their work. The negative comments, however, are far more indicative of a potentially detrimental impact of time pressure on the team's innovative activities.

fs106 - [name of the team leader] put a ridiculous date on it anyway.
fo126 - It's what's a panic a minute.
fo102 - As it happened the reasons that drove that decision was probably purely timing, because we had a position where we had a date and I guess we were within a week of that date. So people had to do something pretty quick

In order to examine the impact of time on teams' behaviour, time awareness will be included as part of the experimental study's code-book.

The final aspect of resources highlights manpower issues in innovation projects, to reveal more political aspects to the behaviour of others in the organisation. This links to the previously mentioned subvention of problems within the organisation.

4.3.5 Summary of teams' in the American organisation

The interviews revealed a complex interplay between the internal behaviours of the team and the organisation. The study indicated the importance of the wider environment to this team as a source of support, advice and ideas. This aspect was often omitted from studies of teams, but included in organisational level studies. These findings indicated that care must be taken in defining the boundary regarding team innovation as it may span several organisations. In this case, we must question how far this extra-organisational support mitigates the resistance, which the team felt from the rest of the organisation. The external support appears to appease internal difficulties and act as a bolster against its potentially negative impact on the team's ideation. It will, therefore, be an aspect included in the design of the experimental study.

The interviews expose a unique approach by the team to innovation. There are several important aspects that emerge. First, innovation is confirmed as a collective activity for the individuals within the team, however, attempts to fix the "set" of teams as Conway and Forrester (1997) define it, prove difficult. In this environment, *who* is actually involved in each innovation emerges as a defining characteristic of the team. Membership at any point in time is fluid and dynamic. At no time can it be regarded as 'set'. It would be difficult to utilise changing membership in the second study, but this is an aspect that will be addressed as a topic for further study in the final chapter.

Second, if we did try to identify the team, then the wider team membership complexity emerges. It is not a virtual team, *per se*, in that it does not interact in the same physical space, but its membership is so dynamic. This raises an important question about the impact of changing membership on team performance, which will unfortunately not be pursued in this research. In the past cohesion has been identified as an important consideration for team effectiveness (Seashore, 1954). However, Forsyth (1990) has questioned the positive correlation between productivity and cohesion.

Boundary spanning emerges as a third significant aspect in the analysis of this team. Ancona (1990) noted this behaviour as important for innovation. The role of team members includes boundary spanning as an integral feature both within and across the organisation. This is another defining characteristic of the team, but we must highlight the potential impact of this in the wider context. Many organisational level researchers, (Aldrich,1979; Marquis, 1982; Uttenback, 1982;Von Hipple, 1988) have characterised organisational innovation in terms of its linkages. They have identified innovation potential as an emergent result from these connections. In Aldrich's (1979:99) terms this organisation appears to have strong ties. It must be noted that we do not know the range of suppliers that are involved, merely the frequency of interactions, so any further comment would be speculative. Nevertheless, under this configuration Aldrich (1979) would argue that there are limitations imposed on the generation of new ideas for the team, as the same ideas and opinions are merely re-circulated through the tight network of the organisation. There was some evidence of this with comments from the team relating to the importing of existing ideas from other manufactures, rather than redefining the standard for themselves. By contrast, Aldrich (1979) argues organisations with weak ties have a far greater potential for new information to be passed on. In order to examine more closely any link between the role of those outside the team innovation outcome the experimental study will explore behaviour related to the external and its impact in the innovation outcome.

The team's proclivity to import innovations is high. This use of an external, who has already tested the idea, however, may limit innovation potential and act as a satisficer for the idea. As noted before, the role of the external may be more important for this team in acting as a support to enable them to achieve their innovations in the face of internal Production hostility. The suppliers at least can furnish the team with the excuse 'this is what the competition are doing' as a lever for change. The importation of ideas will be a behavioural code included for further research in the experimental study.

In looking at the team more closely there is added support for the innovation literature. The value of heterogeneity in creating diverse perspectives is implicit in the design of the team's structure. In drawing members from across disciplines and plants the organisation has created a wealth of knowledge and expertise from which it is evidently already reaping rewards, as Payne (1990) would predict. The vital role of communication, more especially on an informal basis, appears to be significant in enhancing the potential innovation. This links into Payne and Pheysey's (1971), West's (1990) and Zaltman and Wallendorf (1979) views. The importance of communication also is indicative of the quality of the relationship between team members. We can speculate as to the acceleration in the forming of relationships, as a benefit from the team building process. This is certainly what Tannenbaum *et al* (1992) would suggest, and West (1990) has highlighted the frequency of interaction as important in creating safe climates for innovation. In order to incorporate these findings for further study in the experimental design behaviour will be collected related to both task and personal communication so that we can begin to look at the role of both in teams' innovation.

The emergence of humour, however, as a behavioural norm for the team's communication is interesting. The literature is mixed in terms of the impact of humour on innovation (for example, Paton, 1988; West, 1990). We can only speculate as to its longer term impact on innovation, and how far individual difference mitigates the direction of its' impact. Humour emerges as a hallmark of this group, differentiating it from others. We can not say categorically whether it is beneficial to the group's innovation in itself, or indicative, as Sunderstom *et al* (1990) would suggest, of high quality of their relationships. As highlighted before, the role of humour in teams' innovation will be explored through the inclusion of a behavioural code in the experimental study.

The importance of roles corroborates the findings of others work (for example, Isen *et al*, 1987; Kanter, 1983). In particular the significance of a supportive and empowering leader emerges from the organisation. This form of directive behaviour will be another aspect that will be studied in the experimental research.

The study suggests, as West and Anderson (1996) note, the beneficial consequence for innovation of a supportive and co-operative climate. This local climate appears to mediate the wider resistance for the team's ideas within the organisation. This suggests that the impact of negative organisational context can be mitigated by a local climate of innovation. We must question, however, how far the structuring of separate teams for innovation outside the day to day production environment has actually created more hostility by separating idea generation from implementation. The team's interviews suggest an environment in which intention and implementation do not match. The generation of the separate team for innovation is indicative, Argyris (1992) would suggest, of an organisation that does not wish to learn. To corroborate this the team do not appear to see the importance of learning from their mistakes. Innovation has now been placed outside the role of production. We can only speculate as to the long term impact of this for the organisation as a whole. Many of the present team were retired by the organisation, therefore, the organisation risks loosing their expertise by keeping the expertise in this small group. The organisation appears to disregard any formal knowledge transfer. When this does occur, it is on an adhoc basis through informal friendship networks. This is indicative of the potential importance of including personal, as well as task based communication as a code in the experimental study. As team members leave, on their retirement much of this tacit knowledge will probably never return to the organisation.

The study reveals how, in the short term, the organisation has created a force for innovation which is effective. Opposition to innovation in the organisation emanates from internal political motivations, and resistance to externally imposed change. Both of these are well documented in the literature. The creation of a supported and focused team with many of the aspects West (1990) identified as a climate for innovation, does appear to have increased the innovation within the organisation.

Overall the pilot study has identified a number of important aspects to be carried forward into the experimental study. It has shown the need to focus on a number of specific behaviours. These include: goal clarity, the social aspects of idea generation, development, idea importation, intra-team and external communication, measures of relationship quality, including humour, leadership, and resource adequacy. The study also indicated the potentially detrimental impact of deadlines on innovation and the need to incorporate an "external" information source for the teams. The next section will concentrate on comparing and contrasting the findings of the different applications and outcomes of team innovation within the two organisations, before moving on to the experimental study.

4.4 A comparison of the two organisations

This section will begin by making direct comparison between the two organisations in the case studies. The case studies from the two automotive firms have been analysed separately, in order to allow the application of innovative teams within their individual contexts to be examined and to identify which will be important for the empirical study in the following chapters. We now compare the experiences of members of teams involved in innovation. An examination of the interview transcripts has identified important themes operating within each firm. There are a number of striking similarities and differences between the two, which we shall now explore. The features which are identified in this section will be used as the main features of the empirical experimental study.

4.4.1 Strategic and innovation perspectives

One of the most evident differences between the two organisations was the distinctive strategic roles played by innovation itself. These aspects are summarised in Table 4.10. In the U.S. organisation, it appeared that a top down approach was adopted through the establishment of a stand-alone team of engineers. These were separate from the Production areas, with team members drawn from all areas of the operation, specifically designated to innovate on the one product. Team membership varied. The complete reverse was found in the Japanese organisation, in which a more bottom-up approach had been taken. The organisation utilised small teams set up for a fixed time period of two days to innovate for a product. These teams predominantly comprised members from across the two shifts operating within that particular production area. The teams operated over the entire Production and Materials aspects of the business at the shop-floor level. These teams included a centrally based engineer, who was their only external team member.

In examining the approaches which each used, there are definite distinctions in their activities. These centre on the term "innovation". It must be noted that "innovation" was not a term that either organisation formally used, the researcher introduced it. However, the teams that were involved in each study were those that the organisation identified as those involved in innovation. On the basis of these findings the experimental study will focus on team activity, not individual innovation. In looking more closely at the teams' activities, there are a number of specific differences in the scope of operation in which each team is involved. These are closely related to the different perspectives of strategy adopted by the organisation.

Table 4.10: Summary of organisations' strategic response to innovation

Theme clusters	Japanese findings	American findings
Strategy	Bottom up - cascade approach	Top Down - no cascade
Colewell's type of innovation	Incremental improvement	More radical innovation
Team's definition	Continuous improvement	Innovation
Scope of process	Limited impact and risk low	More scope for radical ideas and questioning, risk higher
Main Objective	Financial savings and payback details	Financial savings and payback details

The Japanese firm's strategy was to involve every employee in innovation. Thus, they sought to make innovation the property of all levels in the organisation. As these cases have shown, innovation can be in the domain of all. The experimental study will, therefore, involve no specific membership criteria. Although there is some debate within the literature (Belbin, 1981) regarding composition, the Japanese case revealed that each level within the organisation can be involved in an area of improvement. Specific composition issues, however, will be raised as a topic for future research. One bi-product highlighted by the Japanese supervisors was to increase operator participation and support for this type of planned change. The whole process utilised by the organisation was designed to generate a collectively derived innovation, that the team would also be responsible for implementing. By contrast, the U.S. team concentrated only on innovation development, with a team mostly comprising engineers, who each had a specific area of expertise. Innovation was pursued by these engineers acting in Rosenfield and Servo's (1990) terms as "idea champions". Implementation of the idea was not part of their role. This was the remit of Production.

Across both operations it was clear that the generation and development of ideas were regarded by those interviewed as a collective processes. However, as noted earlier, the scope of innovation activity in each firm was very different. The U.S team concentrated solely on idea generation and development, whilst the Japanese teams covered the implementation as well.

At a superficial level, the approach taken by both operations was identical, with a bias towards action based problem solving. This emerged in the interviews via the importance of developing and testing prototypes of ideas. In both operations, the ideas used were often already in existence within the firm; it was the application of principles, which emerged as novel. This corroborates West and Farr's (1990) definition of innovation, in which they describe a new practical application of existing knowledge. In considering these findings the experimental design will include both design and implementation of the innovation to see how far idea generation and development are important to teams' innovation.

During the generation and development of innovation there were marked differences between the firms. The U.S. teams focused continually on external assistance. They involved others not only in the generation and development of innovation, but also in the clarification of actual objectives of the project. They actively sought involvement particularly from suppliers throughout the innovation. In contrast, the Japanese teams used external assistance only at the end of the process to source the final solution. They did not use external help in generating solutions. Those outside the firm played a part in the team's innovation in two distinctive ways. First, there was an external member of each innovation team, who was a member of a central engineering function. This was the only team member from outside the production area in which the innovation was occurring. Second, there was a small internal group that existed, but only to manufacture the team's ideas; they played no part in designing the solutions. Overall, the Japanese firm's teams can be characterised as closed in nature, ensuring that only team-generated solutions were explored. It would be incorrect to say that the Japanese did not gain any assistance and information from outside, however, the interviews revealed a striking reluctance and apprehension to do so. The role of the external within innovation has been demonstrated from both the literature and these cases to be of interest. In order to examine both the type of interaction and its temporal aspects, the experimental design will include access to an external information source, and a behavioural code collecting the type of interaction. This type of design builds on Gersick's (1988) model.

There were limited comments regarding resistance to the innovation teams. In the U.S. team there were comments highlighting opposition to their ideas. The term used was Allen's (1977) "not-invented-here", however, although commented on in terms of Tajfel's (1982) out-group behaviour, there was no suggestion made that this had an adverse impact on the innovative behaviour from the team. They carried on regardless. This negative behaviour was used to characterise the closed nature of those outside the team, compared with the team members more receptive conduct. In the Japanese based teams there were no direct comments of this nature. As the role of resistance here is in terms of the implemented idea and has some organisational contextual issues surrounding it, it is not possible to incorporate resistance from the organisation into the experimental design.

The interviews revealed that the nature of innovation undertaken by the teams was very distinct in each firm. If we use Colewell's (1996) typology of innovative activity, then the Japanese organisation's teams were only involved in the incremental "improvement" of their operations. Their remit did not permit them to ask more fundamental questions. Indeed, the interviews showed the difficulties that were encountered by teams if they sought to make more radical changes. This can be characterised as an example of what Pascale (1990) terms the 'subvention of problems', in which teams were unable to make the changes they wanted because the impact would have been too radical. Thus, political behaviour thwarted the best intentions of teams. This provides evidence of the Japanese organisation cautions in its' activities. This is in accord with Colewell's prediction. Repeated evidence was found of deliberate attempts by the organisation to minimise the disruption of improvement processes in three distinctive ways; first, by ensuring consent at the start of an innovation from a senior manager. Second, by ensuring the team canvassed the opinions of those who might be affected by any changes, and finally, through using the appraisal system to ensure both of the supervisors affected by the innovation had a common interest in its achievement. Arguably, one potential impact of this was the censoring of revolutionary designs. This aspect, however, was not assessed in depth and must currently be regarded as speculative. By comparison, the U.S. team was able to ask more fundamental questions. Several of the changes they proposed could be regarded as revolutionary. They often produced solutions by using new applications of existing methods. They were empowered to "innovate" in terms of Colewell's (1996) definition and thus the organisation was more open to risks. In terms of looking at whether the teams' outputs are improvements or innovations, Wolfe (1984) and others have noted the difficulty in measurement. Within the experimental design the assessment of the teams' outcome will incorporate Wolfe's (1984) and West and Anderson's (1996) findings regarding measuring innovation. The assessment will be made by a panel of judges, each an expert in different ways. Thus the issue of improvement versus innovation will not be directly tested, instead multiple measures of innovation including execution aspects like clarity of expression and quality, novelty of content and layout. The most direct measure building on Colewell's (1996) ideas, will be the assessment of radicalness, which is looking at a departure from the normal, i.e. not an improvement, an innovation.

From the interviews, it emerged that both organisations' objective was to change for the better; to create an improvement to a greater or lesser extent. Although quality and operator safety were mentioned, the overriding goal for both organisations was cost reduction. The changes which the teams focused on covered a diverse range of topics from altering existing systems, to developing new materials and component applications, through to staffing reductions. The common denominator, however, was the same - the reduction of cost. Every project undertaken within the both firms involved the specific calculation of costs, either in terms of savings or "payback". Any innovation included the justification by teams of any expenditure they incurred and how long before the savings would recoup the cost. A further issue underlying safety or quality focused improvements was to stop any potential expenditure at a later date, either from legal proceedings i.e. being sued for operator strains, or additional repair works having to be undertaken later. The participants' comments from both firms are very similar, but based within an organisational context which will not be possible to replicate directly in the experimental design.

4.4.2 Processes

One of the most striking differences across the two organisations lay in the utilisation of formal processes. Only one of the organisations used formal organisational procedures to support and promote innovation. The Japanese organisations' members repeatedly commented on five specific procedures that were in use. These included the two day innovation stages through which each team must go, the dissemination systems from their ideas and the appraisal procedure, trained innovation processes and the use of identified "experts". These are summarised in Table 4.11. The attention towards process is an aspect of teams' behaviour that will be collected in the experimental study, to see what part it has in innovation outcome. This is an initial study, so we shall just be exploring the role of processes *per se*, and not the type of process undertaken. No attempt to teach and standardise the teams' process will, therefore, be undertaken.

All of the team members across both firms indicated their sensitivity to time deadlines. Everyone interviewed was aware of the exact duration of their project. On closer examination the time deadline for the U.S. team was far longer than their Japanese counterparts. The former had ninety days versus the latter's two days. Thus, the Japanese teams felt under great pressure to achieve their objective in the required time limit. One potential consequence of the deadlines was the emergence of self-censorship as a potential obstacle to innovation in the Japanese organisation. Ideas were not externalised that did not comply with time, but resources and procedural deadlines too. Thus, self-censorship may be related to other team constraints like time, finances, processes. The comments suggested that teams developed and implemented solutions that satisficed rather than optimised. The teams simply did not have the extra time to consider what might be possible, with their tight deadlines reducing the opportunity for direct or independent assessment of the potential solutions. In order to test the suggested detrimental impact of time deadlines on innovation the experimental study will include time constraints as an experimental condition. It will also collect teams' behaviour with regard to resource and time sensitivity to see if these act as constraints on teams' innovation.

The pilot study revealed different organisational conventions surrounding the dissemination of teams' ideas. The Japanese teams used a formal procedure for circulation of their idea, involving idea sharing across the wider organisation. Following their two day innovation process, there were formal presentations of the team's solutions to the entire department. Thereafter, team leaders in that department were responsible for implementing any pertinent ideas. In this way, the Japanese organisation was ensuring the maximum exposure to ideas, creating the internal acceptability for team sourced change, and they also ensured maximum impact of cost saving innovations across the whole organisation. This process provided formal recognition of the team's work within a wider context and created a positive climate for innovation and change. By contrast, the spread of innovation within the U.S. organisation was on the basis of personal relationships. It was, therefore, ad hoc with different processes and procedures operating on the organisation's different products. Thus, the spread of knowledge and cost savings was fragmented. This is not an aspect we can examine in the experimental study, the role of learning and dissemination of ideas links closely to the literature reading innovation (Argyris, 1992).

In terms of the organisations' use of tools to encourage innovation, both of the organisations used existing formal systems of appraisal to promote innovation amongst employees, but in very different ways. In the Japanese organisation there was a formal appraisal system that operated in a distinct number of ways. Each team's leader was given a specific number of innovation targets to meet on an annual basis by their line managers. Thus, potential innovation areas were discussed and agreed sometime before they were carried out. In their interviews the team leaders reported that they had been dissuaded from tackling areas that either had widespread impacts across a number of departments, or were in some way controversial. The finalised objectives were given to both team leaders across a shift. This acted as a means of ensuring support and also acceptance of innovations in that area. Arguably, the impact of this is two fold;

first, to institutionalise innovation by giving every team leader targets to meet, which contributed to their overall annual reward, and second, by ensuring the commitment and co-operation of their colleagues. Thus, the organisation sought to emphasise the value of shared innovations. By contrast, although appraisals were used in the U.S. organisation, only the leader of the team mentioned any type of innovation targets. Two team members talked of being entered for an annual international award based on the savings they had generated through their innovations. Thus, this organisation's emphasis was on rewarding individual performance rather than creating collective action and support. Overall, it is clear that each organisation focused on very different aspects of appraisal. The Japanese company measured both quantity and quality of initiatives, whilst their U.S. counterparts emphasised only quality. Building on some of these findings, the experimental study will look at both the quantity of teams' innovations and there quality through the aforementioned assessment measure. The teams will also have a clear objective they are striving to achieve, public recognition in terms of the most innovative outcome through the awarding of a team prize. The interviews support Sunstrom *et al*'s (1990) findings regarding the complex role organisational context plays in shaping teams' effectiveness.

Table 4.11: Summary of organisational procedures for innovation

Theme clusters	Japanese findings	American findings
Use of innovation process	Innovations followed pre-determined procedure. Limits to type of innovation that could be done	Formal procedure available Innovation conducted with no adherence to formal process
Time deadlines	2 days	90 days
Dissemination of ideas	Set procedure for collecting ideas. Supervisors expected to implement all relevant ideas in own section	Informal dissemination based on informal networks of contacts around firm
Use of appraisal system	Focus on achieving annual targets no. of innovations required from supervisor. Area for innovations set annually	Emphasis more on quality of innovation. Innovators entered into company wide reward scheme based on value of savings
Training procedure	New innovation process training and support to embed new learning	New innovation tools training, but no support to practice new learning
Use of experts	Organisation identified internal "advisors" identified on company basis	Champions chooses their own experts - Both from within larger team and spanning number of organisations

A further distinguishing feature of innovation was the application of formal procedures for innovation at each site. Both organisations had instigated, some time previously, a formal training programme explicitly to improve innovation. Only in the Japanese teams, however, was there a formal attempt to support the application of these new skills. This organisation emerged as operating a cascade approach to the implementation of their innovation process. A further difference in this area arose from the adherence to these formal processes. The Japanese teams appeared far more rigid in their application of their procedures. Despite being trained to the contrary, some comments suggested manipulation by the leader of the team towards a pre-determined outcome. Overall, the Japanese firm's teams stuck to an identical process of data collection, analysis, idea generation and testing. Whilst for the U.S. team's, procedures were far more ad hoc. They treated the processes, in which they were newly trained, as either an optional extra, or confirmation of their existing approaches and methods. Thus, they felt no need to follow the procedures in which they had received training. The role of process has been mentioned before as an aspect of behaviour that will be observed in the experimental setting, many of these findings relate again to Sundstom *et al's* (1990) research. The experimental study will be an abstraction from the complexities of organisation context, and thus will be simplifying the contextual issues.

4.4.3 Role of the External in innovation

The interviews revealed differences between the organisations in relation to the application of procedures for interfacing with those outside the team. As with the aforementioned procedures, it appeared that the Japanese organisation used a more formalised approach. Their teams used a system of formal assistance and information in the personification of an H.Q. appointed "advisor". Their interviews revealed that all of these advisors were Japanese and their role appeared to be two fold. First, as a resource to teams about ideas that might be useful to them from other, predominantly Japanese, sites and second, to disseminate the team's innovation ideas back to Japan. As with other systems, this was designed to ensure the maximum benefits were derived from the teams' improvements for the entire organisation. We can speculate as to how far the provision of the Japanese advisor was aimed at removing the need for teams to network externally. The interviews revealed that these advisors appeared limited in their impact and were often seen as less than helpful to the teams. We must, therefore, question the ultimate value for innovation of attempts by organisations at formally establishing "institutional repositories" of knowledge.

In contrast, within the U.S. team, there was a very different approach to external support. Here the team members were free to select their own information sources, regardless of formal organisation boundaries. It is interesting to speculate how important the role of this self selection of knowledge sources is for innovation. We must, however, question whether it was the appointment of external advisors, or the failure of the appointed experts to provide adequate information to the teams that was the chief problem. The role of external support is evident from the interviews and literature as important for team innovation, there has been no examination of the temporal aspects of this external interaction or any formal attempt to measure its impact. In the experimental study the inclusion of externals will allow the researcher to look more systematically at their role with teams and allow us to make more informed comments.

From this study, it appears that the external focus for the U.S. team was very different to that found in their Japanese counterpart. The role of the external has already been identified in innovation research through the imported and imposed innovation distinctions (King and Anderson, 1990). Within the organisational literature there is also the suggestion that innovation requires external contact (Slappendel, 1996; Zaltman and Wallendorf, 1979). There are, however, very striking differences in the externality of focus of the two groups of teams. The experimental study will seek to discover the importance of external contact and importation of ideas for high team innovation.

Within the Japanese context, there were only two examples of help from outside the organisation being sought. The one that emerged most graphically was with regard to an imposed innovation. In this case the interviewee revealed their reluctance and fear about this contact. What is noticeable about this is the contrast with the Japanese firm encouragement and normalisation of the sharing of ideas across internal team boundaries, in comparison with the team's reticence to do the same activity across external divides. Indeed, we can speculate how far this exchange of internal ideas increases knowledge, or reduces the potential risk and knock-on implications from alternative ideas. The down side of these strong internal linkages is the reduction of new ideas in circulation (Aldrich, 1979). There is no evidence of this to date, but this research did not look formally at the quality of ideas. As noted before, the experimental design will identify if external contact does help the quality of teams' innovation.

Juxtaposed to this, the U.S. team appeared actively to gain knowledge from outside, and eagerly to involve those external to the firm in the process of idea generation and development. This team continually used ideas that had already been tried and tested, albeit in different contexts. They appeared regularly to be applying imported ideas. Using Aldrich's (1979) classification this organisation would have strong ties with the outside. Corroborating the literature, the participants suggested that they gained far more knowledge and insight into potential solutions and their risks through using information from their external contacts (Myres and Marquis, 1969; Tushman and Scanlan, 1981). In the main these contacts were suppliers. As such they had access to solutions and ideas operating in other firms, and were thus able to disseminate greater understanding and insight to this team. The external contacts emerged as acting both as bench-marking experts and system specialists for the team as Utterback, (1982) and Marquis, (1982) suggest. This team's behaviour is more in line with the literatures, highlighting the importance and benefits of boundary spanning behaviour for their innovation (Tushman and Scanlan, 1981; Conway, 1996; Slappendel, 1996). The U.S. team saw very tangible benefits from their boundary spanning. We need to examine this more objectively, with a measurable criteria to identify the tangible benefits of external interaction for teams' innovation.

This external focus also emerged in a more detailed examination of the information sources in each organisation's innovation activity. The U.S. operation used both internal and external sources of data when identifying an area to be addressed, whereas their Japanese counter-parts were far more focused on internal sources of information. This was a pattern which re-emerged in other ways. The different focus of teams is an aspect that the experimental research will explore in detail, looking at both intra and external team ideation and communication and its impact on innovation levels.

The differences between the two organisations and their use of the external leads to further speculation as to the actual value to teams of external contact. Bouwen *et al* (1992) highlights the conflict between new and dominant logics in innovation. In terms of the U.S. team, two potential advantages were revealed from this externality of focus. The study raises the possibility that the team's use of their external resources created a "space" or place that permitted the consideration of new "logics", and approaches, or, more mundanely, it serves as an idea source. This is an interesting question. By contrast, in the Japanese firm, we must ask how far their attempts to internalise boundary spanning, by providing their own information sources for the teams, served to reinforce the status quo in terms of the dominant logic? Their process for teams appeared neither to facilitate, nor liberate their thinking. Indeed, the rigid adherence by the Japanese organisation's teams to formal processes may ultimately have been counter-productive and stifling for innovation. Thus, the exact purpose and impact of boundary spanning in these organisations is raised and will be explored in the experimental research so that we can begin to understand its potential effect and impact.

4.4.4. Team issues

The issue of teams themselves emerged as a major area of difference. A number of different categories emerged including team relationships and communication. In both of the organisations leadership was an important feature of innovation teams, with the appointment of innovation co-ordinators or leaders.

There was evidence across both operations of the strong relationships between team members. There were many examples given of teams spending time together outside normal work activities, e.g. lunch time and outside work. On visiting the sites there were differences in the atmosphere within the U.S. team to the Japanese teams. Both included a great deal of "banter" and humour. Although, there were similar uses of humour in the Japanese environment, it was not a cause for both internal and external comment. The U.S. team's use of humour and "Michael taking" had received comments from those who had come into contact with it. This appeared in stark contrast to the formality of the Japanese dissemination procedures. The importance of personal relationships was evident in the U.S. team, as it emerged as the prime method of information and ideas transfer. The literature regarding the impact of humour is diverse (eg. Foot, 1988 and West, 1990), we can only speculate about its role in innovation in these context. It is unclear how far humour might contribute to the reduction in innovation as individuals fear being ridiculed, or whether it establishes behavioural norms that promote and strengthen teams' relationships and is a feature of teams' behaviour that will be assessed in the experimental study. The next study will also look at quality features of teams' relationships by collecting observation of social interaction and disclosures.

Similar team behaviours with regard to communication were also apparent across both organisations. Within the U.S. firm, due to the informality of much of the communication, some of the team's efforts were frustrated through lack of knowledge about aspects of their problems from other parts of the organisation. Despite the formality of the communication within the Japanese environment, they appeared to have similar problems. There were comments made about inadequate passing on of information by both managers and engineers to the Japanese organisation's teams. The team leaders indicated how inadequate communication led to later changes or in some cases redundancy for the team's innovations. They perceived this as having a detrimental impact on their work. The communication between teams and other sites appeared to be poor, so individuals were passing on information and receiving no feedback. In contrast the U.S. team was characterised by talk of good intra-team communication, but spasmodic inter-team communication. Communication is a further aspect of teams' behaviour, at both the task and social levels that will be examined in the experimental study to see what impact it has on innovation outcomes.

4.4.5 Conclusion

The aim of this research was to examine the discourses of team innovators in two different motor manufacturers in order to identify the most relevant aspects to be incorporated into the experimental study. This study indicates first, the extent to which formal processes were adopted to achieve the team's goal and second, the extent to which the teams felt effective in achieving their aim. In this respect, the results are surprising. The literature suggests that innovation and learning are fundamental to a firm's ability to survive and thrive (for example, Colewell, 1996; Argyris, 1992). The study suggests that the U.S. firm's team appeared to conform more closely with more radical innovation more akin to the double-loop learning model, whilst, the Japanese firm, surprisingly, were found to focus on improvements and appeared to be internally focused and risk averse resulting in (at best) single-loop learning. These results differ markedly from those portrayed some years ago by Pascale (1990), where learning in the U.S. firm was predominately concerned with small "l" or single loop.

This research suggests that adherence by the Japanese to their formal processes not only forced the teams to work to strict deadlines, but may have acted to constrain the team's ideas and prevent radical suggestions being pursued. Teams felt they simply did not have the time! The U.S. team was able to achieve much more valuable savings through their more radical innovations. Although they had more time available, they were also liberated and allowed to challenge underlying assumptions. Potentially more significant, in terms of risk management for the organisation, was the use of external sources who helped the team check their arguments and ideas. Through this the U.S. team became more innovation focused, not process constrained. The net effect was higher financial savings for the organisation, potentially less risk associated with the more radical innovations, and for individuals a much higher level of learning - double loop. The role of temporal constraint on innovation suggested here and its impact on innovation will be examined in more detail in the experimental study.

From a wider organisational perspective the implementation of the teams' innovation produced very different climates for learning or for achieving a positive spiral for ideas across the firms (Polewsky and Wills, 1996). The strengths of the Japanese bottom up strategy, focusing on dissemination, created a positive acceptance for ideas. By involving all levels of staff in new ideas, they were effectively able to reduce internal resistance to continual changes. The data, however, indicated that resistance was not totally eliminated in the Japanese firm, despite the careful selection of projects by managers. In contrast, the U.S. firm, although seemingly able to generate more radical innovation, did meet some internal resistance in their implementation. The phrase "Not -invented - here" was highlighted by one of the team as a barrier to the team's ideas. Surprisingly, however, this resistance did not seem to stifle the generation of ideas. None of those interviewed mentioned stifling idea generation. Nor was there any reference to self-censorship from any of the U.S. firm's team members.

The case studies question the distinctions between the different categories of innovation which King and Anderson (1990) identified. The interviews revealed limited support for the role of the external in both imposed and imported innovations. Across both organisations there were examples of boundary spanning for both of these aspects. The participants' comments regarding innovation, however, did not suggest three such distinctive types of innovation. There was one clear example of an imposed innovation, but in every other case there emerged a melding of imported and emergent innovation. It was not possible to distinguish separate classifications for their innovation. In all except the imposed cases, the innovation of the teams combined imported and emergent features. King and Anderson (1990:82) argued that "antecedents to and process of the three types of innovation are likely to differ fundamentally", thus, they suggest three distinctive types. Whilst this study adds support to the suggestion that imposed innovation comes from senior management, there is no support for the distinctive nature of the other two. It was decided to do further analysis using an experimental approach to examine if there are differences in teams' behaviours by creating an experimental condition based on the three categories of innovation King and Anderson (1990) suggest. This would allow more in-depth analysis of first, the distinctions between innovations and second an examination of the processes of innovation. By looking at the behaviour of teams throughout the course of an innovation, difference between categories of innovation should be illuminated.

A further issue raised by the interviews was the role of time and its potentially detrimental impact as a constraint to ideas. This raises the issue of how far time affects team innovation. Gersick (1988, 1989) suggests team processes vary over time, but how far does time change innovative activity. In a further refinement of this question, we need to ask, does time have a differential impact on different categories of innovation? The experimental study will allow us to use time as an experimental condition thus facilitating the study of its impact on innovation. The interviews also showed that sensitivity to time passing is also important, therefore, in addition to creating an experimental condition, attention to time will also be collected to see its impact on innovation outcomes of teams.

The interviews confirmed the importance of collective action for ideation (King and Anderson, 1990). They revealed innovation to be a collective building process, where individuals expand and extend other's initial ideas. This aspect of behaviour has been omitted from Gersick's (1988, 1989) earlier studies of team behaviour. She also focused only on final ideation, rather than general ideation of teams. Attention towards examining collective action will be included in the longitudinal study, plus looking at quantitative as well as qualitative ideative behaviours. Based on factors like these identified in the pilot research, the experimental study will seek to examine the part teams play in building and generating ideas in more detail than Gersick's (1988) original study.

Previous studies of innovation process have tended to concentrate on unitary sequences of activity (for example, Gersick, 1988; McGrath, 1984). The case studies indicate that the progression of innovation includes multiple activities from team members. The following longitudinal experimental study will help us to consider the various disparate activities that teams undertake in innovation and what impact they have on outcome, as discussed in chapter three.

The study revealed a very important role that those external to teams may play in helping to shape the ideas. This corroborates findings from the literature. In particular, this accords with Gersick's (1988, 1989) ideas concerning external influences being part of a dynamic process and changing during the duration of the project. The second experimental study will, therefore, provide teams with two potential sources of external influence - one who can provide specific facts and data for them to use, and a second, who can provide contextual information about the environment in which their product will be used. Thus, we will be able to see whether the teams' behaviours match Gersick's assertion that seeking external information is time related. We shall also be able to see if there are any differences and the impact of the type of expert information that is sought throughout the process. We shall also examine whether different categories of innovation differ in their utilisation of external resources.

Within the interviews there was evidence, especially from the U.S. team, of the importance of personal relationships in the collective ideation process. The experimental study will seek to look at this in two ways. First, by examining trust behaviour, which can be defined as involving personal disclosure. The coding of longitudinal teams' behaviour will include examining both the giving, and the inquiry into personal details within the group throughout the process. In relation to this the teams task communication will also be collected so that we can examine what role both personal and task communication has for teams' innovation levels. The literature (for example, Foot, 1988; Paton, 1988) and the interviews have elaborated this aspect further, through revealing the potentially powerful role of humour in teams. It may have two distinctive impacts. We have examples of cases where humour may have reduced trust and, therefore, innovation, through teasing ideators. This was found to result in self censorship. Alternatively, humour can be argued to play a part in the generation of team cohesion and norms by differentiating the team from others.

Whilst it may be difficult in practice to differentiate between these two, the study has shown humour as a potentially important independent variable. Thus, it will be included as an aspect to be explored in more detail in the experimental design.

The interviews revealed other aspects of team behaviour that may be important variables in assessing innovative activity, including the need for goal clarity. In both the cases their objectives appeared clear, although there were differences regarding the role of leadership. This is a further behaviour to be examined. The study highlighted three distinctive types of ideative behaviours, including idea importation, generation and development. These aspects will also feature in the code-book of teams' behaviours to be used in the next study. There were marked differences in the case study regarding the use of formal procedures. The participants' responses suggested that formality may have a detrimental impact on ideation. Finally, the availability of resource was a source of some comment. This is a further aspect to be explored.

The experimental study is discussed in the following chapter. Details regarding the reliability of both the measurer of teams' behaviour and outcome is highlighted first, followed by an analysis of whether teams operating under the distinct conditions showed different behavioural characteristics and then an exploration of the link between teams' behaviour and innovation outcome.

Chapter 5

Study two: Longitudinal experimental study: Part one

Does team behaviour vary as a result of category of innovation and time deadlines?

5.1 Introduction

This is the main part of the research, which provides the key empirical element to the research and as such gives the basis for the contribution to the theoretical field. The empirical study was an attempt to reduce, or simplify, the behavioural themes, using features which had emerged from the pilot study, in order to examine in more detail their importance in teams' innovative performance. Thus, this experimental study uses the findings of the first to help inform and develop a more traditional experimental piece of research. This type of approach to research is, by its very nature, an attempt to reduce the complexities of the world. The study sought to recreate many aspects of reality that other researchers have indicated as important for those using this type of approach. The goal of the main study was to observe and record teams' behaviour as they worked through a concrete innovation task.

This study sought to incorporate two aspects previously identified together. First, Gersick's (1988; 1989) experimental paradigm is employed in order to examine the teams' process towards an innovative goal as it actually unfolded. It was designed to measure teams' behaviour over the duration of the task. Second, King and Anderson's (1990) three types of innovation category were used to see if different types of innovation have different types of behaviour associated with them. The focus of this chapter is deliberately to examine the teams' behaviour throughout the duration of their innovation, not on the innovative level of any teams' outcome. These aspects will be considered in chapter six. Each of the three studies that are incorporated in this chapter will be examined and discussed separately, before a final summary looks at all three analyses together and identifies the main findings and some practical implications.

In part one of this study, the focus was to examine the impact of two factors on teams' innovation behaviour. In the earlier study, and in line with the literature, these two issues had emerged as potentially changing teams' behaviour. These were the types of innovation being undertaken (in terms of King and Anderson's, 1990 three categories) and time *deadlines*. The categories were *emergent, imposed* and *imported* innovations. The interviewees had suggested that these aspects affected the teams' behaviour.

The task for the teams was determined using Arrow and McGrath's (1995) and Gersick's (1989) work as guidelines. (These are outlined in more detail in the Chapter three.) The final task that was given to the teams mimics Gersick's (1989) study. In this case, the assignment was to design and draw a national anti-drugs campaign poster aimed at secondary school children. It would be piloted in a local secondary school. The audience is suitably near in age group to the team members. The subject matter of the task is also one to which this population had received considerable exposure, so they were familiar with the issues. All of the teams were told that their posters would be assessed and a prize awarded to the best one

5.1.1 Approach to analysis

The teams' activities were video and audio taped. Narratives were transcribed verbatim and, coupled with observational data, coded for twenty innovative behaviours. The study expanded Gersick's (1988) original coding of time, external information influences, and contributions to the final innovation, by including goal setting, leadership, wider idea processing, information sharing, feedback, and "trust" categories. The additional coding were developed as a result of features which emerged as important in the pilot study.

5.1.2 Innovation category

King and Anderson (1990) had suggested three distinctive types of innovation: *Emergent, imported and imposed* (for a more detailed review, see page 34). Each, they argued, had different types of behaviour associated with it and they identified innovation as either being inherent to the team, or something external to it that was brought in and used by the team. Anderson later (1992:151) amended their original categories, to define the three in the following ways.

> *Emergent* "Where novel, unproved ideas and proposals are developed and implemented uniquely to a particular group or

organisational sub-unit (e.g. the implementation of original information technology systems unique to the organisation)."

Imported "Where systems and procedures already in use within comparator organisations are replicated and introduced into the organisation by the group (e.g. replicating production processes used by competitors)."

Imposed "Where environmental changes force the group to modify its procedures or work practices (e.g. shifts in customer demand or changes in industrial regulatory framework)."

The interviews in the pilot study had revealed that *imposed* innovation appeared to be a distinctive category, but *emergent* and *imported* innovations had merged. It was, therefore, decided to manipulate each of these categories experimentally. Teams were observed as they developed and implemented ideas, with each of the categories having access to different levels of information and different requirements.

The teams were randomly allocated to one of the three conditions (see page 72 - 73) in order to reduce sampling error (Lindsey, 1999). In the case of the *emergent* condition the team was entirely free to develop their own ideas. In the *imposed* condition, they were given the final poster slogan, "Only mugs do drugs" and some further details, including a confidential telephone line number, that they must include in their poster. In the *imported* condition the teams were given a folder containing a range of previous drugs campaigns aimed at this age group. They were free to use, i.e. import, this information as they saw fit.

The literature highlights the role of those outside the team in innovation (for example, Allen, 1977; West, 1990). Gersick (1988, 1989) in an attempt to introduce more realistic settings used external assistance for her teams. As the pilot study confirmed the important role of those outside the team for innovative behaviour, Gersick's system was adopted in the current work. Every team was given access, via a telephone, to two external advice sources.

These roles were played by confederates. The first external advisor was a medical expert, who could offer answers to any questions relating to the effects of drugs. The second expert was a head teacher of the school in which the poster would be piloted. This is a direct copy of Gersick's (1989) study in which a member of the target organisation was available to answer any context questions from the team. The teams had a telephone visible to them for contact with the externals. Each external was available on a different telephone number.

5.1.3 Time *deadline*

The interviewees in the pilot study raised the issue of different *time deadlines* and indicated that they might have a detrimental impact on innovative behaviour, by reducing the ideation level of teams. Gersick (1988,1989) had also suggested the impact of time in her work. She argued that time awareness was used as a means of pacing the group, thus time was treated as a resource of the group, as "an alarm clock" (1988: 35). It was, therefore, decided to manipulate the *time deadline* of teams to examine what, if any, effect it had on their performance. The teams were randomly allocated to one of two conditions. They were either free to complete the task when they, as a team, decided they had finished, or they were given a one hour *deadline* by which time the poster must be completed. In the case of free time teams, they were asked to indicate completion of the task by putting their poster up on a poster board at the side of the table.

Each team worked in a room which had a large clock clearly visible to them throughout the duration of the task. Thus, they could be aware of time passing, but only those in the timed teams were restricted by it. The teams were requested to arrive at a specific location at a pre-set time. In order to try and control for time sensitivity, the arrival times of teams were designed to be at less obvious times, so for example, they might be asked to arrive at ten past, or to the hour. A standard pack of materials that they could use were placed on a table in front of them. The teams were informed of the condition under which they were operating at the start of their session. They were given an opportunity to ask questions at the start of the process. The teams' entire activities were video and audio taped. The teams' narratives were transcribed verbatim and coupled with observational data.

5.1.4 Sample

The details of the teams can be found earlier on page 72 - 73. They comprised university students who volunteered to take part. They were randomly arranged into one of six categories. In total forty-eight co-acting work teams were measured for the duration of an innovative process, see Table 3.2). There were eight teams per distinctive category. The categories included either a *time deadline* of one hour, or *free time*, with the team determining themselves when their task was complete. Teams were also randomly placed under one of the innovation dimensions; *emergent, imported,* or *imposed.*

5.2 Definitions of codes

There are five main categories of code including ideation, external relations, goal setting and direction, interpersonal behaviour and resources. A summary table (5.1) of the codes can be found later.

The first group of codes concentrated on ideative behaviour. This was divided into general and final ideative behaviour. This built on Gersick's (1988) original seven code model. General behaviour consisted first of idea suggestion. This code was suggested in the pilot study and identified any suggestions for the contents of the poster that were not used in the final design. Ideas were only included in this category if it was the first time they had been mentioned. If the same idea had been mentioned before by another team member, it was not included in this category as it could not be regarded as an original idea for this team. This code could be considered as a surrogate measure for quantity of ideation. A second specific category of these ideas was also identified in the pilot. This captured imported ideas. These included only those ideas that the team attributed to a previous external campaign. This code emerged as team members frequently tagged their ideas by identifying their original source, for example, government drugs campaigns. This behaviour was frequently associated with comments relating to the team's perceptions of the adequacy for that original campaign. They would discuss the idea either to identify something they perceived as successful, or something they thought should be avoided in their poster. These ideas were, therefore, not novel ideas per se, but were new to this unit of adoption. A third category of code was idea building, again identified in the pilot study. This focused on referrals by team members to their own intra-team previously suggested ideas. They would be modifying an existing idea, rather than generating a novel one. A fourth category also looked at building ideas, but specifically looking at being critical of others' ideas, whilst trying at the same time to identify positive aspects of them. This code builds on West's (1990) notion regarding climates of excellence in which criticism was used positively to improve the quality of the idea.

The final set of ideative codes were all based on Gersick's original (1988) model. They focused specifically on the final idea that the team used. The sub-categories related to contributions to adopted ideas' content, detail and format. Content included any facet of the final poster design content. Detail focused more specifically on more particular aspects, for example, the colour of part of the final design. Finally, format details relating to how to layout the contents were coded as a separate category. In every category except idea building, or constructive controversy, it was the first mention of an idea that was collected. The re-mentioning of an idea by another team member was not recorded. This is important as the focus of this study was on the temporal nature of general and final idea generation and, therefore, it was important to identify when in the duration of the task the idea was mentioned, not that team members were not paying attention.

The second category of codes were related to directive and goal setting behaviours of the team. This was a facet that received much attention in the literature and was confirmed as important in the pilot study, but which Gersick (1988, 1989) omitted from any of her codes. The first code in this area looked at attention towards clarification of teams' objective. The code identified the attention of the team as it focused on establishing the goal of their activity, "what they were trying to achieve". This would also include any attention towards what they were also trying to avoid. A sub-category of this identified in the pilot and focused on behaviour regarding the processes by which they might achieve their goal. This code was also based on Gersick's (1988) model. For example, the identification by the team of the need to use techniques, like brain-storming, to focus the attention of the team. The final category of code in this area was leadership or directive behaviours by an individual, again the literature (for example, Anderson, 1992) and the pilot had confirmed its importance. This drew attention towards individuals within the team who took charge and formally directed others, telling them what to do. For example, a team member saying "you do this part of the poster and you do the other". This behaviour was about setting assignments and goals for others in the team to achieve. The coding did not attempt to identify whether or not these directions were followed. This will be pursued at a later date. The important aspect was the emergence of a more autocratic style of behaviour within the group. The code was looking at aggregated behaviour. Additionally, no attempt was made to identify the effectiveness of individual styles of directiveness.

The third category of behaviour that was identified for the study was taken in part from Gersick's (1988,1989) work and from the pilot research. In her studies she did not use a specific code for this behaviour, but her work centred upon the temporal pacing of this behaviour. The pilot identified that the external can play an important role in teams' innovation, therefore, both a design and coding aspect were incorporated into the experimental work. This category concentrated on externally focused behaviour. Each team had access to two sources of external assistance throughout the task. In reviewing the transcripts of the experimental teams, it was evident that external behaviour could be further sub-divided and, therefore, three specific *a posteroiri* codes were developed. The first code identified the articulation by the team of a need for external contact. The second was concerned with enacting this need by actually contacting the external source. A third sub-category emerged from this study related to external focus, but more in terms of clarifying the purpose of the contact. Thus, this was also a sub-set of objective clarification, or goal setting. It was, however, externally focused clarification, for example, 'what should the team try and find out from the external contact? What was the objective of the contact'?

The literature and pilot study indicated the importance of information exchange for innovation, and so two sets of codes were established in this area. The first centred on task based information. It distinguished between the sharing of task based information, for example, what the individuals in the team said they knew about drugs, or the direct questioning of individuals by others in the team regarding task based information, for example, "does anyone know about....".

The second set of codes looked at personal information sharing. This type of behaviour emerged from the transcripts and linked into the literature and pilot regarding trust and safety. Thus, personal disclosure by team members was identified as a distinctive category of information sharing. Literature (Paton, 1988; Foot, 1988) has highlighted humour in teams as a potential indicator of good team relationships. Humour also emerged from the pilot study as an important aspect of team behaviour. A further code was, therefore, established to capture behaviour from the team that was concerned with establishing or maintaining the team relationships through the use of laughter and jokes. This is a notoriously difficult type of code to enact as there may be times when the researcher themselves does not understand the team based humour. The code, therefore, was recorded at times when the team itself responded to the use of humour, for example, when the team laughed at an in-joke, or when teasing occurred within the team. Following West's (1990) identification of the need for feedback within the team, a final category of code was established in this area. This distinguished attempts at giving positive feedback to each other within the team. This was distinct from constructive controversy in that the team would be actively complementary towards each other. For example, saying "that was a good idea", or "I liked your idea about that".

The final two codes were again based on Gersick's (1988) model and confirmed by the pilot, identifying what Gersick referred to as "action statements" (p. 284). The first category, resource comments, identified comments relating to materials or expertise from the team that was necessary to achieve the task. For example, did the team have the right colour pen, or could anyone in the team draw well? The final code concentrated on time pacing comments by the team. This included both direct information for timed teams relating to how much time they had remaining, and also comments regarding the passing of time generally. For example, team members might say " are we nearly finished yet?" The researcher also noted from the video tape non-verbal behaviour related to gaining information about time passing. The clock in the room was placed such that it was obvious when the team would look at it. Thus, every time an individual looked at the clock it was recorded as a time pacing activity.

The data were transformed to take account of the different completion times for the task, by expressing the coding category as a proportion (%) of the total behaviour for each team. Thus, a standardised measure of activity was produced regardless of the time taken by teams in completing their task. This allowed the teams' activities to be assessed, first in terms of "what they did", through counting the frequency of their coded behaviours and expressing the codes as percentages of their total activity, and second, examining "how they did it". This was achieved through using Fisher's (1970) approach which examines the dynamics of activity through analysing the coded behaviour over four equal phases. The duration of each non-timed team was identified by working backwards from their end point and identifying the quartiles. This ensured that teams' behaviour, regardless of its duration, could be assessed in a standardised form allowing comparisons to be made between frequencies of activity. The teams' behaviours were expressed as percentiles of their total behaviour in that quartile, thus, enabling changes in behaviour to be most easily identified.

5.3 Analysis

5.3.1 Analysis methodology

The analysis examined differences in the frequency of the teams' coded behaviour, to identify whether they were due to more than chance than either of the two main conditions (three types of innovation and two types of time). The data analysis employed forms of multi-variant analysis of variance (MANQ VA) to look at differences between the group means of variables across groups of observations (Iversen and Norpoth, 1987). This type of analysis is appropriate when "evaluating the differences among a set of dependent variables (DV) when there are two or more independent variables (IV)" (Tabachnick and Fidell, 1989: 24). MANOVA has a number of advantages over a series of ANQVAs. First, it improves the researcher's chances of discovering what has changed as a result of the different conditions by measuring several dependent variables instead of just one. Second, it offers protection against inflated type I errors. Third, it may reveal differences not shown by separate ANQVAs, therefore, Tabachnick and Fidell, (1987: 372) argue that MANQVA, "which considers DVs in combination, may sometimes be more powerful than separate ANQVAs".

Multi-variant analysis of variance is based on a number of assumptions that will now be discussed in turn, before going on to consider the details of the analysis undertaken. An analysis of variance, whether it is repeated-measure or independent-measure, is identical in terms of the assumptions made concerning the data. First, it is assumed that the data are obtained from a random sample. In this laboratory based study the participants were undergraduate students from a range of courses who were randomly put into groups. They all volunteered for the task and, therefore, some attempts to randomise participation were introduced.

Second, there should be a normal distribution of data. The data were collected from groups that varied in the time they had and took to complete the task. The data used were the behaviours that the team produced and thus, as task time increased, so the chances to produce more behaviour increased. To correct for this effect, the coded behaviours were translated into percentiles of behaviour as they related to the other behaviours. This resulted in the generation of a standardised unit of measurement, which indicated where teams' activity was concentrated. In comparing specific aspects of behaviour to the total amount of behaviour elicited by the groups, it was possible to show changes in behaviour. The central question to all of the analysis was does the category of innovation in which a team is placed, and the imposing of deadlines upon the team's activity change the frequency pattern? In asking these questions, we violate the assumption of normal distribution. In the final repeated-measure analysis the premise was that behaviour would vary differently over the course of the task, not necessarily following a normal distribution pattern, otherwise there would be no difference between the types of team. This assumption is particularly problematic for small samples. The size of each of the six categories of teams was small, with only eight groups per team. Thus, this assumption remains problematic. Suggestions regarding how this study can be addressed in future studies are discussed in the final chapter.

Third, the variance in the distributions for each treatment should be equivalent. Where variance in groups is not equal, results from ANOVAs can tend to be conservative, and the analysis fails to identify real differences. SPSS has a number of tests for equality of variance. In this study Wilks' lambda (Λ) was used. A hypothesis cannot be rejected if the groups have the same variance. As Norusis (1986, p.158) suggested, however, the ANOVA test is not particularly sensitive to violations of variance under conditions where "the variances appeared to be different, but the sample size in all groups were the same". The significance of Wilks' lambda was high only for category of innovation in the total behaviour analysis, in the first and third quartiles, and high in most of the quartile measures in the repeated-measures. Consequently, the likelihood that the teams had the same variance can not be diminished. In a number of cases groups did not have the same variance and assumptions of equality were not violated.

In repeated-measure ANOVAs there is an additional assumption of "homogeneity of co-variance". This refers to maintaining the relative standing for each subject in each stage, with no difference or practice being given to any one participant over the other. In this study, we were looking at the same population throughout, with distinctions between stages being made after the task was completed and without the participants' knowledge: They were just performing one task in one time frame. Participants were treated equally before and after the task and, therefore, the assumption of homogeneity of co-variance was not violated.

Where appropriate Tukey's honestly significant difference (HSD) post hoc test was deployed. This test is used for groups of the same size (Clark-Carter, 1997:290) and "uses the studentized range statistic to make all the pairwise comparison between groups and sets the experimentwise error rate to the error for the collection of all pairwise comparisons. When testing a large number of pairs of means, Tukey's (HSD) is more powerful than Bonferroni's test" (SPSS, 1997, help page). This test is less conservative than Sheffe's test, which is not recommended for pairwise comparison, or in between-subject design (Clark-Carter, 1997:289). Tukey's (HSD) provides a more stringent correction than Dunnett's test (Tabachnick and Fidell, 1989).

There were three stages of analysis undertaken, each of which examined behaviour differently. The following pages will examine these in turn. In the first stage of analysis, the differences in the total frequencies of all the behaviours were explored. This was to give an overview of the data. Multiple analysis of variance was used to examine if there were significant differences between the different types of teams. In the second stage, the teams' behaviour within each separate quartile was examined to identify if their coded behaviour changed as a result of the two test conditions (type and time). Multivariant analysis of variance was again employed. Finally, in order to consider teams' behavioural differences in a more dynamic way, variations in their behaviour across the quartiles was assessed. This used repeated-measures analysis of variance to ascertain whether individual aspects of teams' behaviour varied throughout the duration of the task. This technique allows the researcher to look at differences in behavioural changes over time (Girden, 1992).

Mauchley's test of spherity was undertaken (Kinnear and Gray, 1997:184), which is a within-subject test of the homogeneity of covariance. This related to one of the central assumptions of repeated measure ANOVA, which is that population distribution is normal (Tabachnick and Fidell, 1989: 378). Epilon's Greenhouse-Geisser correction was applied to reduce the degrees of freedom. This is a recommended procedure in repeated-measure, ie within-subject, analysis (Kinnear and Gray, 1997:184), as it ensures type 1 error rate is not greatly inflated. Following identification of significant within- or between-subject findings, post hoc analysis was performed to examine in more detail where the significant variants lay. There is some debate concerning the appropriateness of different post hoc tests in this type of analysis (Keppel and Zedeck, 1989). In this post-hoc analysis a series of paired T-test was undertaken for each set of data.

5.3.1.1 Reliability and Validity of coding

Reliability refers to the consistency of a measure. In order to ensure the reliability of the coding system an independent coder was asked to code of five randomly selected verbatim transcripts using the code-book (See Table 5.1). This revealed acceptable coding agreement levels (100 - 83 percent agreement) according to King (1994).

The validity of the code-book was established through the pilot study and a review of the literature, which identified relevant behavioural aspects of innovation teams. Thus, the construct validity of the measure was established. The concurrent validity of the behaviours was identified through the final regression analysis, which identified the aspects of behaviour that were related to high levels of team innovation. This is discussed in the next chapter.

Table 5.1: Summary of final code book agreement levels

Main category	Sub- categories	Code agreement levels (%)	out of
Ideation	General idea suggestion	90	63/69
	Idea building	89	88/98
	Imported idea	100	11/11
	Constructive criticism of ideas	91	15/17
	Contributions to adopted idea content	100	81/83
	Contributions to adopted idea detail	100	77/77
	Contributions to adopted idea format	100	43/43
External Relations	Articulation of need for external contact	100	36/36
	Clarification of objectives for external interaction	97	73/75
	Actual external contact	100	13/13
Information sharing	Information sharing (task related)	83	176/213
	Questioning to elicit task information	83	60/72
Interpersonal relations	Humour	100	58/58
	Information sharing (personal disclosure)	100	85/85
	Positive feedback	92	89/97
Goal setting & direction	Clarification of team objectives	83	138/166
	Clarification of team procedure	75	14/18
	Leadership / directiveness	84	87/103
Resources	Resources, inc. materials, expertise	100	31/31
	Time awareness	100	37/37

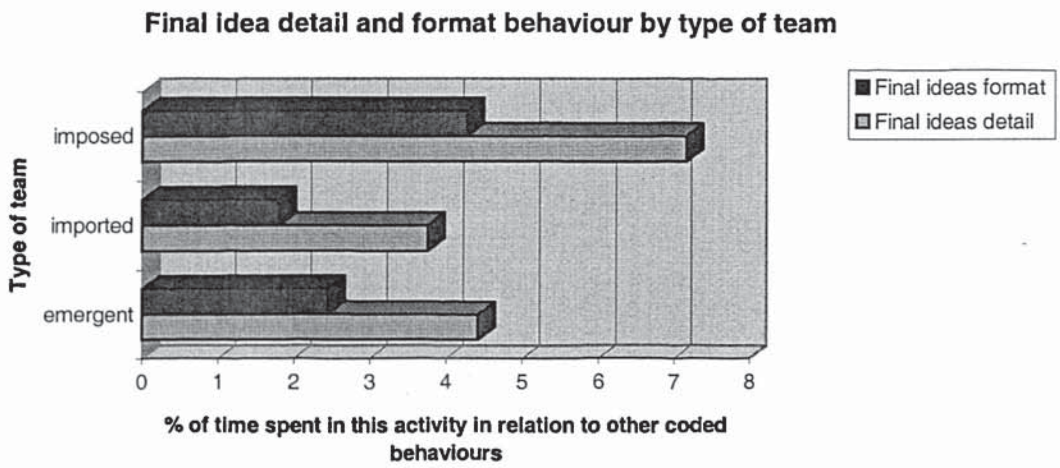
Further analysis was undertaken to determine the relationship between the team size and subsequent production of team behaviours. This was undertaken to ensure that different sizes of group did not significantly effect the amount of behaviour in the teams and thus, the size would have to be controlled for in any subsequent analysis. This involved two stages; first, a Pearson's correlation of the total coded behaviour with team size was run, which was not significant ($r = 0.333$). Second, each of the standardised coded behaviours was correlated with team size. This revealed that only final idea content correlated negatively at five percent level with team size ($r = -0.330$), therefore, the MANOVA analysis could proceed.

5.3.2 Analysis one: Variations in overall team behaviour by category and *deadlines*

Manovas were employed to test the effect of type of innovation and time *deadlines* on the teams' overall aggregated behaviour in undertaking the innovative task.

Ideative behaviour showed significant interaction in terms of innovation type for both adopted idea detail ($F(2,42) = 3.47, p<0.05$) and format ($F(2,42) = 7.53, p<0.01$). Tukey's post hoc analysis revealed that only final format varied significantly across the teams, with *emergent* and *imposed* differing at the below five percent significance level, and *imposed* and *imported* at below the one percent level. Although showing similar differences in the final idea detail behaviour, the results lay just outside the accepted significance levels. In reflecting on these results, the teams with the most initial information (*imposed*) are those that showed highest ideative behaviour in terms of format. These findings suggested that information was helpful for groups in providing some scope for final ideas. It is interesting to note that in this analysis, teams did not differ in their general ideative behaviours.

Graph 5.1: Average ideation behaviour by team type



External interactions showed significant effects across the two categories of innovation both in terms of articulating the need to contact the external resources ($F\ (2,42) = 3.15, p<0.05$), and for enacting that need ($F\ (2,42) = 5.42, p<0.01$). Tukey's post hoc analysis revealed the areas of significant results. In the case of articulation of the need to make contact, *emergent* and *imported* categories lay outside the accepted significance level. Whilst in the case of enacted contact, *imported* groups differed from both *emergent* and *imposed*. The findings suggested that different categories of innovation impact on the teams' perceived requirements for external advice. The graph (5.2) showed the significantly lower external related behaviour by *imported* teams in comparison to the others. The results indicate that both teams with a lot of information, and those with a free rein, will seek advice. Examining the content of the transcriptions of these two types of teams revealed that teams were seeking similar types of information.

Graph 5.2: Average external interaction by team type

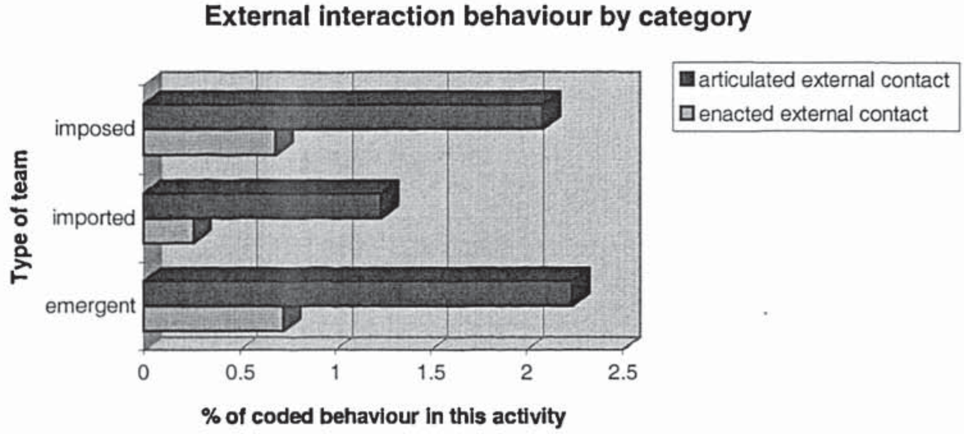


Table 5.2: Average external interaction by team type

Type of team	**Overall proportion of time spent in directive behaviour (mean percent)**
Emergent	11.29
Imported	13.07
Imposed	17.26

These results suggest that high initial team information levels may also result in an increased need for direction. An important question, therefore, is how does their leadership behaviour vary over time? We would speculate that it should be *emergent* teams that have a higher initial direction behaviour.

The analysis indicated the significant impact of *deadlines* in increasing teams' attention to time (F (1,42) = 15.72, $p<0.00$.) More interestingly, the analysis revealed an interaction effect of category of innovation on teams' behaviour.

In terms of interactions between the main variables, category of team and *deadlines*, only two behaviours showed any significant interaction. Unsurprisingly, time awareness again showed type and *deadline* sensitivity (F (1,42) = 4.34, $p<0.05$). Final ideation detail also indicated a significant effect (F (2,42) = 3.75, $p<0.032$). The means below reflect the complexity of the interaction.

Table 5.3: Means of Time sensitivity and final idea detail behaviour

Type of team	Total proportion of time spent in time aware behaviour (mean %)	Total proportion of time spent in final idea detail behaviour (mean %)
Emergent, deadline	2.10	4.50
Emergent, no *deadline*	0.71	4.35
Imported, deadline	2.83	4.35
Imported, no *deadline*	1.17	3.16
Imposed, deadline	4.24	10.30
Imposed, no *deadline*	0.50	4.02

These results indicated the difference in these behaviours of the *imposed deadline* group in comparison with the others. Overall, the proportion of final idea detail behaviour varied little across the other teams. Time awareness showed low sensitivity for *imposed* and *emergent 'no deadline'* teams in comparison with the others. *Imported* teams were more sensitive to time pacing.

Summary

In summarising the analysis in terms of the teams' activity an analysis examining the proportions of coded behaviour of teams was undertaken. It revealed that *emergent* category teams (who were free to allow their own ideas to emerge), were found to have higher externally focused behaviour than the others. They differed significantly from the *imported* teams. *Emergent* teams also were found to exhibit lower interpersonal information sharing than any of the others. Those teams in the *imposed* classification (with prescribed elements for inclusion in the final task) were found to pay significantly more attention to the detail and format of the final outcome than either of the other two types of team. They also had higher personal disclosure and higher directive behaviour. Arguably, this produced a style of leadership that was supportive and made people feel it was safe to disclose personal details. The analysis indicated a complex interaction of *deadlines* and types of innovation on time sensitivity and final idea detail behaviour; for example, those operating under an *imposed* and *deadlined* category were found to have significantly more behaviour related to final innovation detail and time sensitivity than any other group.

5.3.2 Analysis Two: Differences in teams' behaviour within each quartile by category of innovation and *deadline*

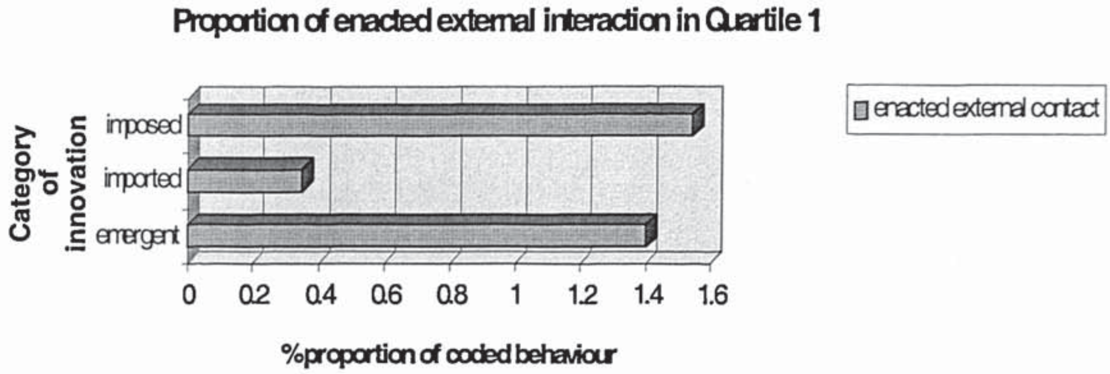
A second set of manovas were undertaken to explore in more detail the changes in behaviour of teams within each specific quartile. This analysis sought to examine Gersick's assertions concerning the seeking of external information and final ideation behaviour with regard to *deadlines* and category of innovation. For this analysis the proportions of behaviour within each quartile was assessed. The results indicated that the greatest impact of innovation category and *deadlines* occurred in the first and final quartiles of the teams. The analysis is presented in terms of coded behavioural variation within each quartile with main type and deadline effects and their interactions indicated.

5.3.2.1 Quartile 1

In this quartile seven main interactions were found between behaviours and the type of time groups, and four interaction effects. As in the previous analysis, innovation category was found significantly to interact with adopted idea format comments ($F(2,42) = 12.72, p<0.01$). Tukey's post hoc analysis revealed, as before, that *imposed* teams had significantly more focus on final idea format than either *emergent* or *imported* teams, both at below the one percent significance level. This finding indicated that adopted final idea behaviours are not only a product of the second half of teams' processes, thereby disputing Gersick's (1988) assertion. Indeed, all three types of team demonstrated final idea behaviour in this initial quartile.

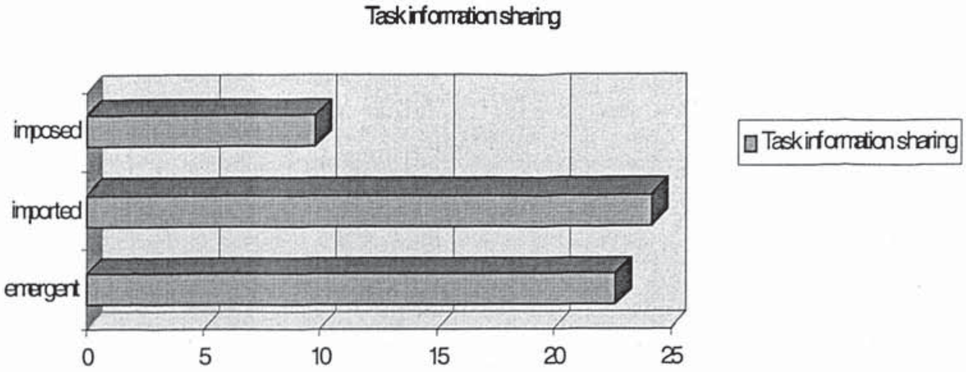
There was a significant interaction between type and time regarding external interaction behaviour. This was suggested in the initial analysis and by Gersick (1989, 1989). In this case, however, only enacted external interaction behaviour showed any significant effect with category of innovation level (F $(2,42) = 3.67, p<0.05$). The graph below (5.3) shows the highest percentage of the means for this behaviour amongst the *imposed* and the *emergent* teams. Post hoc (Tukey's) analysis revealed significant difference between *emergent* and *imported* (five percent significance level).

Graph 5.3: External interaction - enacted in Quartile 1



A further interaction was found between innovation category and information sharing (F (2,42) = 5.44, $p<0.01$). This was, however, task based and not relational in nature. Post hoc analysis indicated that *imposed* groups showed significantly less attention to exchanging information than *imported* or *emergent* teams (below five percent significance level). In terms of resources, it was evident that the *imposed* team with definite information to include did not increase their attention to other knowledge, or seek to put the information in the context of their personal knowledge. The *imposed* teams were potentially, therefore, more likely not to question the information provided. Instead of gaining information they got on with the task, focusing on the format. Both the high information, *imported* teams, and no information *emergent* teams, however, increased their emphasis on information exchange in this quartile. It was perhaps not surprising that was those in the *emergent* team category, who had no information, spent more of their initial time pooling their information on an intra-team basis. For the *imported* teams' seeking their own internal levels of information was potentially indicative of their need to take account of others' ideas and to filter them through their own knowledge.

Graph 5.4: Average proportion (percent) of time spent in task information sharing in quartile 1



The role of leadership emerged as significant in this first phase (F (2,42) = 5.44, $p<0.05$). The main interaction was with the type of innovation. In terms of directive behaviour the *imposed* team category showed more directive behaviour than *emergent* (below five percent significance level), or *imported* teams (below one percent significance level). On average fourteen percent of the *imposed* teams' first quartile were involved in directive behaviour. Gersick (1989) argued that one leader initially emerged, who is challenged in the midpoint and may be replaced. In examining the transcripts behind these findings both dual and solo directive behaviour were found. The role of the leadership within the *imposed* teams appeared far more concerned with focusing the team. The other two categories spent on average a far lower proportion, (six percent), of their time in this type of behaviour. In looking across all the behaviours in this quartile for all the teams, directive behaviour was the third most exhibited behaviour at this time, following either objective setting , or general ideation. The focus of the *imposed* teams on directing others was potentially indicative of their focus on getting the task done. They knew what had to be done and what to include, there was no difference between the teams in goal setting, but here we can see this leadership as providing direction to the team.

Emergent teams demonstrated significantly more attention to the way their team should embark on the process than either of the other teams (F (2,42) = 4.66, $p<0.05$), with Tukey's post hoc analysis confirming the dominant role of this behaviour for this category (significantly below the five percent level) compared with the other two. In contrast to the directive behaviour found above, this suggested that lack of overt direction resulted in higher intra-team attention to determining their own process.

The main effect of *deadlines* was to influence the time sensitivity of teams (F $(1,42) = 5.40, p< 0.05$).

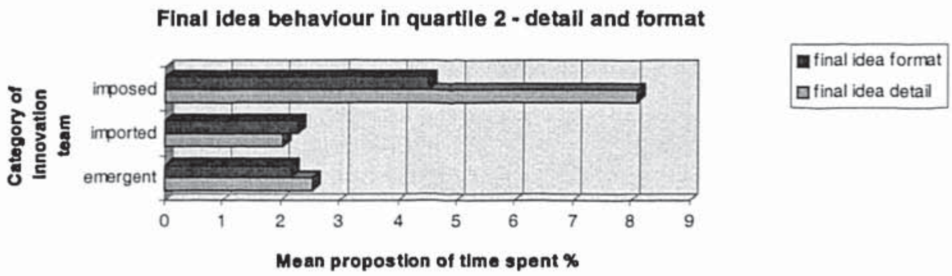
Summary

In assessing this initial phase, it was evident that teams' early attention to final adopted ideation behaviour was contrary to Gersick's (1988,1989) findings. From the analysis the importance of actual external interaction emerged for both *emergent* and *imposed* teams. The teams showed no difference in their need for external interaction, the divergence stems from the enactment of this need. Both *emergent* and *imposed* teams demonstrated more external advice seeking behaviour. In contrast to their *emergent* and *imported* counterparts, *imposed* teams showed less interest in internal information gathering. Instead, their attention was on commencing the task, as indicated by their concentration on final ideation behaviour and actively directing the behaviour of the team. A distinctive initial pattern for *emergent* teams was their focus on the need for both internal and external information, and consideration of their procedural behaviour. Thus, it could be argued that both teams were aiming to clarify their operational direction, however, *imposed* teams demonstrated more micro level task based behaviour, compared with *emergent* teams' more macro level procedural concerns. In practical terms, this finding suggested the importance of the initial time spent by supervisors in clarifying their team's objectives. Those in the *imported* teams showed significant attention towards collecting internal information and less attention to the final product. From this first quartile, there emerged potentially different approaches for teams dependent on information and autonomy levels. *Imported* teams had information and freedom to determine their own direction. Their concern for external advice was, therefore, reduced, whilst their need to share their own information was highest. Those with either a blank sheet or with definite aspects to include, sought to fill their different information values in different ways. The difference between the use of internal or external information sources was striking in this first quartile. There, therefore, is evidence to suggest that managers, and those outside the team, should pay greater attention to the impact that the type of task may have on the requirements of those within the team.

5.3.2.2 Quartile 2

The section leading up to the mid-point indicated three main categories impacted on behaviour and one combined *deadline* and type effect. This was the only quartile in which no main effect of *deadlines* was identified. Two significant interactions between final ideation and innovation category were found. Adopted idea detail and format showed significant interactions with team innovation category, (F (2,42) = 4.48 $p < 0.05$) and (F (2,42) = 4.38, $p < 0.05$) respectively. Tukey's post hoc analysis revealed significant difference for both types of behaviour between *imposed* and *emergent*, and *imported* teams ($p < 0.05$). *Imposed* teams were found to be more likely to spend time in this phase working on finer details and format of their final idea than either of the other teams. The liberation from determining a final slogan and some of the contents of the poster may have played a role in focusing the earlier attention of these teams on micro level tasks. The graph below (5.5) shows the mean proportion of time spent in these behaviours by teams.

Graph 5.5: Adopted idea behaviour in quartile 2



A further impact of *deadlines* and category of innovation was found for final adopted idea details (F (2,42) = 3.82 $p < 0.05$). The table below shows the mean proportion of behaviour focused on final detail by the teams. It was evident that the *imposed deadline* teams spent significantly more time than the others on their final task. The imposition of both content and time restrictions for these teams may have contributed to this concentration of effort. Both of the other two *deadline* teams spent the lowest proportion of time in this type of activity than any of the free time teams. It may be that at this stage it was too early for these teams to be able to determine their final decisions.

Table 5.4: Proportion of time spent discussing adopted idea details by teams in quartile 2

Category of team	Mean proportion of time spent %
emergent deadline	1.6
emergent no *deadline*	3.48
imported deadline	1.57
imported no *deadline*	2.51
imposed deadline	12.72
imposed no *deadline*	3.48

Type of innovation category was found to interact with leadership directive behaviour of teams (F (2,42) = 3.62, $p < 0.05$). In this quartile, however, only *emergent* and *imposed* teams differed significantly, with *imposed* teams spending on average fourteen percent of their time in leadership compared with seven percent by *emergent* teams.

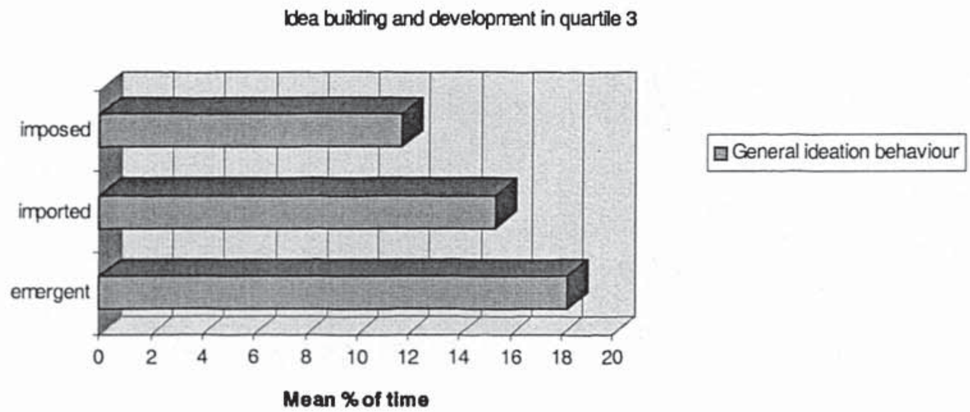
Summary

In reviewing this second phase the impact of the category of innovation was evident in terms of adopted final idea related behaviour and leadership. The distinctive focus of the *imposed* timed teams' behaviour emerged as different from the other types of team. These teams appeared to be concentrating more on task activities, with higher directive and final ideative behaviours. Arguably, the inclusion of definitive product increased the teams' focus on the final product quicker than the other categories of team. In practical terms, this finding highlights the importance of leadership skills for those undertaking *imposed* innovations. It indicates differences in behaviour of different types of team, which will be examined to see their impact on teams' performance in the next chapter.

5.3.2.3 Quartile 3

The third quartile began at Gersick's (1988) mid - point. In examining ideation behaviour two significant impacts emerged. First, the implementation of *time restrictions* interacted with behaviour focused on the content of the final adopted idea (F (1,42)= 4.47, $p<0.05$), with *non deadline* restrained teams spending more time (twenty-two percent) than *timed* teams (fourteen percent). This suggested that *deadline* constraints may have a detrimental effect on the quantity of final idea behaviour. This part of the study has not examined the outcome to see if any reduction in this behaviour had a deleterious impact on actual team performance. Second, teams' idea building and development behaviour emerged as affected by category of innovation (F (2,42)= 3.27, $p<0.05$). Tukey's post hoc analysis indicated a significant difference between *emergent* and *imposed* teams ($p<0.05$). In this quartile the ideative behaviour of the *emergent* teams was highest of all the categories. This was not surprising given the open nature of this team that they should potentially build and develop more alternatives to the final product, however, it was the late emergence of this form of teams' behaviour that was most striking.

Graph 5.6: Mean proportion of time spent on idea building and development in quartile 3



Once more the manova indicated the re-emergence of a significant change in attention to time passing by *deadline* constrained groups, (F(1,42)= 5.10, $p<$ 0.05).

Summary

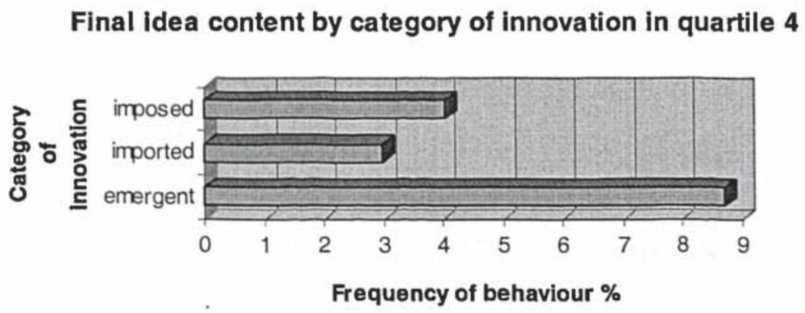
In quartile 3 the changing role of ideative behaviour, both in terms of content of adopted final ideas and development of alternative ideas across the teams emerged. *Deadlines* appeared to interact and restrict teams' concentration on the final product. This may have an impact on subsequent performance of teams. It will be interesting to see if there is a resultant decline in the performance outcomes of these teams. In terms of Gersick (1988, 1989) it was worth noting that there has been no re-engagement with those outside the team during either of the quartiles that straddle the mid-point.

5.3.2.4 Quartile 4

In quartile 4 the impact of time and category of innovation changed. Analysis through the manova revealed the greater impact in this final quartile of *deadline* constraint, than of type of innovation on teams' behaviour. *Deadlines* affected four types of behaviour, in comparison with category of innovations two affects.

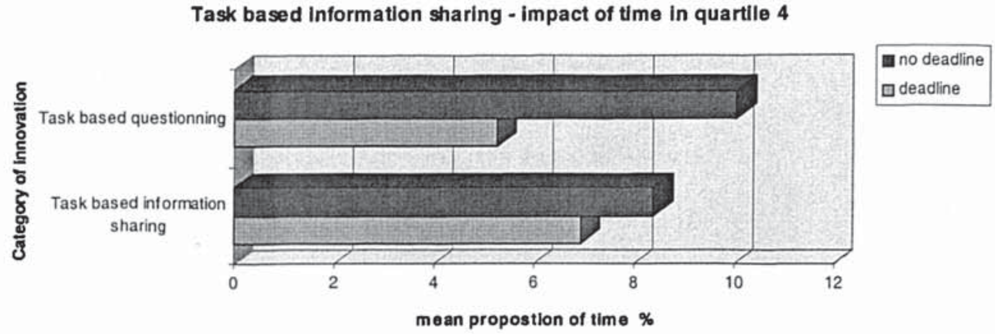
The interaction of innovation category was confined to the teams' final content of final adopted idea ($F(2,42) = 3.91, p<0.05$). Tukey's post hoc analysis indicated that significant difference lay between *emergent* and *imported* teams ($p<0.05$). The graph below shows clearly the higher proportion of *emergent* teams' behaviour spent concentrating on the content of final ideas. This finding was pertinent concerning the change in the ideation process between *imposed* and *emergent* teams. It was only in this final stage that the *emergent* teams focus relatively more attention than the other teams on final ideation activity.

Graph 5.7: Mean proportion of behaviour for adopted final idea content in quartile 4



Further significant interactions emerged for task based information sharing behaviour of teams. Both questioning to elicit information ($F(1,42) = 10.62$, $p<0.05$), and open sharing of information ($F(1,42) = 4.80, p<0.05$), were found to vary significantly in this last phase. The results indicated that *non-time* constrained teams engaged in more task based information sharing and questioning behaviour.

Graph 5.8 Impact of time on task based information sharing in quartile 4



As in quartiles 1 and 3, time sensitivity increased amongst groups constrained by a *deadline* (F (1,42)= 10.10, *p<0.01*). On closer examination, however, a complex interaction between type and *deadlines* was revealed (F (1,42) = 5.06, *p<0.01*). For the first time in any quartile, category of innovation appeared to have an impact on time sensitivity behaviour (F(2,42) = 4.13, *p<0.05)*. Post hoc (Tukey's) analysis indicated that *imposed* teams showed greater sensitivity than those operating under more open *emergent* conditions (*p<0.05*). The results suggest that time sensitivity was increased by the double constraint of nearing a deadline and pre-determined task content elements during this final phase.

For the first time in this second section of analysis, differentiation in teams' attention towards goal setting emerged. (F(1,42) = 3.85 , *p<0.05*. Those not operating under a *deadline* were found to pay increased attention towards their objective. In reflecting on this it was, however, perhaps not surprising, as in order for *open-time* teams to finish their task, they had to determine whether they have achieved their objective. In reviewing the transcripts, this goal setting behaviour emerged as a re-opening of discussion concerning the objectives, so that the team could finish. This behaviour was either absent or significantly smaller in *timed* teams. The reviewing of potential objectives was an integral part of *non-deadline* teams' process.

Summary

In reviewing quartile 4, there was an increased interaction from both *deadline* and type of innovation for some aspects of behaviour of teams. The final emergence of increased attention towards the final product content by *emergent* teams was only surprising in its late appearance. Also of note was the reduction in *deadlined* teams' task based information sharing and questioning. *Deadlines* in this final quartile appeared to stifle intra-team task communication. Again it would be interesting to see if there was any corresponding impact on the outcome of the teams (see chapter 6). Additionally, the re-emergence of goal setting behaviour from *non timed* teams was significant as they sought to ensure they have completed their objectives. There were no differences between the teams with regard to either directive or general ideative behaviour during this phase.

5.3.2.5 Discussion

Deadlines emerged as playing a consistent role in sensitising teams to the passing of time. Other than sharpening teams' attention to time as a resource, *deadlines* produced four distinct changes in teams' behaviour. These changes, however, occur only within distinctive stages in the duration of the task. First, post mid-point, they reduce teams' attention towards final idea content. Second, in the final quartile, they inhibited the concentration of teams on task based questioning and sharing behaviour. Third, again in the final quartile, they reduced the attention of teams towards reviewing and re-assessing their goals. Finally, in combination with the *imposed* innovation category and *deadlines*, this time only at the pre-mid-point quartile, they increased the focus of teams on final idea detail. This combination of innovation category and *deadline* teams was the most aware of time passing in the final quartile. The magnitude of the impact of deadline on performance will be examined in more detail in the next chapter.

Although different behaviours appear to vary across the different quartiles of the task, there was relatively little support for Gersick's (1988) findings. Teams did not confine their attention to final innovative behaviours in the second half of their activities. Nor did they re-engage with the external significantly after the mid-point. Indeed, this aspect of behaviour was more likely to occur only at the onset of the teams' task. Changes in goals also did not appear to be affected by the midpoint.

The quartile analysis indicated no current support for Anderson and King's (1990) assertion regarding the early ideation of *emergent* teams. Although *emergent* teams exhibited early ideative behaviour, they did not appear to do so more significantly than other types of innovative team. Indeed, the only difference in the behaviour of *emergent* teams was found in the final quartile when their concentration on final idea content increased. There was support for their suggestion regarding the externality of focus for *imported* innovation teams.

The mid-point did reveal significant changes across the different categories of innovation in regard to their innovative behaviour. Prior to the mid-point, the *imposed* teams showed more attention to both final idea format and detail than the other teams. Only after the mid-point did *emergent* teams increase their innovative behaviour in relation to the other teams. However, they only changed relative to others in terms of their focus on building on each others' ideas, in quartile three, and in their attention to the content of their final idea, in the last quartile.

The early behavioural characteristics of *imposed* teams appeared to be their focus on the final task and their autocratic, more directive style. In contrast, *emergent* teams were initially characterised by more attention than the others towards the procedural aspects of their task. They spent more time discussing how they were going to accomplish the task, whereas *imposed* teams appeared to have more propensity to begin the task straight away. The *emergent* teams' utilisation of process clarification appears as an alternative means of determining teams' action. The increased focus on task information from *imposed* teams offers some corroboration for Kelly's (1993) findings. He found that reducing the requirements of the task increased task orientated behaviour, but reduced personal interaction. This appears to follow that which occurred in *imposed* teams.

Actual external interaction behaviour emerged as the only distinctive form of external focused team behaviour. It was, however, only a feature of the onset of the teams' process.

Interpersonal relationship behaviour did not differ in any of the quartiles as a characteristic of any of the types of team. The work of West (1990) and others have suggested a link between relationship building and subsequent ideation behaviour. This has not been supported here, however, he looked at outcome of teams in his study and this was not the focus of the current research.

5.3.4 Analysis three: Variance of behaviour over duration of process by category of innovation and *deadlines*

A repeated measure analysis of variance was performed to examine the impact of type of innovation for each of the twenty categories of behaviour across all four quartiles. Assessment of category of innovation and time *deadlines* was done separately. As reported earlier (p.164) Mauchley's test of spherity was undertaken as a within-subject test of homogeneity of covariance and Epilon's Greenhouse-Geisser correction was applied to reduce the degrees of freedom. This procedure is recommended so that type 1 error is not inflated (Kinnear and Gray, 1997:184). This has resulted in non-significant findings in every case. The findings of both the *deadline* and category of innovation analysis are considered in terms of the five areas of behaviour, ideation, external relations, interpersonal relations, direction and time and resource awareness.

5.3.4.1 Innovative activity

The repeated-measures analysis of variance indicated that four aspects of ideation were significantly different over the task duration. A summary is shown below in Table 5.5. An aggregate code for total innovative activity, "total ideas", revealed no significant differences between- or within-subjects regarding either of the two experimental conditions of *deadlines*, or category of innovation. There were significant differences for this aggregated aspect of the teams' behaviours over the duration of the task in the category of innovation assessment (F (3,135) = 3.68, $p < 0.05$). A more detailed post hoc t-test revealed that only two quartiles differed with the second quartile being significantly higher than quartile four. When ideation was broken into its component behaviours a more complex interaction of type of innovation and task duration was found.

Table 5.5: Innovation repeated-measures manova showing quartile and behaviour effects

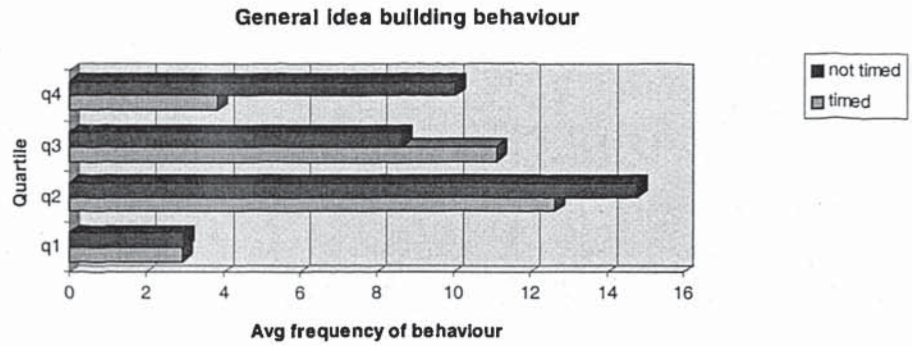
Behaviour category	Degrees of freedom	F	significance level
Total ideas	3,135	3.667	0.014
Idea building	3,138	18.949	0.000
Final idea detail	3,138	18.910	0.000
Idea constructive criticism	3,138	5.229	0.002

The results of the repeated-measures analysis of variance (in Table 5.5) indicated that behaviour related to the development and building of ideas that were not part of the final idea changed significantly over the course of the task. Both within- and between-subject effects were found. Between-subject differences were only found for the category of innovation (F (2,45) = 3.82, $p < 0.05$). Post hoc t-test analysis revealed that idea building behaviour was significantly different for *emergent* and *imposed,* and *imported* and *imposed* types of teams. *Emergent* teams spent on average ten percent of their overall time in this form of behaviour in comparison to the six and seven percent of *imposed* and *imported* respectively. Idea building also differed across the duration of teams' activity [time condition (F (3,138) = 19.34, $p < 0.000$), category of innovation (F (3,135) = 15.95, $p < 0.000$)]. Idea building peaked in the second quartile for teams and then declined, see Table 5.5. There was also an difference in the teams' behaviour over the task by *deadline,* [time condition (F (3,138) = 2.76, $p < 0.044$)]. Post hoc t-test analysis of quartiles by time condition showed only the *non deadline* teams' behaviour in the second quartile differed significantly from the first and third quartiles *deadlined* teams' behaviour (F (df = 1,23), F= 2.92, $p <0.008$) and (F (df = 1,23), F= 2.30, $p <0.031$) respectively. Graph 5.9 below shows clearly the higher attention to idea building from *non deadline* teams than their *time constrained* counterparts.

Table 5.6: Results of series of post hoc T-tests over duration of the task

Name of behaviour	Idea Building				
Quartiles	time 1	time 2	time 3	time 4	Mean
time 1	x	0.00	0.00	0.006	2.94
time2	x	x	0.017	0.00	13.70
time3	x	x	x	0.029	9.86
time 4	x	x	x	x	6.94

Graph 5.9: Idea building by *deadline* over time



We can see in graph 5.9 that teams have different patterns of behaviour which emerge over the duration of the task. The *non-deadline* teams appeared to follow a cresivity pattern, increasing just prior to the mid-point, reducing and then increasing again towards the close. *Deadline* teams followed a standard normal distribution.

In looking at ideative behaviour related to the teams' final poster idea, all three aspects of final task ideation behaviour varied significantly over the course of the task. The analysis revealed significant within-subject differences through the quartiles in relation to two aspects of behaviour for different categories of innovation team. Final idea format behaviour emerged as differing only between categories of innovation, with between-subject effects showing significant differences (F 2,45) = 4.07, $p < 0.024$). Post hoc t-test revealed that the final format behaviour of *emergent* teams was significantly higher than that of *imported* teams (F (1,15) = -2.78, $p < 0.014$), and that *imposed* teams' attention to format was higher than *imported* teams (F(1,15) = -3.59, $p <$ 0.003). There was no difference between imported and emergent teams. Overall, *imposed* teams spent over thirty-seven percent of their behaviour focusing on format, in comparison to *imported* teams' thirteen percent, and *emergent* teams' eighteen percent.

Analysis of the behaviour of teams by category of innovation in relation to final idea detail indicated a significant increase occurred over the duration of the task, [Category of innovation within-subject effect (F (3,135) = 15.92, $p <$ 0.00)]. There was no significant variation in behaviour for the different categories of team over the duration of the task. Post hoc T-test isolated the significant increases in the amount of idea detail behaviour for teams to the first two quartiles. After the mid-point, detail focused behaviour remained consistently high for the rest of the teams' life span. Table 5.7 shows the results of this analysis.

Table 5.7: Significance levels of post hoc T-tests over duration of the task

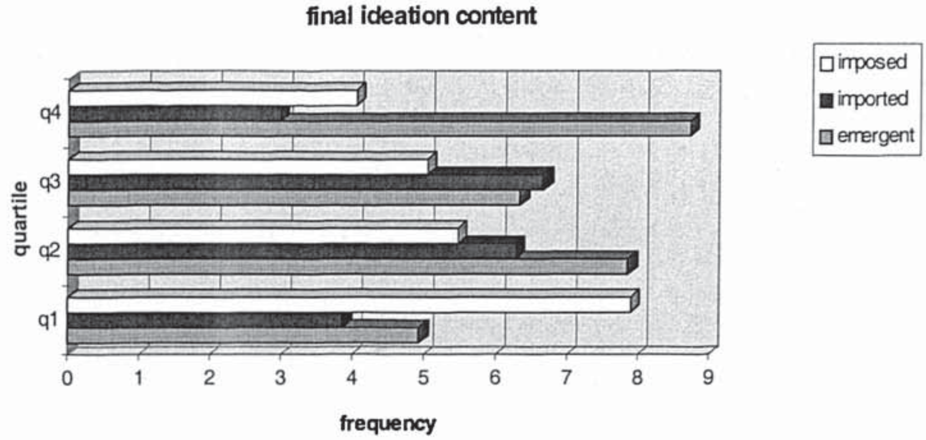
Name of behaviour	Final ideas – detail				
Quartiles	time 1	time 2	time 3	time 4	Mean
time 1	x	0.002	0.00	0.00	1.75
time 2	x	x	0.009	0.00	4.27
time 3	x	x	X	Ns	7.31
time 4	x	x	X	X	8.18

In contrast, final idea content related behaviour showed significant changes over time in relation to category of innovation team (F (6,135) = 2.46, $p <$ 0.05). Post hoc t-tests revealed significant differences in behaviour only between *emergent* and *imported* team types across the quartiles. The pattern that can be seen for *emergent* teams (see graph 5.10 below) shows that in their final quartile attention to detail increased. The post hoc analysis found that *emergent* teams in quartiles two, three and four paid more attention to content than *imported* teams in their first and final quartiles (see Table 5.8). At the mid-point there appeared to be an increase in *imported* teams' attention to this aspect of the innovatory task, although the pattern from the other two categories of team was not significantly different. Thus, the significantly different patterns of behaviour were limited to only four pairs of *emerged* and *imported* activity.

Table 5.8: Significant post hoc findings for teams' attention to final idea content by category of team over duration of task

Category of team and quartile	degrees of freedom	T	significance
Emergent 2 / *Imported* 4	1,15	2.854	0.012
Emergent 3 / *Imported* 4	1,15	2.73	0.015
Emergent 4 / *Imported* 1	1,15	2.137	0.049
Emergent 4 / *Imported* 4	1,15	2.759	0.015

Graph 5.10: Final idea content by category of innovation team over the duration of the task



The final aspects of ideative behaviour to show any significant affect of type of team and task duration was constructive controversy. There was no main difference between subject effect. Within-subject analysis, however, indicated that teams' behaviour varied significantly over the quartiles [time condition (F (3,138) = 5.45, $p < 0.001$), category of innovation (F (3,135) = 5.23, $p <$ 0.002)]. Post hoc t-tests indicated that quartile one was significantly lower than any other quartile (see Table 5.9), with no differences found between the other quartiles.

Table 5.9: Results of series of post hoc T-tests over duration of the task

Name of behaviour	Constructive controversy				
Quartiles	time 1	time 2	time 3	time 4	Mean
time 1	x	0.001	0.024	0.034	1.99
time 2	x	x	ns	ns	4.18
time 3	x	x	x	ns	2.90
time 4	x	x	x	x	3.03

The results of the different teams' attention to ideation showed complex differences in behaviour. Teams only differed with regard to five specific aspects of innovation. There was no difference in the behaviour regarding the quantity of general ideation and importation of ideas. Overall, the teams' behaviour regarding building ideas varied by category of innovation. At a dynamic level, teams operating under *deadlines* showed a significantly different pattern of behaviour. *Non timed* teams had a double peak, increasing their attention to building ideas in quartile two and four, whilst *timed* teams showed a more normal distribution peaking in quartile three and then declining.

Attention to final aspects of the task showed some differences across the course of the task. Behaviour focused on both final idea content and detail varied across the duration of the task. Category of innovation only affecting the pattern of behaviour for final content. *Imposed* teams who had more information regarding final content showed more attention to format than the other types of team, while *imported* showed less initial and final attention to content than *emergent* teams. Controversy between team members regarding ideas grew through the course of the event, but only saw significant changes between the first quartile and the others.

As we have seen there were no uniform differences between the teams. It was evident that different categories of innovation affect teams' behaviour in a limited way. This raises questions regarding the innovative abilities of the individuals in the team. In the present study difference in innovation ability levels were not a factor that was of interest and, therefore, it was not controlled for this. *Emergent* teams showed more attention to developing and building their ideas. The dynamic impact of the mid-point on teams' behaviour was limited. Teams increased their attention to final detail up to the mid-point and then it remained high, whilst attention by *emergent* teams towards final content peaked in the third and in the final quartile. Similarly, for *non-time* constrained teams, attention towards building ideas increased in the second quartile. *Imported* teams' attention to final content followed a more standard distribution, peaking in both quartiles around the mid-point. This suggested that for some types of team the quartiles around the mid-point may indeed be a trigger for behavioural change. It was not, however, a uniform finding and confined to a few types of team calling into question Gersick's (1988) main premise. Alternatively, the teams' constructive controversy became more frequent over time, with no alteration in frequency of behaviour from the mid-point. Instead we saw a difference from the onset verses the rest of the task.

5.3.4.2 External relations

External relations examined temporal changes for three aspects of externally focused behaviours; discussion of the potential need to contact the external world, clarification of objective and goals of this contact and actual contact.

Repeated-measure analysis of variance examined the changes across the quartiles with regard to type of innovation or type of time condition under which a team was operating. The results indicated that teams' behaviour toward the external world changed over the duration of the task with differences between category of team for two of the aspects of behaviour.

In looking at the focus of the team on the external and discussion of the possibility of contact, there were significant changes for teams' activities over the duration regardless of type of team, [time condition (F (3,138) = 25.89, $p <$ 0.000), category of innovation (F (3,135) = 25.52, $p <$ 0.000)]. *Deadlines* and category of innovation did not affect teams' overall behaviour. The results of a post hoc t-test analysis to identify in more detailthe quartile where differences occurred, are found in Table 5.10 below. The analysis indicated a significant reduction in the teams' focus on the external throughout the duration of the task. Initially, teams spent on average four percent of their time considering the external, compared with half a percent in the final quartile. The post hoc analysis shows a marked reduction from the first half of the teams' activity to the much lower second half, after which there was little difference in the final two quartiles.

Table 5.10: Results of series of post hoc T-tests for Potential contact with external over duration of the task

Name of behaviour		Potential contact with external			
Quartiles	time 1	time 2	time 3	time 4	Mean
time 1	x	0.00	0.00	0.00	4.35
time 2	x	x	ns	0.002	1.56
time 3	x	x	x	ns	0.93
time 4	x	x	x	x	0.47

Repeated-measure analysis of variance also indicated that teams' behaviour with regard to the clarification of the objectives for external contact differed significantly over the duration of the task. Within-subject analysis indicated highly significant differences between the quartiles of teams' activity [time condition (F (3,138) = 13.71, $p <$ 0.000), category of innovation (F (3,135) = 13.72, $p <$ 0.000)]. No within-subject effects were found specifically for either experimental condition. Post hoc t-test analysis of behaviour across the quartiles showed significant differences between all except one of the quartiles, with no differences found across the midpoint quartiles. The high initial focus can be seen clearly in the graph 5.11.

Table 5.11: Results of series of post hoc T-tests for Clarification of objective of external contact over duration of the task

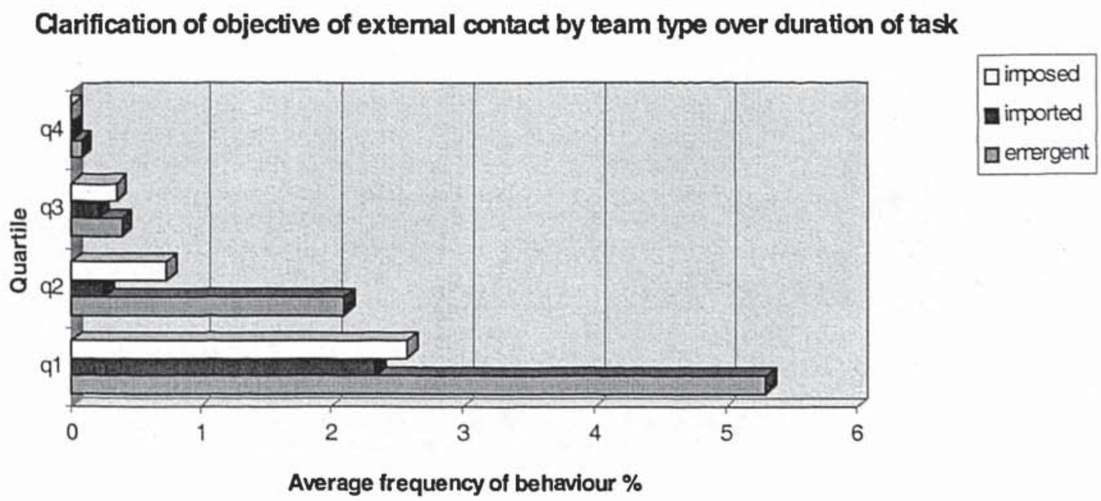
Name of behaviour	Clarification of objective of external contact				
Quartile	time 1	time 2	time 3	time 4	Mean
Time 1	x	0.004	0.00	0.00	3.40
Time 2	x	x	ns	0.024	1.03
Time 3	x	x	x	0.027	0.32
Time 4	x	x	x	x	0.03

Table 5.12: Mean frequency of behaviour for clarification of external objective behaviour by type of team

Name of behaviour	Clarification of objective of external contact			
Type of team	Mean time 1	Mean time 2	Mean time 3	Mean time 4
Emergent	5.30	2.10	0.39	0.08
Imposed	2.34	0.26	0.21	0
Imported	2.58	0.74	0.35	0

The repeated-measures analysis of variance indicated that the type of innovation category of teams significantly affected behaviour with this regard ($F\ (2,45) = 3.20, p < 0.050$). Post hoc analysis to examine the difference in the behaviour of teams across the categories of team did not indicate sufficiently significant variation. Graph 5.11 shows the teams' behaviour by type.

Graph 5.11: Clarification of objective of external contact by type of team



Analysis of teams' behaviour in terms of actual external contact, as with the other two codes, indicated within-subject differences on the basis both of *deadlines* and category of innovation [time condition (F (3,138) = 5.91, p < 0.001), category of innovation (F (3,135) = 5.03, p < 0.001)]. Using post hoc t-tests to analyse the behaviour across the quartiles, it emerged that only the first quartile was distinctively different from the others (see Table 5.13). Teams tended to make external contact at the onset of the task. The results show a significant decline. Category of innovation was also found to distinguish overall differences between teams with regard to actual contact, with significant between-subject effects (F (2,45) = 3.20, p < 0.050). Post hoc t-test indicated that both *emergent* (two percent) and *imposed* teams (1.8 percent) showed significantly more actual external contact than their *imported* (1.3 percent) team counterparts. The results were (F (1,15) = 3.64, p < 0.002)] and *imported* and *imposed* (F (1,15) =-2.29, p < 0.04)] respectively.

Table 5.13: Results of series of post hoc T-tests for Actual external contact over time

Name of behaviour		Actual external contact			
Quartiles	time 1	time 2	time 3	time 4	Mean
time 1	x	0.036	0.008	0.00	1.10
time 2	x	x	ns	ns	0.58
time 3	x	x	x	ns	0.31
time 4	x	x	x	x	0.21

The analysis indicated that attention to the external occurs predominantly at the onset of the teams' activity. There appears to be an inter-relationship between behaviour focusing on external sensitivity. The difference in the teams' behaviour in terms of each of the three measures of external behaviour was very limited. Actual contact was a significant feature of the first quartile, and it declined markedly from quartile two. Behaviour directed at the potential need for external contact continued until the mid-point, after which it declined significantly. Clarification of the objectives of any contact continued and showed the most marked contrast after quartile three.

Overall, however, teams' behaviour concerning the external reduced throughout the duration of the task, and showed no affect of the mid-point in terms of generating a resurgence of contact. This was in direct contrast to

Gersick's (1988) assertion that following the mid-point teams' would re-establish contact with the external. The teams in this study showed a continual reduction in attention towards the external for all three aspects of externally focused behaviour. Category of innovation produced some differentiation in both actual contact and clarity of objective. External contact was significantly higher for both *emergent* and *imposed* teams. *Emergent* teams did appear, unsurprisingly given their limited initial information, to spend more time clarifying what they would like from external contact. This was not, however, translated significantly to increased behaviour for potential or actual contact with their external information sources. *Deadlines* appeared to have no impact on teams' attention to the external world.

5.3.4.3 Information and Interpersonal relations

Information and interpersonal relations codes focused on behaviour including the exchange of information pertinent to the task and interpersonal aspects such as personal disclosure and positive feedback within the teams. The repeated-measure analysis of variance indicated that there was no change in teams' task based questioning behaviour. Information exchange between team members, however, did change significantly over the duration of the task. The analysis of type of innovation category revealed no affect between groups, but indicated within-subject differences in this aspect for *deadline* conditions over the duration of the task ($F\ (3,135) = 10.57, p<0.000$). Similarly, an analysis looking at *time* constrained teams found their behaviour varied over the duration of the task, with information exchange between team members being higher at the start of the task (see Table 5.14 below). Interestingly, although there was no overall between-subject effect for the teams' behaviour for either time constraint nor type of innovation classifications of team, *deadlines* did influence the behaviour of teams' within the different quartiles. Graph 5.12 shows the different patterns of information exchange throughout the task. On average information exchange declined from the onset.

Table 5.14: Repeated-measures anova for time constraint condition within subject effect

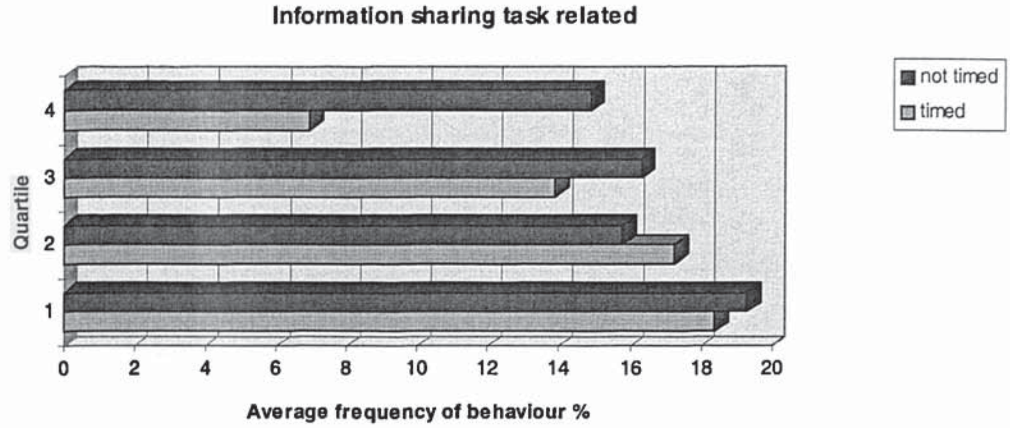
Behaviour category	Degrees of freedom	F	significance level
Information sharing task related quartile	3,135	10.831	0.000
Information sharing task related quartile and time deadline	3,138	4.544	0.005

Post hoc analysis through t-tests (see Table 5.15) showed that task based information sharing declined significantly for teams. The difference that emerged between the behaviour of *non-timed* and time constrained teams were limited. The analysis only indicated that *non-time*-constrained onset was significantly higher than *deadline* teams' third and final quartiles, (F (1,23) = -3.00, $p<0.006$, and (F (1,23) = -2.86, $p<0.009$) respectively. The behaviour of *non time* constrained teams was also found to increase following the mid-point with a resurgence in exchange in quartile three for *non timed* teams, whilst *timed* teams merely continued to decline. There was, however, insufficient difference between the behaviour of teams. Later analysis, in chapter six, will examine whether this reduction in behaviour affects the performance outcomes of time constrained teams.

Table 5.15: Results of series of post hoc T-tests for Information sharing task related over the duration

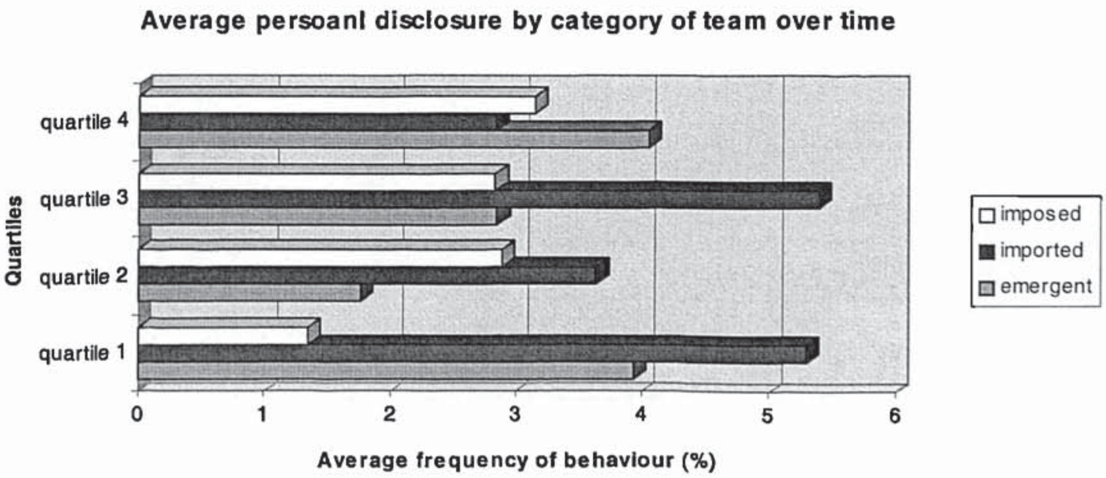
Name of behaviour	Information sharing task related				
Quartiles	time 1	time 2	time 3	time 4	Mean
time 1	x	ns	0.012	0.000	18.86
time 2	x	x	ns	0.001	16.53
time 3	x	x	x	0.001	15.10
time 4	x	x	x	x	10.91

Graph 5.12: Information sharing task related



In terms of interpersonal behavioural variation in the teams, the repeated-measure anova identified significant difference in personal disclosure and positive feedback. The analysis of teams' personal disclosures indicated variation between type of innovation team (F (2,45) = 5.28, $p<0.05$). Post hoc t-test analysis of the difference by innovation category showed *imported* teams had significantly more personal disclosure than *imposed* teams (F (1,15) = 2.46, $p<0.026$). The teams' behaviour in this regard also varied over time, with within-subject effects of (F (3,135) = 2.12, $p<0.05$). Post hoc analysis indicated the only significant variation (p<0.05) was between *imported* and *imposed* teams during the first quartile. Graph 5.13, below, shows the lower personal exchange of *imposed* teams than *imported* at the onset of the task and the patterns of behaviour across the different categories of team.

Graph 5.13: Personal disclosure over time over time by category of innovation



The final significant aspect of behaviour identified from the repeated-measure anova was positive feedback. The analysis indicated that this form of behaviour varied significantly over time [time condition (F (3,138) = 5.34, $p <$ 0.000), category of innovation (F (3,135) = 5.36, $p <$ 0.000)]. Post hoc t-tests showed feedback increased significantly from the on set. Table 5.16 shows the results below.

Table 5.16: Results of series of post hoc T-tests for positive feedback over time

Name of behaviour	Positive feedback				
Quartiles	time 1	time 2	time 3	time 4	Mean
time 1	x	0.00	0.00	0.001	4.90
time 2	x	x	ns	ns	8.10
time 3	x	x	x	ns	8.56
time 4	x	x	x	x	8.58

Information exchange was affected by *deadlines* with different behaviour patterns being found for teams operating under the *time constraint.* The *non timed* teams had a fluctuation around the midpoint raising some interesting questions regarding Gersick's (1988) model. She did not include this aspect of coding, but this was an indication of a mid-point potentially affecting teams' behaviour, but only for those not affected by deadlines. *Time constraints* appeared significantly to influence behaviour throughout the task, although no main overall affect was identified. The mid-point was not important in rates of interpersonal relationship behaviour. These did change over the duration of the task. Positive feedback increased for all teams to a standard level from quartile two, whereas the disclosure of personal information varied by innovation type, with *imported* teams showing more initial attention to this than *imposed* teams. Once past the first quartile these two aspects of behaviour did not reduce significantly.

5.3.4.4 Direction

The behaviour of teams with regard to establishing their direction was analysed using the same repeated-measure analysis of variance to explore if the three aspects of directing behaviour varied across the duration of the teams' task. The behaviour assessed included formal directing of teams' activities, i.e. leadership, defining and clarifying the objectives of the teams' activities and attempts to establish a procedure for them to follow. All of the analysis indicated that teams' behaviour changed significantly over the duration of the task.

In examining the repeated-measure analysis of variance for team leadership behaviour there were significant within-subject increases in the teams' behaviour over the duration of the task [time condition (F (3,138) = 27.80, p < 0.000), category of innovation (F (3,135) = 25.38, p < 0.000)]. In the final quartile over twenty two percent of the average teams' activities are focused on directing each other. Post hoc t-test analysis to identify significant differences across the quartiles revealed that each quartile was significantly different from each other. Table 5.17 below shows the results of the analysis and the graph (5.14) shows the average behaviour of the teams over the duration of the task.

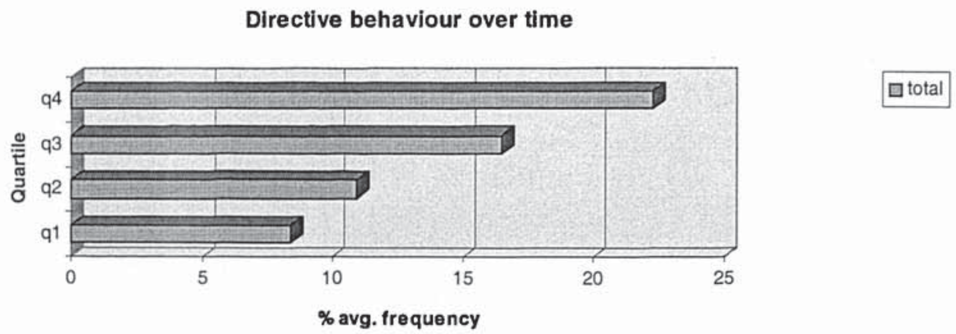
Table 5.17: Results of post hoc T-tests for directive behaviour over duration

Name of behaviour	Directive behaviour				
Quartiles	time 1	time 2	time 3	time 4	Mean
time 1	x	0.036	0.00	0.00	5.40
time 2	x	x	0.00	0.000	10.92
time 3	x	x	x	0.005	15.49
time 4	x	x	x	x	22.56

Table 5.18: Results of post hoc T-tests directive behaviour by type of innovation

Name of behaviour	Directive behaviour			
Type of team	Mean behaviour	*Emergent*	*Imposed*	*Imported*
Emergent	11.441	x	0.001	ns
Imposed	15.632	x	x	ns
Imported	13.776	x	x	x

Graph 5.14: Average directive behaviour of team over the duration of the task



Type of innovation category emerged as a significant between-subject effect for teams (F (2,45) = 4.77, p < 0.013). The analysis indicated that there were significant differences between the teams' overall directive behaviour. Post hoc t-test indicated that *imposed* teams showed significantly more leading and directing than *emergent* teams (F (1,15), t = -4.20, p< *0.001).* No difference was reported for *imported* teams.

In contrast, the repeated-measures analysis of variance examining goal setting behaviour, showed that type of innovation and time constraints did not affect that teams' behaviour. Significant within-subject differences were found, indicating that this aspect of behaviour changed significantly over the duration of the task [time condition (F (3,138) = 35.78, p < 0.000), category of innovation (F (3,135) = 37.54, p < 0.000)]. Post hoc analysis by t-test indicated the areas of significant difference between the quartiles of teams' activity (see Table 5.19). Goal setting significantly declined throughout the task. There was no mid-point change to the continued decline.

Table 5.19: Results of series of post hoc T-tests for goal setting behaviour of teams over the duration of the task

Name of behaviour		Goal setting			
Quartiles	Mean	time 1	time 2	time 3	time 4
time 1	14.457	x	0.00	0.00	0.00
time 2	5.918	x	x	ns	0.00
time 3	3.716	x	x	x	0.034
time 4	1.582	x	x	x	x

Finally, the repeated-measures analysis of variance of teams' processual activities also indicated a significant variation through the duration of the task.

The analysis showed that only within-subject quartile behavioural frequencies changed [time condition (F (3,138) = 3.26, p < 0.024), category of innovation (F (3,135) = 3.26, p < 0.024)]. Innovation type and deadlines had no affect on the behaviour of the teams. Post hoc t-test revealed the final quartile's reduction in attention of teams was significantly different to the first two (see Table 5.20). The teams' behaviour regarding the establishment of a process for its activities was limited, however, it does show a significant decline in attention as the team progressed through the task.

Table 5.20: Results of series of post hoc T-tests processual activities over the duration of the task.

Name of behaviour		Processual activities			
Quartiles	Mean	time 1	time 2	time 3	time 4
time 1	1.506	x	ns	ns	0.016
time 2	1.751	x	x	ns	0.010
time 3	1.366	x	x	x	ns
time 4	0.816	x	x	x	x

All the teams revealed significant changes in directing, processual and goal setting over the duration of the task. Leadership behaviour within the teams showed a significant increase throughout the teams' time. *Imposed* teams displayed significantly more directive behaviour than *emergent*. This suggests that teams with existing externally imposed rigidity were also teams which show higher internal rigidity in the form of this directive behaviour. This was an overall difference and not one that changed through the task. *Imposed* teams were significantly more autocratic in their patterns of behaviour than emerged. Rhetorically, we must ask if this was due to the existing need for compliance to externally set goals for the team. In contrast, teams' goal setting and attention to their processes did not show any impact of category of innovation. Unlike directive behaviour they merely declined throughout the task. It could be argued that these latter two aspects of behaviour were more necessary at the on-set of the task with teams' determining the way they wished to progress and were, therefore, redundant as the team progresses. The findings with regard to goal setting challenged Gersick's (1988) argument of a mid-point re-evaluation by the team of its direction. Instead, a decline was found. Leadership, as a means of ensuring the teams stay on track following the original direction, instead increased. Again the mid-point does not trigger any change in this behaviour.

5.3.4.5 Temporal and resource awareness

This final aspect of the teams' behaviour included attention towards either temporal or other resources. Resources that were coded included attention towards the materials required to produce the poster, or skills and expertise of those within the team. Repeated-measures analysis of variance were performed to identify differences across the quartiles and the variance that was attributable to either of the two conditions, the time constraint or the type of innovation category. Post hoc t-tests were used to examine any differences in more detail.

Teams' attention towards resources was found to vary significantly over the duration of the task, indicating significant within-subject effects [time condition (F (3,138) = 3.78, p < 0.012), category of innovation (F (3,135) = 3.72, p < 0.013)]. The analysis revealed that there was no affect of either time constraint or type of innovation of the teams' behaviour. Post hoc t-tests for the differences between the quartiles showed that the teams' initial behaviour towards resources was in marked contrast to the rest of the quartiles. Teams' attention towards resources increased after time one, but did not significantly change thereafter.

Table 5.21: Results of series of post hoc T-tests Resource attention over duration.

Name of behaviour		Resource attention.			
Quartiles	Mean	time 1	time 2	time 3	time 4
time 1	1.650	x	0.041	0.015	0.007
time 2	2.334	x	x	ns	ns
time 3	3.206	x	x	x	ns
time 4	3.185	x	x	x	x

The analysis of time awareness and sensitivity of teams revealed by far the most complex interaction of all the behaviours. Teams operating under *time constraints* were found to increase their attention to the passing of time, between-subject effects revealed a very significant main effect (F (1,45) = 11.85, $p<0.001$). *Time constrained* teams spent on average approximately four percent of their overall activity monitoring the passing of time, in contrast with *free time* teams who spent a mere 0.8 percent of their activity in this behaviour. The analysis revealed teams in this regard changed their behaviour significantly over the duration of the task, within-subject effects are indicated in Table 5.22.

Table 5.22: Within subject effect for teams' time awareness behaviour in quartiles by type of innovation of teams and time constraint

Source	degrees of freedom	F	Signif
quartile	3	9.125	0.000
quartile * type of team	6	2.824	0.013
Error (quartile)	135		

Source	degrees of freedom	F	Signif
quartile	3	9.283	0.000
quartile * time constraint	3	5.525	0.001
Error (quartile)	138		

Post hoc t-tests examining the differences across the teams across the quartiles showed that team activity varied with regard to four pairs of quartiles (see Table 5.23). The increase in the final quartile of teams' attention towards time differentiated it from the rest of the quartiles. Similarly, the increased attention in quartile three differentiated it from quartile one. A series of post hoc analysis t-tests were performed to examine differences in behaviour, first between *deadline* and *non-time* constrained teams, (see Table 5.24) and, second, between the categories of type of innovation and quartiles (see Table 5.25). It indicated that different categories of team had different patterns of behaviour.

Table 5.23: Results of series of post hoc T-tests Time awareness over duration

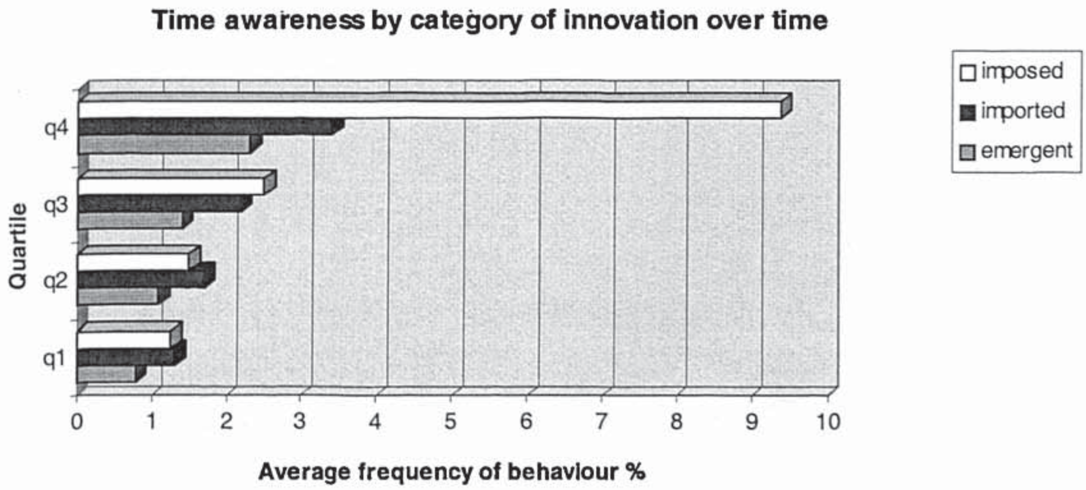
Name of behaviour		Time awareness			
Quartiles	Mean	time 1	time 2	time 3	time 4
time 1	1.119	x	ns	0.017	0.002
time 2	1.434	x	x	ns	0.004
time 3	2.036	x	x	x	0.008
time 4	5.034	x	x	x	x

Table 5.24: Post hoc t-test analysis significant findings from analysis of time awareness in each quartile by time category

Category of team and quartile	degrees of freedom	t	Significance
Timed 1 / Not timed 1	23	-2.332	0.029
Timed 1 / Not timed 2	23	-2.589	0.016
Timed 1 / Not timed 3	23	-1.024	0.002
Timed 1 / Not timed 4	23	-3.172	0.002
Timed 2 / Not timed 3	23	-2.944	0.007
Timed 2 / Not timed 4	23	3.332	0.003
Timed 3 / Not timed 3	23	-2.109	0.046
Timed 3 / Not timed 4	23	-2.428	0.005
Timed 4 / Not timed 4	23	-2.881	0.008

Post hoc analysis revealed marked differences for nine pairs of quartiles by *deadline constraint* (see Table 5.24). *Free time* teams showed lower attention to time than their *deadline constrained* colleagues. This was most marked in quartile one. In comparing through post hoc t-test analysis, the increase in attention to time over the duration of the task of *non timed* teams, they were still significantly below the *deadlined* teams across most quartiles. By contrast, the same analysis for the *timed teams* increased attention to time ($p < 0.001$) only between the final quartile and each of the others. No significant differences were found between any other quartile.

Graph 5.15: Time awareness in each quartile by type of innovation team

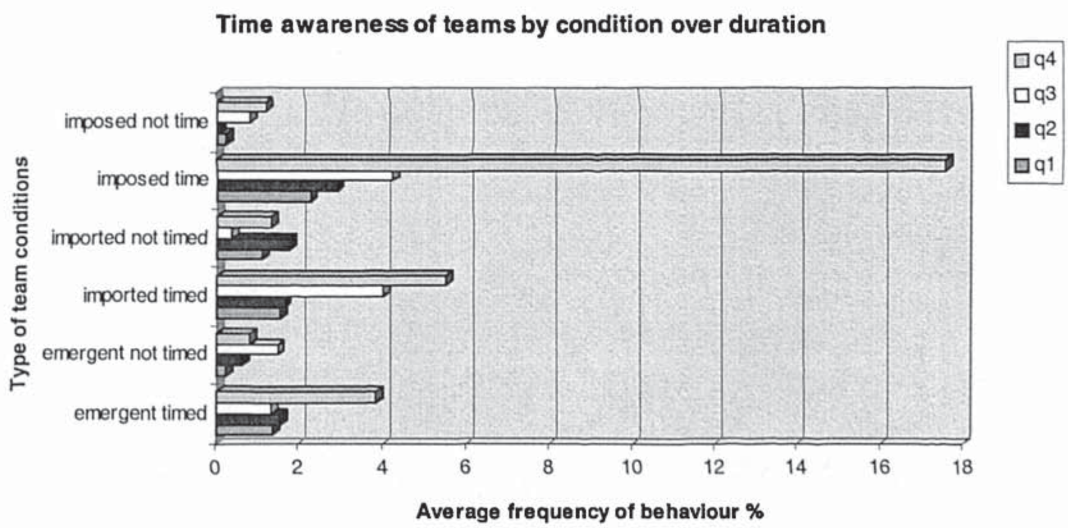


In examining the analysis of time awareness by category of innovation for team, there were eleven significant differences between teams over the duration of the task. Most evident was the lower attention to time by *emergent* teams, especially when compared with the high attention from *imposed* teams in quartile four. *Imposed* teams in quartile four emerged as paying significantly higher attention to time than any other category and across the quartiles. On close examination *imposed* timed teams were, as a group, more sensitive than any other team. They appeared to be hyper-sensitive spending on average seventeen percent of their time in the final quartile, but with large variations within the group (standard deviation = 15.648). The different pattern of behaviour for this class of team can be clearly seen in graph 5.16.

Table 5.25: Post hoc t-test analysis significant findings from analysis of time awareness in each quartile by type of innovation team

Category of team and quartile	degrees of freedom	t	significance
Emergent 1 / Imported 3	15	-2.174	0.046
Emergent 1 / Imported 4	15	-2.515	0.024
Emergent 1 / Imposed 3	15	-2.094	0.054
Emergent1 / Imposed 4	15	-2.523	0.023
Imported 1 / Imposed 4	15	-2.296	0.036
Emergent 2 / Imported 4	15	-2.455	0.027
Emergent 2 / Imposed 4	15	-2.447	0.027
Emergent 3 / Imposed 4	15	-1.213	0.037
Imported 3 / Imposed 4	15	-2.119	0.051
Emergent 4 / Imposed 4	15	-2.219	0.042
Imported 4 / Imposed 4	15	-2.217	0.042

Graph 5.16: Time awareness by team type over duration of task



Attention towards resources was found to increase for teams after the first quartile and did not change significantly. In contrast attention to the passing of time increased for every category of team throughout the task. It was also affected by both *deadline* constraint and the type of innovation undertaken. The *imposed* and *deadlined* teams were as a whole significantly most attentive to the passing of time than any other category of team.

5.3.4.6 Discussion

In examining the changes over the duration of the task, several interesting patterns emerged. Many are general trends that all the teams appear to follow. These will be discussed later. There are only three cases in which different trends in behaviour are identified for the different categories of innovation. In no case in this study are there three significantly different patterns corresponding to the three types of innovation team. This, therefore, only offers limited corroboration for King and Anderson's (1990) suggestion that behavioural differences are apparent for distinct types of innovation. There are some distinctions, however, that rarely if ever are across all three categories of innovation. These differences will now be examined in more detail.

The main differences that emerged for *imposed* teams was with regard to time awareness. The imposition of both *deadlines* and definitive final content aspects markedly increased time sensitivity in the final quartile of the task. This appears to be the most significant aspect of change in this specific type of team behaviour. Second, differences were identified regarding the disclosure of personal information by innovation category. In this case, *imported* teams were likely to spend more time after the mid-point in sharing personal information than the *imposed* teams. Although the frequency of behaviour was not substantial, limited to approximately five percent of the behaviour of teams, nevertheless, at the onset *imposed* teams showed less attention to personal information. Although not significantly different from either of the others, *emergent* teams temporarily reduced their frequency of this form of behaviour just prior to the mid-point. Third, there was a trend regarding attention to final idea content which changed across teams. In this case, *emergent* teams had a different pattern compared with *imported* teams. The *emergent* teams showed low initial interest towards final idea content, which rose to approximately seven percent of their attention for the rest of the task. In contrast, *imported* teams increased their attention level to approximately six percent towards final content around both mid-point quartiles. The *imposed* teams were more interested at the onset in this aspect of the task.

The impact of time *deadlines* also showed three distinctive differences across teams' behaviour. As indicated earlier, attention to time was heightened for *time constrained* teams, especially in the final quartile. Second, the attention of teams in exchanging information differed. It should be noted that this form of behaviour emerged as a dominant activity for most teams across the entire task, with frequencies ranging from on average ten to twenty percent of teams' behaviour. *Timed teams*, however, reduced their attention to this activity markedly in the final quartile, whilst non constrained teams' activity level remained high. Third, teams' behaviour regarding idea building was affected. In this case *non timed* teams showed two peaks, the first just prior to the mid-point and then again in the final quartile. In comparison *deadlined* teams had one around both mid-point quartiles. This suggests that the imposition of a deadline may reduce the willingness of teams to divert activity from the major focus. Although Gersick's (1988) model of teams' behaviour corresponded more closely with that of the *non-timed* teams, the moderating impact of time was significant. This finding indicates that care should be taken in setting time deadlines for future studies of team innovation.

The analysis showed that there were twelve aspects of behaviour that changed over the duration of the task for most of the teams. The graph 5.17 shows the trends of these aspects of team behaviour over the course of the study. In looking in more detail, six potential patterns emerge to the behaviour of teams over time. A first set of behaviours emerge as significant only at the start of the task, goal setting and all three external focus behaviours. We can clearly see the link between the advice and support from outside in helping to clarify the team's objective.

A second pattern emerged concerning behaviours which remain high for most of the task, reducing considerably only in the final quartile. Task based information sharing was one example of this. As noted before, however, *deadlines* did appear to reduce markedly final phase attention to information. The behaviour of *non-time* constrained teams in terms of information sharing suggested a consistently higher attention to this aspect of behaviour. More research, however, needs to be directed here before we can clearly identify a third trend. Attention towards processual aspects of teams' behaviour showed a similar pattern to that overall information exchange. It did not appear to be affected by *deadlines* in the same way and was a far less frequent occurrence.

In contrast to this general reduction trend, leadership/directive behaviour, attention towards resources, and time awareness show the opposite types of pattern, and a potential third trend. These behaviours increased from the onset and peaked at the end. Intuitively, the need for direction and ensuring adequate resources become more important as the task neared completion.

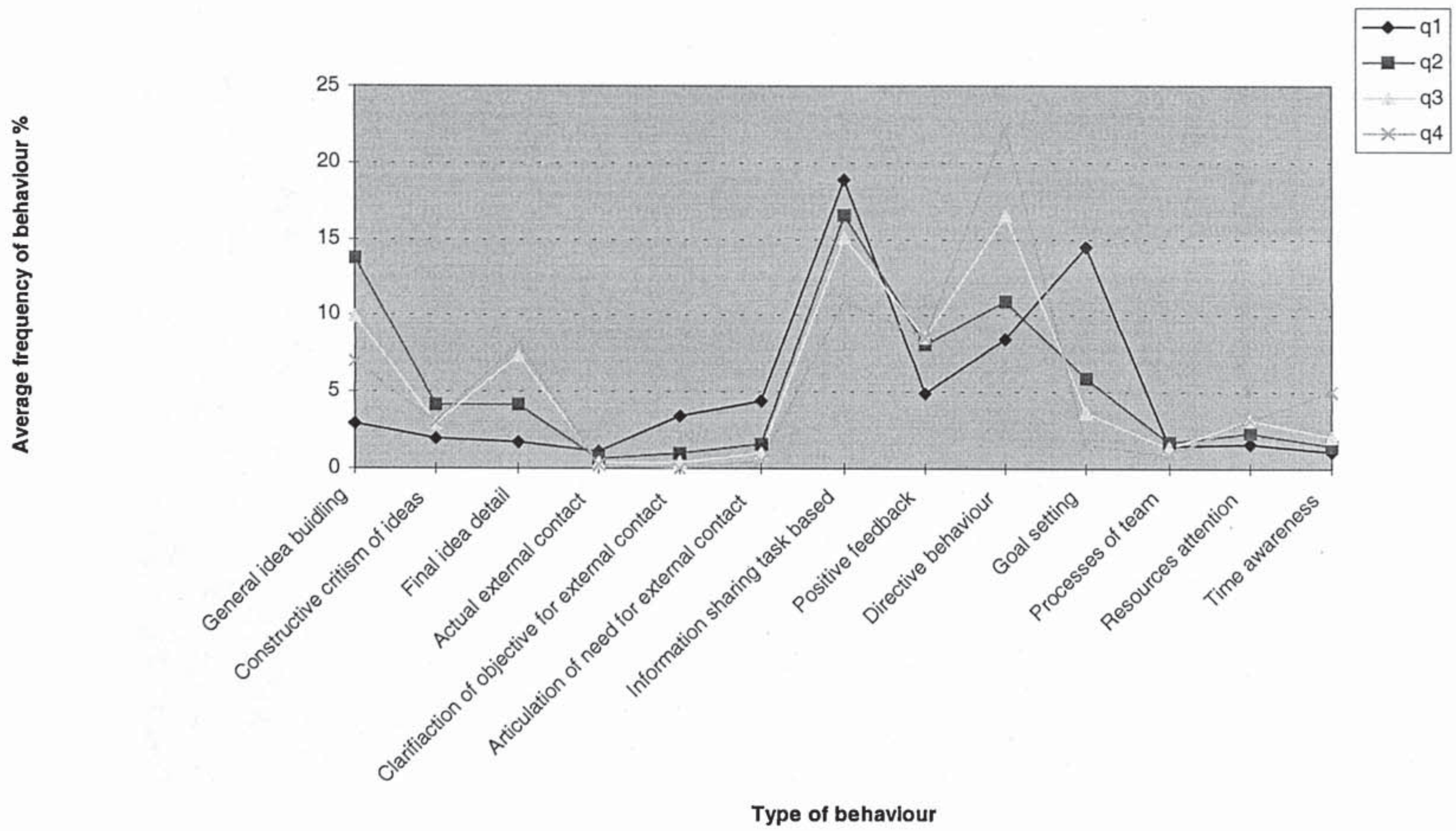
A fifth trend emerges from behaviours that increase from the second quartile, prior to the mid-point and are sustained throughout. These include the two behaviours most akin to notions of safety and trust, namely, constructive criticism, and positive feedback. The occurrence of these two aspects at this stage in the second quartile offers some corroboration to West's model, although there are differences in the categories of behaviour here that may be seen as denoting trust.

In comparison with this fifth grouping, ideative behaviours show a sixth distinctive trend. Both general idea building and final ideation detail emerge more in the second quartile, yet they show opposite patterns, with general ideation gradually reducing whilst behaviours specific to the final product correspondingly increase.

Teams' behaviour does appear to vary over the duration of the task. Six specific trends are suggested that are indicative of the complexity of teams' behaviour. This was further complicated by the mitigating impact of category of innovation and *deadlines* for five specific aspects of behaviour.

There are a number of assumptions that analysis of variance is based on, these will be explored in relation to the current research.

Graph 5.17: Significant changes in teams behaviour over the duration of the task



5.4 Summary of the three analyses

In looking at three analyses, the study indicated some support for the existence of a limited range of behavioural processes that differentiate between the types of team (category of innovation and *deadline* constrained). Consistent differentiation, however, between all three of the categories of innovation was not found. This suggests that there was considerable overlap between behaviours for the three types of innovation. Some support was offered for the existence of different behaviours from a series of pairs of innovation teams, suggesting limited differentiation between these categories of innovation in the behaviours of teams. It must be remembered that this study was based on an artificial created experimental world. More attention should now be directed to real life longitudinal work in this area to gain support for the behaviours that were found to differentiate teams. These included external interaction, some ideational aspects, directive, processual, information sharing (task and personal) and time sensitivity behaviour codes. It is important that these codes, which have been found to be useful in a laboratory setting, are tested in the real world.

The most evident difference between the categories of innovation was found regarding teams' task based information seeking at a more general level. Each of the teams was found to have a different foci to their attention. Table 5.27 below illustrates this. This finding has important implications regarding boundary spanning behaviour.

Table 5.26: Sources of information seeking by category of innovation for teams

	Sources of information	
Category of innovation	Internal	External
Emergent	✓	✓
Imported	✓	x
Imposed	x	✓

The main impact of *deadlines* on team processes was, unsurprisingly, to increase time awareness. Other effects, however, did emerge. *Deadlines* were found to reduce final innovative behaviour after the midpoint of a team. *Non* *timed* groups' process showed more attention to final content, a re-engagement in late goal setting and different patterns to their task based information sharing behaviours. Thus, a pattern of influences on behaviours was suggested here too, but again a more detailed study of real time longitudinal analysis of team processes is required.

The study also suggested some aspects of behaviour that changed the more constrained a team was. It emerged that *time* and product content constrained teams (*imposed)* were found to have a more directive style, paying more attention to external influences than those of their other teams. Alternatively, less constrained teams sought more internal information, and were potentially more autonomous in discussing their way forward together, rather than having one person directing operations. The *imposed* teams in this study appeared to become task based more quickly than the other types of team. Thus, the level of constraint in which a team is operating may have an effect on their psychological climate. In this way the link between type of task, team behaviour and psychological climate of teams may be examined. There needs to be more attention towards these aspects in a real time organisational setting in future research.

Importantly for organisations, the role of the external in shaping team activity was also identified. This was an aspect that many studies within psychology have overlooked by confining their study to purely intra-team activity. This study indicated that the role of the external interaction may be affected by the stage in the team process. Teams'attention to the external was found to be most significant at the onset of their activity, particularly for those involved in either *imposed* or *emergent* categories of innovation. This may have important implications for the effective management of teams, but again further longitudinal organisational studies are required in this area.

Overall, the study highlighted the complexity of team processes. It showed the need to consider team activity in terms of multiple and not single sequences of activity. It also revealed the need to consider many different aspects of teams' behaviour. In the past innovation processual studies have tended to confine their attentions to a small number of behaviours. This study identified a number of distinctive aspects of behaviour that appeared to be important for innovative teams. This part of the study, however, deliberately concentrated on the outcome of team activity in terms of behaviours alone. In one sense this study has, therefore, only dealt with variations in the quantity of team activity, both over the duration of the task and in relation to moderating influences on this behaviour such as category of innovation and *deadlines*. In the next chapter we shall concentrate on examining links between the behaviour of teams and the quality of their innovation outcome. Thus, we will be able to comment on the actual importance of the teams' behaviours for innovative.

Chapter 6

Study two: Longitudinal experimental study: Part two

What behaviours predict successful outcomes of teams?

6.1 Introduction

This chapter also looks at the experimental study examining the behaviour of teams, but this time in relation to their innovation outcomes. It focuses on identifying behaviours that link to more innovative outcomes. The chapter commences with an appraisal of the problems of successfully measuring team behaviour before analysing through stepwise regression outcomes and antecedent behaviours. In particular the analysis identifies temporal aspects of teams' behaviour to reveal whether the impact of replicated behaviours in different time frames of team activity may have a very different impact on teams' innovative outcomes.

Many researchers (Guzzo and Shea, 1992; West and Anderson, 1996) in this area focus on the model of teams in terms of "inputs - process - outputs". In this study output can be measured in a number of ways: first, through the qualitative output - "how they went about their process", in other words, by the exploring the behaviour exhibited by the teams, or second, we could look at the *quality* of their task outcome in relation to their behaviour to see if differences in performance outcome may be due to behavioural aspects of the teams' process. In this chapter we shall explore team innovation by looking at the link between the quantity and quality of teams' behaviour and its relationship to their resultant performance outcomes using stepwise regression analysis to assess the teams' behaviour, and its links to innovative success. This is a technique that allows one to assess the relationship between one dependent variable, in this case, different features of innovation and several independent variables, which are the different types of teams' behaviours. We shall commence with examining this relationship at the overall level, before exploring the importance of behaviours in each of the distinct quartiles and finally, identify the overall impact of different behaviours.

6.2 Assessing the validity of team performance measurers

There are many inherent problems in producing a valid measure of team innovation performance. Chapter three highlighted some of these. Most notably, Amabile (1983) highlighted the difficulties of devising one all-encompassing measure for creativity in her studies. Her work, although focusing on the individual level, also has direct impact on team innovation studies too. Others (West and Anderson, 1996) have cited this as the reason behind the development of distinct dimensions of innovation. Rather than one main factor, West and Anderson (1996) developed a range of assessments of a team's innovative output. This drew mainly on the work of Wolfe (1994), and resulted in the categorising of successful performance into a number of evaluative statements. The development of this measure provides some construct validity for measures, which are notoriously difficult to devise. Although West and Anderson's study focused mainly on health service innovation, it does provide some concurrent validity and, therefore, it is possible to utilise their established approach to measuring other types of innovation teams. Through using this approach, the examination of the distinctive dimension of a team's innovative output is possible. Their dimensions include the following; clarity, novelty, radicalness and quality. The details behind the rating system adopted can be found on page 77 and following pages. The scale was a modified version of the previously mentioned West and Anderson (1996).

The task the teams were set was a replication of Gersick's (1989) study, asking them to produce an advert. In this study, as noted in chapter three, each team was asked to produce a poster to warn secondary school children of the dangers of drugs. The task was chosen as it would necessitate multiple activities within the team, but it involved teams producing a tangible outcome. The age group for the perceived end user was close to the participants and they would, therefore, have some knowledge of teenagers and drugs.

The basis for assessing the teams' innovative performance was the ratings from a panel of judges. This is in line with other studies, for example (West and Anderson, 1996), which utilised expert raters to quantify teams' innovative outcomes. As highlighted in chapter three, each of the judges was drawn from different areas of expertise, such as graphics design, education and drugs counselling. The judges were briefed on the descriptions of the aspects on which they would be asked to assess each of the posters at the onset and encouraged at that point to ask any questions if they were unsure what was meant. They were also requested, in their introduction to the task, to use the entire five point rating scale if possible. This is in accordance with assessment centre rating procedures (Woodruffe, 1993). To aid further in the research, the judges were also asked to include comments after each rating to ensure consistency, checked in terms of the aspects that had formed the basis in making their rating decision. The final rating sheet can be found in appendix C.

6.2.1 Analysis of judge's rating of teams' performance

An analysis of the judges' rating behaviour showed that all except one of the judges used the entire spectrum of marks (Table 6.1). The judge who differed from the other had a minimum rating of 3 for the posters. Standard deviations of the judges' rating by dimension showed they ranged from 0.9 to 2.2.

6.2.2 Reliability of judges ratings

The reliability of the judges' rating behaviour was assessed using a Cronbach's alpha test of internal consistency. This is a test undertaken to ascertain whether there is sufficient agreement between the judges' scores to allow us to aggregate their results together. This analysis found agreement levels ranging from 0.56 - 0.72. There is some debate regarding the acceptable level of reliability. Kline (1993) considers alphas above 0.7 to be acceptable, whilst Pedhazur and Schmelkin (1991) argue that the circumstance of each study must be taken into account by the user of the measure in determining the appropriate level. The internal consistency of the ratings can be seen in Table 6.1 below.

Table 6.1: Reliability of judge's rating for the teams' task

Rating dimension	Mean	Standard deviation	Inter-rater agreement (Kendall's Coefficient of concordance)	Alpha co-efficient
Radicalness	4.2	1.730	0.38	0.66
Novelty of content	4.5	1.641	0.32	0.64
Novelty of layout	4.4	1.658	0.34	0.68
Clarity of message	4.9	1.75	0.23	0.56
Quality of presentation	4.4	0.00	0.21	0.72

Attempts were made to see if the reliabilities could be raised through reducing the number of judges used, by reconfiguring the final aggregate. Analysis revealed, however, that the highest alpha co-efficients were found for the aggregated assessments of the whole panel of judges. The outcome assessment measures used in the following analysis are, therefore, based on the mean of the innovation dimension of all of the judges' ratings.

6.3 Inter-correlations of behavioural variables

In order to examine the detail for multicollinarity a series of correlations were undertaken. This was also done to examine the innovation outcome data in more detail. The following section discusses the areas of significant correlation. In 6.3.3 the implications of the correlations are reviewed.

6.3.1 Independent variables

a. Input variables

The first assessment examined the correlations of the input variables and the rated outcomes. These input variables included type of innovation category and deadline variables. They were not significantly correlated with the each other. In terms of correlation with behavioural outcomes, only one was found for either of the variables, type of innovation category correlating negatively with clarification of team procedure (-0.32, $p<0.05$).

Outcome in terms of independent variables in this analysis comprised two distinct aspects. First, the time taken by the team to complete the actual task. This correlated positively with idea building (0.51, $p<0.01$) and constructive criticism (0.32, $p<0.05$), leadership (0.68, $p<0.01$) and task based questioning (0.37, $p<0.05$). Time taken did not correlate significantly with either of the input variables, type of team or deadline.

The second aspect of output were the twenty behavioural codes produced by teams. In looking at the correlations (see Table 6.2), there were thirty-three behaviours that inter-correlated. There were four aspects of teams' ideative behaviour that inter-correlated. Constructive criticism correlated positively with general idea suggestions (0.41, $p<0.01$) and also idea building (0.46, $p<0.01$). Idea building correlated with contributions to final idea content *(0.31,* $p<0.05$*).* There was also a correlation between final idea format and detail (0.42, $p<0.01$).

There were inter-correlations between all three aspects of external directed behaviours, clarification of external objectives, actual contact and articulated external contacts at the one percent level. Articulated need for contact also correlated with constructive criticism of ideas (0.29, $p<0.05$), and clarification of objective correlated positively with final content of ideas (0.39, $p<0.01$).

In terms of directive behaviours, leadership was found positively to correlate with both idea building (0.44, $p<0.01$), constructive controversy of ideas (0.50, $p<0.01$), task based questioning (0.34, $p<0.05$), humour (0.51, $p<0.01$), positive feedback (0.30, $p<0.05$) and attention towards resources (0.45, $p<0.01$). Procedural behaviour correlated positively with final idea content (0.58, $p<0.01$) and positive feedback (0.32, $p<0.05$). Goal setting correlated general idea suggestions (0.37, $p<0.01$), articulation of need for external contact (0.49, $p<0.01$) and actual external contact (0.51, $p<0.01$).

Looking at interpersonal behaviours, four aspects, task based information sharing (0.39, $p<0.01$), questioning (0.40, $p<0.01$), humour (0.30, $p<0.01$) and positive feedback (0.49, $p<0.01$) all correlated positively with idea building. Positive feedback also correlated positively with constructive criticism of idea (0.48, $p<0.05$) and final idea content (0.29, $p<0.05$). Task based information and questioning are positively correlated (0.51, $p<0.01$). Humour was positively correlated with task based questioning (0.36, $p<0.05$), personal disclosure (0.45, $p<0.01$) and positive feedback (0.48, $p<0.01$).

Finally, in looking at resources behaviour, there was a correlation between positive feedback and resource attention (0.36, $p<0.05$). Attention towards resource aspects of the task are significantly positively correlated (0.31, $p<0.05$). Seventeen percent of the coded behavioural aspects indicate inter-correlations. Given the number of categories of coded behaviour that indicate inter-correlation, there may be a significant clustering effect. The overall majority of behaviours, eighty-three percent do not show this interrelationship.

6.3.2. Dependent variables

There were significant inter-correlations across all except one of the dependent team outcome variables. *Radicalness* and *clarity* were the only non-significant correlations. Despite the earlier assessment of the inter-rater reliabilities of the measurer, the inter-correlations suggest that raters were at best distinguishing between two distinct aspects of innovation. This will be discussed in more detail later.

6.3.3 Relationship between dependent and independent

This correlation analysis was undertaken as a means of also testing for multicollinearlity, which is the extent to which variables are highly correlated with each other. Tabachnick and Fidell (1989:87) indicated that this is above the 0.90 level. In order to test for this we need to explore the relationship between dependent and independent variables, as multicollinearlity results in redundancy of variables and impacts on the degrees of freedom of errors weakening the analysis. The results of the correlation indicated that although thirteen significant results were found these were not above the 0.90 level, suggesting multicollinearlity was not adversely effecting the subsequent regression analysis.

In terms of correlations between the team input and outcome innovation ratings there were no significant correlations, except in the case of *novelty of content* which correlated negatively with both type of innovation team and deadline variables (-0.09, $p<0.05$, and -0.29, $p<0.05$) respectively. Also type of category of innovation correlated negatively with *radicalness* (-0.3, $p<0.05$). As Table 6.2 below shows, the analysis suggests stronger and more positive relationship between behavioural aspects rather than input variables, with fifteen behaviours correlated with the dependent outcome variables. The total innovation measures revealed positive correlations with clarification of external objectives (0.30, $p<0.05$), task based questioning (0.32, $p<0.05$), and positive feedback (0.29, $p<0.05$).

Table 6.2 shows the significant relationships between behaviour and innovation outcome. Breaking down innovation outcomes into the five distinct aspects indicated no correlation between *clarity* and any of the behaviours. Novelty of content with three aspects, *novelty of layout* collated negatively with two. Quality also correlated negatively, as Table 6.2 shows, with the same two, namely actual external contact and clarification of external objective. Quality positively correlated with task based questioning. Finally, *radicalness* correlated positively with three. There appear to be limited relationships between actual ideative behaviour and innovative outcome with only final idea format and idea building correlating with *novelty of content* and *radicalness* respectively. There is some evidence of a relationship between external directed behaviour and innovative outcome with actual external behaviour and clarification of external objectives significantly correlated with different aspects of outcome. Goal setting and procedural aspects of directive behaviour also showed a relationship with innovation outcome, however, there was no relationship found with leadership. Finally, only task based questioning and positive feedback indicated significant positive correlations with outcomes. These findings are discussed in more detail later.

Table 6.2: Intercorrelations of innovation outcome, structure, and behavioural variable

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1. Overall innovation																									
2. Clarity	0.61**																								
3. Novelty of content	0.85**	0.29*																							
4. Novelty of layout	0.82**	0.34*	0.63**																						
5. Quality	0.86**	0.69**	0.57**	0.61**																					
6. Radicalness	0.78**	0.07	0.86**	0.65**	0.48*																				
6. Idea suggestion	-0.12	-0.12	-0.01	-0.21	-0.15	0.01																			
8. Idea building	0.13	-0.16	0.18	0.16	0.04	0.29*	-0.15																		
6. Imported idea	0.02	-0.02	0.07	0.21	-0.12	-0.04	0.00	-0.08																	
10. Constructive criticism of ideas	-0.06	-0.22	0.06	-0.03	-0.13	0.08	0.41**	0.46**	0.26																
11. Contributions to adopted idea content	0.21	-0.06	0.28	0.22	0.14	0.26	-0.22	0.31*	-0.07	0.00															
12. Contributions to adopted idea detail	-0.17	-0.21	-0.20	-0.06	-0.07	-0.14	0.01	0.05	-0.08	0.02	0.05														
13. Contributions to adopted idea format	-0.12	0.03	-0.30*	-0.08	0.09	-0.21	-0.04	0.15	-0.16	0.05	0.22	0.42**													
14. Articulating need for external contact	-0.15	-0.15	-0.03	-0.22	-0.18	0.01	0.24	0.21	0.05	0.29*	0.06	-0.04	-0.11												
15. Clarifying external objectives	0.30*	0.14	0.36*	0.20	0.16	0.32**	-0.23	0.21	0.06	0.00	0.39**	-0.20	-0.06	0.43**											
16. Actual external contact	-0.25	-0.22	-0.10	-0.32*	-0.30*	-0.03	0.09	0.26	-0.13	0.10	0.07	0.06	-0.02	0.60**	0.46**										
16. Clarification of team objective	-0.28	-0.24	-0.12	-0.29*	-0.35*	-0.08	0.37**	0.13	-0.15	0.25	0.05	-0.06	-0.06	0.49**	0.28	0.51**									
18. Clarification of team procedure	0.18	-0.11	0.28	0.25	-0.04	0.34**	-0.14	0.20	0.22	-0.04	0.58**	-0.01	0.10	-0.03	0.18	-0.02	-0.05								
16. Leadership	0.01	-0.08	-0.01	0.08	0.01	0.03	0.12	0.44**	-0.05	0.50**	0.08	0.28	0.24	0.05	0.01	0.06	0.11	-0.06							
20. Info. sharing (task related)	0.08	0.00	0.08	0.06	0.04	0.13	-0.18	0.39**	-0.03	0.16	0.11	-0.27	0.01	-0.02	0.28	0.21	0.13	0.20	0.24						
21. Questioning to illicit task information	0.32*	0.22	0.17	0.25	0.36*	0.25	-0.07	0.40**	-0.09	0.16	0.17	0.02	0.14	-0.13	0.17	0.06	-0.10	0.18	0.34*	0.51**					
22. Info. sharing (personal disclosure)	0.19	-0.03	0.22	0.18	0.23	0.13	-0.23	0.04	-0.07	-0.06	0.11	0.07	-0.16	-0.13	0.09	-0.21	-0.09	-0.01	0.19	0.09	0.04				
23. Humour	0.17	0.04	0.25	0.11	0.12	0.16	0.10	0.30*	-0.05	0.23	0.07	0.04	-0.13	0.00	0.13	0.03	0.19	0.01	0.51**	0.22	0.36*	0.45**			
24. Positive feedback	0.29*	0.02	0.39*	0.25	0.17	0.34**	0.17	0.49**	0.10	0.48*	0.29*	-0.06	0.06	0.03	0.12	0.05	0.32*	0.21	0.30*	0.25	0.28	0.14	0.48**		
25. Resources, inc. materials, expertise	0.11	0.02	0.25	0.00	0.04	0.14	0.11	0.18	0.02	0.27	0.01	0.13	0.00	-0.15	-0.07	0.03	-0.05	0.18	0.45**	0.21	0.23	0.19	0.63**	0.36**	
26. Time awareness	-0.18	-0.21	-0.03	-0.19	-0.23	-0.05	0.18	-0.01	-0.13	0.12	-0.15	0.16	-0.21	-0.05	-0.16	0.06	0.21	-0.01	0.09	-0.04	-0.10	0.09	0.24	0.24	0.31*

6.4 Regression Analysis

The examination of whether there was any predictive relationship between teams' innovation outcome and their behaviour was tested using a series of multiple regressions. Tabachnick and Findell (1989) highlight the appropriateness of this statistical technique when looking at the combined effect of a number of independent variables in predicting a dependent variable. Regression produced a range of "statistical information" which is useful in a number of ways. First, the correlation co-efficient indicates the association of the two variables. As with other previous correlation analysis, the largest achievable value is one, indicating a perfect correlation, through to zero, indicating no relationship. Multiple regressions examine the relationship between a number of independent variables and one dependent variable. Regression, however, differs from correlation in indicating the importance of the dependent variable in predicting independent variables. The higher the regression value (r^2), therefore, the more important that variable is in predicting final outcome. In the first analysis, a stepwise regression was undertaken to see the importance of team inputs, like category of innovation and time deadlines, to the teams' innovative outcome. The time teams took to complete the task was also examined. This was to ensure this variable had no significant impact on teams' behaviour and innovative success.

In addition, a series of multiple stepwise regressions were undertaken, examining at an overall level whether any overall aspect of the teams' coded behaviour was a significant predictor of innovation. Second, a series of stepwise regressions were performed to examine whether team behaviour in each of the separate quartiles predicted innovative outcome. The stepwise regression differs from other forms of regression as it uses a statistical cut off, of five percent of the variance, to identify those independent variables which have a significant impact on the dependent outcome variable. Thus, it can be called statistical regression. Using this criteria, it indicates a series of cumulative models that show, in order of importance, those independent variables that are most significant in predicting the dependent variable. Thus, stepwise regression is a useful tool in identifying significant predictors.

Regression was, therefore, used as a preliminary means of identifying predictive relationships. Regression is a means of assessing the strength of degree of association between dependent and independent values (Kinnear and Gray, 1997). Along side the correlation co-efficient, the regression analysis also indicates the proportion of the squared error in the dependent variables, this is r^2. Thus, as Howell (1982), notes r^2 can be interpreted as "the percentage of the variability in the criterion that can be explained by variation in the predictor" (p.247). The regression also indicates, through the beta weight statistic, the change in the dependent variable, in terms of the number of standard deviations, that would produce a positive increment of one standard deviation in the independent variable, in this case the innovation rating. Finally, the regression also tests the significance of the linearity of the relationship between the variable through an anova analysis, hence an F result is reported.

6.4.1 Analysis one: Team inputs and total behaviour with their innovative success

First, a series of regressions were performed to assess the contribution of the four separate team input variables of team size, type of innovation, deadlines and a combination of deadlines and type in predicting overall innovation outcome. The regression anova indicated that there was no significant linear relationship between any of these variables and innovation outcome. Type of team and size of teams accounted for one percent of the total variance. A similarly low amount of variance was accounted for by the time teams took to complete the task, (two percent). The beta weights for each of the analysis were also non-significant. Table 6.3 below shows the results of the regression analysis.

Table 6.3: Regression of input variables and time taken onto overall outcome variables.

Outcome variable	Independent variable	r2	F	dfs	p	Beta	p
Overall innovation rating	Type of innovation team	0.01	0.16	1,47	ns	-0.06	ns
Overall innovation rating	Deadline	0.04	1.74	1,47	ns	-0.19	ns
Overall innovation rating	Size of team	0.01	0.08	1,47	ns	-0.04	ns
Overall innovation rating	Time taken	0.02	0.72	1,47	ns	0.12	ns

This suggested, contrary to other researchers (for example, Guzzo and Shea, 1992), that inputs have a minimum impact on the eventual innovation outcome of a team.

A further analysis examined total coded behaviour of teams with total innovation outcome. This indicated that a small amount of variance (less than two percent) of teams' innovation outcome could be predicted by examining the total amount of behaviour of teams. This finding echoes Amabile's (1983) concerns about the meaningfulness of a total innovation measure. As the behavioural aspects are far more complex than a crude aggregate, it was decided to examine in more detail the relationship between behaviour and innovative outcome.

Overall, this preliminary analysis suggested low predictions of teams' outcome based on the input variables. It also indicated that crude assessments of behaviour, like overall amount of interaction, are unrelated to final ideation levels.

6.4.2 Analysis two: Specific aspects of team behaviour and innovative success

6.4.2.1 Overall teams' behaviour and success

A series of stepwise regressions were performed to identify the most important aggregated behavioural variables in predicting teams' innovation outcome. This analysis showed that only total task based information questioning was an important predictor in identifying aggregate overall innovation, accounting for ten percent of the variance (R_2 0.104, $F(1,47) = 2.91$, $p < 0.025$; beta 0.323, $p < 0.025$.) This suggests that openness on an intra-team basis is important for the innovative outcome of teams.

Dividing the dependent innovative outcome into its five separate aspects, again stepwise regressions were performed. In the case of innovative *clarity* no behavioural variable was found to account for variance at a statistically acceptable level. The analysis of predictability from *novelty of content* of innovation indicated a four component model could account for forty-eight percent of the variance. The table below (6.4) records that the most predictive model included; total positive feedback, final idea format, clarifying external objectives and goal setting team behaviours. In looking at the standardised beta coefficients for each of the identified behaviours, a complex relationship was revealed. The final four aspect model reported highly significance levels (P<0.001) in each case. It indicated that there was a positive relationship between total positive feedback and clarifying clarification of external objectives, with beta weights of 0.39 and 0.29 respectively. This suggested that there was a positive linear relationship between the variables and *novelty of content*. Two other important aspects of behaviour, final idea format and goal setting, however, had a negative relationship with *novelty of content*, with beta values of -0.34 and -0.40 respectively.

Table 6.4: Regression of significant total behavioural variables and *novelty of content* outcome variables.

Outcome variable	**Independent variable**	**r2**	**F**	**dfs**	**p**	**Beta**	**p**
Novelty of content	Total positive feedback	0.15	8.23	1,47	<0.01	0.39	<0.01
Novelty of content	Final idea format	0.26	7.89	2,47	<0.01	-0.33	<0.05
Novelty of content	Clarifying external objectives	0.35	7.75	3,47	<0.01	0.30	<0.05
Novelty of content	Goal setting	0.48	9.91	4,47	<0.01	-0.40	<0.01

The regression regarding predicting *novelty of layout* outcome showed slightly different, but a no less complex set of relationships. A model comprising two behaviours was indicated by the stepwise regression. Both of these predictive behaviours were externally focused, and included actual external contact and clarification of external objectives, which together were found to account for twenty-six percent of the variance in this dimension of innovation. As Table 6.5 indicates, the direction of the relationship between these variables, through analysis of the beta values, showed that whilst external objective clarification had a positive relationship with *novelty* of the innovation, actual external contact had an opposite negative effect.

Table 6.5: Regression of significant total behavioural variables and *novelty of layout* outcome variables.

Outcome variable	Independent variable	r2	F	dfs	P	Beta	p
Novelty of layout	Actual external contact	0.10	5.34	1,47	<0.05	-0.32	<0.05
Novelty of layout	Clarification of external objectives	0.26	7.78	2,47	<0.001	0.44	<0.01

Similar external behaviours were found to be important in predicating *quality* of innovation. The most important behaviour identified was task based questioning which was found alone to account for thirteen percent of the variation, actual external contact and clarification of external objectives added a further eighteen percent. This indicated a three stage model that could account for thirty-one percent of the variation in this quality of innovation dimension. The direction of the relationships between the variable, as before, was found to be complex. As in the case of *novelty of content*, the relationship between task based questioning and clarification of objectives was positive, whilst actual external contact showed a negative with *quality* outcomes (See Table 6.6 below).

Table 6.6: Regression of significant total behavioural variables and *quality* of presentation outcome variables.

Outcome variable	Independent variables	r2	F	dfs	p	Beta	p
Quality	Task based questioning	0.13	6.96	1,47	<0.01	0.36	<0.05
Quality	Actual external contact	0.23	6.78	2,47	<0.01	-0.32	<0.05
Quality	Clarification of external objectives	0.31	6.64	3,47	<0.01	0.32	<0.05

Finally, important behaviours for predicting *radicalness* of innovation were processional aspects and positive feedback. Together these accounted for nineteen percent of the variance in this dimension. Table 6.7 records the positive nature of their association.

Table 6.7: Regression of significant total behavioural variables and *radicalness* of innovation outcome variables.

Outcome variable	Independent variables	r2	F	dfs	p	Beta	p
Radicalness	Attention to teams' procedural aspects	0.11	5.94	1,47	<0.05	0.34	<0.05
Radicalness	Positive feedback	0.19	5.21	2,47	<0.01	0.28	<0.05

In examining the outcome of this set of regressions there emerged a complex interaction. The results showed that only one aspect of directly innovative behaviour had a significant predictive relationship with any innovation dimension: namely, final idea format and innovative *novelty of content*. Surprisingly, however, this relationship showed a negative beta weighting, suggesting that the more attention teams pay to the format of their final ideas, the lower the eventual innovation level which they reach. Instead, intra- and inter-team behaviours emerged as an important predictive group of behaviours. In terms of inter-team behaviours, attention towards the external was important for predicting three innovation dimensions, both *novelty* measures and *quality*. Actually contacting the external, however, appeared to be negatively associated with *quality* and *novelty of layout* outcomes for teams. This may indicate that it was the externality of the teams' focus that was important in innovation, not the actual contact. (Alternatively, this finding may indicate that the quality of advice given to teams from their actual contact was not important in assisting their innovating.) Specific aspects of openness were also revealed as important on an intra-team level, where task based questioning was found to impact on the *quality* of innovation dimension. This suggested that openness can be seen at two levels, internal and external. On an intra-team level, positive feedback behaviour between team members was identified as important in predicting two dimensions of innovative performance. The significance of this aspect of behaviour corroborates earlier findings (for example, Amabile, 1984; Glassman, 1986; Sundstrom *et al*,1990).

Finally, internal directive behaviours were also identified as predictive of ideation outcome. Goal setting, however, was found to be negatively associated with *novelty of content* and processual aspects were positively linked to *quality* outcomes. Both of these behaviours, although shaping teams' subsequent behaviour, are focused on clarifying the teams' outcome, not on leadership based directive behaviour. This adds indirect support to the notion that more authoritarian forms of directive behaviour may stifle innovation. These findings suggested that closure may have a detrimental impact on innovation. Overall, this first analysis has indicated the importance of the quality of relationships between team members in supporting and listening to each other and in being sensitised to the external customer for teams to increase innovativeness.

6.4.2.2 Teams' coded behaviour in the quartiles and success

The analysis above has concentrated on aggregations of teams' behaviour over the entire duration of the task. Earlier repeated measure anova analysis (see chapter five) indicated that teams' behaviour varies significantly throughout the duration of the task. Two forms of analysis were, therefore, undertaken consisting of a series of stepwise regressions of teams' behaviours and their prediction of outcomes across the different dimensions of innovation. First, the analysis examined the predictive importance of the different aspects of behaviour **within** each separate quartile. Second, in an attempt to identify predictive team behaviours in a more dynamic fashion, and irrespective of which quartile they occurred, in a stepwise regressions was performed on the teams' behaviours **across all** four quartiles, to gain an understanding of the importance of different behaviours over time.

6.4.2.2.1 Teams behaviour in quartiles

6.4.2.2.1.1 Quartile one

The stepwise regressions indicated that there were no behaviours elicited in the first quartile that passed the statistical test for predicting *clarity* of innovation. Of the other dimensions of innovation only five behaviours were found to have any importance in their prediction. They can be found below in Table 6.8. The only aspects of ideative behaviour that emerge as important for innovative outcome in this initial quartile is the importation of ideas. This was found to account for twelve percent of the variance in *novelty of layout*. Externally focused behaviour featured in this early stage as playing a potential role in innovative outcomes. It was, however, only externally focused objective clarification that emerged as important, accounting for variation in three accepts, *novelty of content* (twelve percent) *quality* (twenty-four percent) and *radicalness* (twelve percent). Finally, goal setting was found to be a significant predictor of innovation *quality*. As in the case of total behaviours mentioned earlier, however, there was a negative association between goal setting and innovation outcome. In looking more closely at goal setting behaviour there were wide variations across the teams in goal setting behaviour (mean 13.1, standard deviation 8.7). The results, however, suggest that over attention towards goal setting had an important deleterious effect on the *quality* of innovation. It is suggested that instead teams needed to focus on their external clients' requirements.

Table 6.8: Stepwise regression significant behaviours variables and innovation outcome variables for quartile one

Outcome variable	Independent variable	r2	F	Dfs	p	beta	p
Novelty of content	Clarifying external objectives	0.12	6.43	1,47	<0.05	0.36	<0.05
Novelty of layout	Imported ideas	0.12	5.97	1,47	<0.05	0.34	<0.05
Quality	Goal setting	0.26	8.62	1,47	<0.01	-0.40	<0.01
Quality	Clarifying external objectives	0.24	7.03	2,47	<0.01	0.29	<0.05
Radicalness	Clarifying external objectives	0.12	6.43	1,47	<0.05	0.35	<0.05

6.4.2.2.1.2 Quartile two

This is the pre-midpoint quartile. The stepwise regressions suggested that no behaviours were statistically important in the prediction of two innovation dimensions of *quality* and *radicalness*. There were, however, significant results from the regression for the other three dimensions, see Table 6.6. Two models were found with regard to the prediction of *clarity* of innovation. One of the variables that emerged relates directly to innovative activity. In total twenty percent of the variance in *clarity* was accounted for by ideative behaviours, with thirteen percent of the variance from general ideative team behaviour and a further seven percent from task based questioning aspects. The beta weights revealed a complex effect for innovation *clarity*. General idea building was found to be negatively associated with clarity at this stage in the task, whilst task based questioning revealed a more positive association. General ideative behaviour was also identified as accounting for ten percent of the variance in outcome variable, *novelty of layout*. As in the case of idea building, this was a negative association within this quartile. Finally teams' attention towards the resources necessary in completing the task emerged as accounting for eight percent of the *novelty of content*.

Table 6.9: Stepwise regression significant behaviours variables and innovation outcome variables for quartile two

Outcome variable	Independent variable	r2	F	dfs	p	beta	p
Clarity	General ideation building & development	0.13	6.88	1,47	<0.05	-0.36	<0.05
Clarity	Task based information questioning	0.20	5.71	2,47	<0.01	0.27	<0.05
Novelty of content	Attention towards resources	0.08	4.42	1,47	<0.05	0.30	<0.05
Novelty of layout	General ideation	0.10	4.89	1,47	<0.05	-0.31	<0.05

9.4.2.2.1.3 Quartile three

The stepwise regressions in quartile three, the post-mid-point stage, revealed a general consensus in terms of behavioural variables that predicted innovation outcomes. The behaviours that emerged as important in predicting outcome, included, actual contact with the external, positive feedback, time awareness and positive feedback. There was no suggested impact on innovation ratings from ideative behaviours at this time. Instead, aspects of the teams' relationship in the form of positive feedback, emerged as the most important aspect of behaviour for predicting innovation *novelty of content*, accounting for seventeen percent of the variance and *radicalness* (fourteen percent of the variance), and was also a second order behaviour for predicting *novelty of layout*. In focusing on the *novelty of layout* dimension of innovation, when time awareness was added they accounted for twenty-eight percent of the variance. In each of these relationship dimensions, the direction of the association of the relationship was positive. Beta values can be seen in Table 6.10 below. The only other behaviour that was found to be positively associated with innovation outcome was attention by the team to their process, which emerged as a third level behaviour for the *radicalness* dimension. This behaviour added to positive feedback and time awareness accounted for thirty-eight percent of the variance in this aspect.

Actual external contact emerged as an important predictive behaviour for three outcomes, namely *clarity,* accounting for twenty-three percent of the variance, and as a third order model in both *novelty* of *content* and *layout,* increasing the percentage of variance accounted for to thirty-nine and thirty-five percent, respectively. In each case, however, the coefficient analysis indicated that there was a negative relationship between actual external contact and the innovative outcomes at this stage in the task. On closer examination of this type of behaviour, in contrast to Gersick's (1988) assertion that teams re-engage in this behaviour in this temporal phase, actual external contact only occurred in twelve and a half percent of the teams at this time. This finding suggested that teams who start to concentrate on the external at this time are too late in terms of boosting their innovation levels, and the impact on innovation was actually detrimental.

Finally, time awareness emerged as important for the first time in this analysis. It was found to be negatively associated with innovation outcome, accounting for nearly eleven percent of the variance in *novelty of layout.* Together with positive feedback, it emerged as predictive of nearly twenty-nine percent of the variance in *radicalness* and thirty-one percent of the variance in *novelty of content.* In examining this behaviour more closely sixty percent of the all the teams noted the passing of time during this quartile (mean 1.6, standard deviation 1.8). The analysis suggested that over attention to this resource was important in the generation of less innovative outcomes.

Table 6.10: Stepwise regression significant behaviours variables and innovation outcome variables for quartile three

Outcome variable	Independent variable	r2	F	dfs	p	beta	p
Clarity	Actual external contact	0.23	13.70	1,47	<0.01	-0.48	<0.01
Novelty of content	Positive feedback	0.17	9.61	1,47	<0.05	0.42	<0.05
Novelty of content	Time awareness	0.31	10.28	2,47	<0.01	-0.39	<0.01
Novelty of content	Actual external contact	0.39	9.31	3,47	<0.01	-0.28	<0.01
Novelty of layout	Time awareness	0.11	5.60	1,47	<0.05	-0.33	<0.05
Novelty of layout	Positive feedback	0.28	8.82	2,47	<0.01	0.43	<0.01
Novelty of layout	Actual external contact	0.35	7.80	3,47	<0.01	-0.26	<0.05
Quality	Actual external contact	0.15	8.15	1,47	<0.01	-0.39	<0.01
Radicalness	Positive feedback	0.14	7.50	1,47	<0.01	0.38	<0.01
Radicalness	Time awareness	0.29	8.99	2,47	<0.01	-0.41	<0.01
Radicalness	Processional aspects	0.38	5.67	3,47	<0.01	0.31	<0.05

6.4.2.2.1.4 Quartile four

In quartile four there was the first support for final ideative related behaviours emerging as accounting for variance in innovation outcomes. Two aspects of final idea behaviour were identified as important predictors. In the case of *clarity* of innovation, final idea detail was the only behaviour found to be predictive accounting for twenty-three percent of the variance. Co-efficient analysis, however, indicated a negative beta weighting. This result suggested that over attention towards detail does not necessarily improve the *clarity* of the outcome. In the case of final detail content, *novelty of content,* and *radicalness* of outcome the reverse was the case with this behaviour increasing innovation levels. Final idea content was found to account for eleven percent and nine percent of the variation in these dimensions, respectively.

As found in the preceding quartile, actual external contact was negatively related to innovation outcomes. In the case of *novelty of content,* this type of behaviour was found to account for twenty percent of the variance, and eleven percent of the variance in terms of *quality* of outcome. Actual contact was found to occur in six of the teams. The results suggested that attention to the external at this time had a deleterious impact on some innovation dimensions.

Attention towards the teams' relationships emerged as an important aspect in terms of *novelty of layout*. Ten percent of the variance in this outcome was accounted for by intra-team personal disclosure. This form of behaviour was positively associated with *novelty of layout.* A surprisingly late second component of behaviour, attention towards resources, was also found to be of value in predicting *novelty of layout.* It accounted for twenty-six percent of the variance. In the case of this behaviour, however, it was negatively associated with this innovation outcome.

Table 6.11: Stepwise regression significant behaviour variables and innovation outcome variables for quartile four

Outcome variable	**Independent variable**	**r2**	**F**	**dfs**	**p**	**beta**	**p**
Clarity	Final idea detail	0.23	13.36	1,47	<0.01	-0.48	<0.01
Novelty of content	Final idea content	0.11	5.79	1,47	<0.05	0.35	<0.05
Novelty of content	Actual external contact	0.20	5.65	2,47	<0.01	-0.31	<0.05
Novelty of layout	Personal information disclosure	0.10	5.31	1,47	<0.05	0.32	<0.05
Novelty of layout	Attention towards resources	0.26	7.82	2,47	<0.01	-0.46	<0.05
Quality	Actual external contact	0.11	5.82	1,47	<0.05	-0.34	<0.05
Radicalness	Final idea content	0.09	4.63	1,47	<0.05	0.30	<0.05

6.4.2.2.1.5 Summary

In looking across all of the quartiles a number of trends important to innovation in relation to different types of behaviour emerged. The analysis revealed distinctive changes over the duration of the task in the behaviours that were predictive of teams' innovative performance. In quartile one, five potential predictive assessments were identified, reducing to four in quartile two, increasing to eleven in the third quartile and seven in the final quartile.

At the onset of the task, three distinct types of behaviour appeared to be important in predicting innovation levels. Most prevalent was teams' sensitisation towards the external which emerged for three innovation measures. It was not, however, in terms of contact per-se, but thinking about what questions to ask the externals that was significant. In this case, the clarification of external objectives could also be regarded as externally focused information gathering by teams. Ideation was highlighted, but in terms of existing ideas that were imported into the teams. Imported ideas may, therefore, be an important starting point for innovation, with team focusing on the successes and failures of others earlier ideas. Finally, goal setting was found to be an important predictor of innovation, however, it showed a negative association, suggesting that premature closure may stifle team innovation. In examining the dimensions themselves predictions of innovative performance *clarity* from teams' behaviours emerged as difficult to identify.

In quartile two the important behaviours shifted towards general innovative based behaviours, in the form of general ideas and their building and development. At this stage it appeared that although final idea related behaviour was not significantly predictive, the continuation of more open exploration of the possible ideas by teams actually had a detrimental impact on their final ideative performance. In contrast, openness in this quartile, switched from the earlier more externally focused attention to that inside the team, with task based questioning emerging as an important predictor. Attention towards final resources necessary to complete the task also becomes of value to the team. In this quartile, unlike the onset quartile, none of the aforementioned behaviours were important across more than one innovation dimension. In this quartile two innovation dimensions, *radicalness* and *quality* proved statistically impossible to predict from team behaviours.

Following the mid-point, there was a definite shift towards more relationship based aspects of behaviour. Positive feedback emerged as an important and prevalent type of behaviour for predicting three innovation dimensions. This finding corroborates other work (for example, Moscoviq *et al*, 1985; Peters and Waterman, 1982; Nemeth and Wachter, 1983) on the role of supportive environments in increasing innovation levels. Attention towards the teams' process also appeared to be important. Temporal awareness was found to be of note, but in terms of its deleterious impact on innovation outcome. Similarly, although the teams' externality of focus re-emerged as important behaviour, the regression identified that actual external contact reduced innovation levels. This type of behaviour was negatively associated with innovative *clarity,* both types of *novelty* and *quality* outcomes.

In the last quartile, final ideative behaviour emerged as important in predicting innovation outcome. Both final idea content and detail were highlighted. The prevalence of final content was indicated as raising innovation for two dimensions of outcome, whereas detail was found to be negatively associated with ideation. Interpersonal behaviours continued to be important. This time, however, it was personal disclosure that emerged as an important predictor. This adds support to the notion of trust building in teams, increasing innovation levels (West, 1990). Examination of the link between support and trust and innovation, revealed the emergence of these 'relationship quality' type of behaviours as predictors of the same innovation dimensions, in particular *novelty of layout*.

There may also be a temporal link worth exploring here. We need to explore in more detail the link between the post mid-point emergence of these behaviours as important predictors. How far does earlier behaviour, although not currently identified in this analysis as important, accumulate to produce a supportive environment that acts as a catalyst to innovation? Are there some forms of this behaviour that are more important than others?

There was a re-emergence in this final quartile of teams' attention towards resources necessary to complete the task. Unlike the previous emergence of this type of behaviour, in quartile two, this time the association with the *novelty of content* innovation dimension was a negative. Similarly, late actual external contact was negatively associated with innovative performance. What emerges as important here is the distinctly different impact on innovation outcome that repetition of the same types of behaviour in a later time frame produces.

There are also some patterns of behavioural influence for specific innovation measures that vary over time. General ideative behaviours appeared to be predictive of *clarity* and *novelty of layout* dimensions, whereas final ideative behaviours were more frequently predictive of *clarity*, *novelty of content* and *radicalness* of ideas. Externally focused behaviours emerged as predictive of all dimensions of innovation, whereas relationship-related behaviours, appeared to be predictive of *clarity*, *novelty* and *radicalness* measures. Directive clusters of activity like goals and team process, were predictive of *quality* and *radicalness* aspects of innovation. Finally, resources directed behaviours, including time awareness, were predictive only of measures of novelty.

6.4.2.2.2 Importance of behaviour changing over time

The analysis of importance of behaviour within a single or static quartile, indicated that sixteen behaviours were statistically predictive across a range of innovation outcomes. These were, however, measuring a static quartile of behaviour. Although important they did not identify the potential importance of changes in behaviour over time. West (1990) suggests that different behaviours are important for different phases of innovation. In order to examine this in more detail a final, more dynamic analysis was undertaken. The analysis performed examined teams' behaviour and its influences in innovative outcomes, through a stepwise regression across all four of the quartiles for each of the five innovation outcomes. This was an attempt to expose any potential temporal contingency of teams' behaviour as they related to innovative outcomes. The analysis was designed to reveal the importance and ordering of the influence of distinctive types of behaviour, regardless of the quartile it occurred within. Table 6.12 shows the models produced from this regression.

Table 6.12: Stepwise regression significant behaviours variables and innovation outcome variables across all four quartiles

Outcome variable	Quartile	Independent variable	r2	F	dfs	p	beta	p
Clarity	Four	Time awareness	0.30	9.51	2,47	<0.00	-0.26	<0.05
Novelty of layout	Four	Personal information disclosure	0.23	6.68	2,47	<0.05	0.33	<0.05
Novelty of layout	Four	Attention towards resources	0.35	7.86	3,47	<0.01	-0.41	<0.01
Quality	Four	Clarifying external objectives	0.50	8.65	5,47	<0.01	-0.26	<0.05
Radicalness	Four	Imported ideas	0.44	8.52	4,47	<0.01	-0.25	<0.05
Novelty of content	One	Clarifying external objectives	0.64	11.89	6,47	<0.01	0.31	<0.05
Novelty of layout	One	Imported ideas	0.12	5.97	1,47	<0.05	0.34	<0.05
Novelty of layout	One	Actual external contact	0.73	13.11	8,47	<0.01	0.24	<0.01
Quality	One	Goal setting	0.16	8.62	1,47	<0.01	-0.40	<0.01
Quality	One	Clarifying external objectives	0.35	7.94	3,47	<0.01	0.31	<0.05
Clarity	Three	Actual external contact	0.23	13.70	1,47	<0.01	-0.48	<0.01
Novelty of content	Three	Positive feedback	0.17	9.61	1,47	<0.01	0.42	<0.05
Novelty of content	Three	Time awareness	0.31	10.28	2,47	<0.01	-0.39	<0.01
Novelty of content	Three	Processional aspects	0.50	10.75	4,47	<0.01	0.25	<0.05
Novelty of content	Three	Task based information questioning	0.55	10.41	5,47	<0.01	-0.25	<0.05
Novelty of content	Three	Actual external contact	0.68	11.95	7,47	<0.01	-0.21	<0.05
Novelty of content	Three	Imported ideas	0.71	12.03	8,47	<0.01	-0.20	<0.05
Novelty of layout	Three	Positive feedback	0.51	8.86	5,47	<0.01	0.32	<0.01
Novelty of layout	Three	Time awareness	0.60	10.44	6,47	<0.05	-0.33	<0.01
Quality	three	Actual external contact	0.26	7.71	2,47	<0.01	-0.31	<0.05
Radicalness	three	Positive feedback	0.14	7.50	1,47	<0.01	0.38	<0.01
Radicalness	three	Time awareness	0.29	8.99	2,47	<0.01	-0.40	<0.01
Radicalness	three	Processional aspects	0.38	8.99	3,47	<0.01	0.30	<0.05
Clarity	Two	Task based information questioning	0.38	9.03	3,47	<0.01	0.31	<0.01
Novelty of content	Two	Attention towards resources	0.44	11.35	3,47	<0.01	0.36	<0.01
Novelty of layout	Two	Leadership	0.42	7.83	4,47	<0.05	0.29	<0.05
Novelty of layout	Two	Actual external contact	0.38	12.06	7,47	<0.01	-0.29	<0.01
Quality	two	Positive feedback	0.45	8.70	4,47	<0.01	0.32	<0.01
Quality	two	Personal information disclosure	0.55	8.30	6,47	<0.01	0.22	<0.05
Radicalness	two	Attention towards resources	0.51	8.75	5,47	<0.01	0.27	<0.05

This analysis of the temporal dynamics of teams' innovative behaviour reveals a number of key changes. One of the most evident is the reduction in the predictive overall value of ideative behaviour. In the within-quartile regressions, final ideative behaviour emerged as predictive of innovative outcomes later in the course of the task. In this analysis that importance has waned. The stepwise regression revealed that only imported ideas were significant in predicting some forms of innovative outcomes. Importation of ideas was found to be predictive of three types of innovative outcome, *novelty of content* and layout and *radicalness*. More complexity, however, was suggested, with early importation activity being found to be positively associated with *novelty of layout*. Yet the same behaviour later, post-mid-point, was found to be negatively associated with either *novelty of content* in quartile three or *radicalness* in quartile four.

Externality of teams' focus remained important in two distinct ways. First, actual contact with externals was found to be associated with innovation across four of the five innovation dimensions. On closer examination, this group of behaviours elicited at the onset of the task was positively associated with *novelty of layout* measures, but across the mid-point in quartile two and three, this changed to a negative association. The negatively predicted variance was found for *novelty of layout* innovation measures in the second quartile and in *clarity*, *novelty of content* and *quality* dimensions a quartile later. Second, initial clarification of external goals predicted variation in both *novelty of content* and *quality*. As with actual contact, however, later appearance of the same behaviour, in the final quartile, was negatively associated with predicting variance in *quality* outcomes.

In examining interpersonal behaviours, a similar complex pattern was found in the case of task based questioning behaviour. This behaviour was found positively to predict variance in *clarity* in quartile two, and then, the opposite impact in the next quartile for *novelty of content* innovation measure. In the case of both positive feedback and personal information disclosure, behaviours were found to be consistently positively associated with innovation measures. Positive feedback emerged as of value across the midpoint. It was predictive of variance in innovation *quality* in quartile two and of variance in *clarity, novelty of layout* and *radicalness* aspects in the next quartile. Personal disclosure was found to be an important behaviour for predicting variance in innovation outcome in quartile two for innovation *quality* and in the final quartile for *novelty of layout* dimension.

The assessment of temporality of behaviours indicated that all three directive behaviours predicted variance in a range of innovation measures. Leadership behaviour emerged as important in predicting *novelty of layout* innovation measures, but only in the second quartile. Post mid-point processual attention of teams was found significantly to predict variance in both *radicalness* and *novelty of content* in the third quartile. Both of these aspects of behaviour were found to be positively associated with innovation. The reverse was true in the case of early goal setting behaviours, which again, were found to be negatively associated in its prediction of variance in innovation *quality* assessments.

Resource awareness was also found to predict changes in a range of innovation outcomes. Attention to more generic resource and materials issues was found to be positively associated with predicting variance in two measures of innovation in the second quartile. Both *radicalness* and *novelty of content* ratings suggested the value of this behaviour, however, attention to such aspects in the final quartile, was found to be associated negatively with predicting variance in *novelty of layout* assessments. A more consistent finding was the negative association between time awareness and innovation. Time awareness in the third quartile significantly predicted variance in both *novelty of content* and layout and also *radicalness*. In the final quartile variance in *clarity* of performance was found to be predicted by this behaviour too.

This final series of stepwise regressions indicated the complexity in the teams' behaviours with the potential impact of behaviours changing over time. Imported ideas, actual external contact, clarity of external objective, task based information questioning and attention to resources all showed changes in the type of impact they had on a range of innovation outcome measures. This provided some corroboration of Gersick's (1988; 1989) findings regarding the re-emergence of behaviours across time. But it goes further, suggesting differences in this impact over time. It also provides an illustration of the complexity of studying team behaviours.

6.4.3 Discussion

The stepwise multiple regressions showed, as West and Anderson (1996) found, that input variables like team size, innovation type and deadline accounted for extremely low levels of variance in overall innovation levels. There was no significant relationship with team outputs. This suggested that team input is of limited importance in predicting innovative outcomes.

This study indicated that it is not behaviour per-se which is important, but that when in it occurs in the life time of the task is crucial to our understanding of its potential impact. Studies of team processes have consistently been thwarted by apparent contradictions across the research. The present findings offered some explanation as to why these apparent contradictions may emerge. As Payne (1990) found in his explanation of the contradiction between the issue of team heterogeneity or homogeneity, it is only through studying teams over time than we can gain a better understanding of the actual impact of behaviour on innovation. In the case of these five behaviours, it was their early presence that appeared to be linked with increased innovation. Their presence later in the task had the very opposite impact on innovative performance.

Instead of inputs, this study has shown the importance of team behaviour in predicting innovative outcomes. In the final temporal regressions between thirty-eight and seventy-three percent of variance was accounted for by behavioural aspects alone. Only variations in predicting *clarity* levels did not rise above thirty-eight percent. In looking at ideative behaviours across both types of analysis, this group of behaviours did not emerge as the most important behaviour for innovative performance. The analysis suggested that importation of ideas was of value at the onset of an innovation. It can be argued that teams are using ideas in two important ways, either as examples of what has worked in the past, or as examples of what has failed. Both of these show how valuable insights are gained by teams from outside, this links to King and Anderson's (1990) hypothesis from their original definitions. Final ideation emerged as important in relation to other behaviours in quartile four, however, when assessed against all the other behaviours this influence decreased. What emerged was the potentially detrimental impact on innovation of late ideation. Interestingly, the only important emergence of general ideative development and building of ideas was within the second quartile and this was negatively associated with innovation.

The study also revealed that some behaviours were more consistently in their potential impact on innovation outcomes. Two categories of interpersonal behaviours: positive feedback and personal disclosure were consistent positive in their proposed impact on innovation. There may, however, again be a temporality issue here too. In this analysis personal disclosure in the second and final quartiles was predictive of variance in two measures of innovation. In the case of positive feedback, its presence across the mid-point quartiles was important. Another type of behaviour, temporal awareness, was found when it occurred post mid-point to have negative associations with innovation outcomes.

The results of this research showed that specific ideative behaviour related to the end product were limited in their significance with overall levels of team innovation. This is contrary to what would be expected. Gersick's (1988; 1989) work focused entirely on final ideation. In this research, however, behavioural indications of the quality of teams' interpersonal relationships were found to be predictive of innovation outcomes. The two measures, positive feedback and personal disclosure, are both arguably measures of team trust.

In looking across the behavioural dimensions the issue of team openness and innovation emerged. Openness can be observed at two levels. First, in terms of bringing the external into the team with the importation of external ideas, sensitivity towards and actual contact with the external. Second, openness can be seen at an intra-team level, in terms of asking for information from team members. Adding to the complexity of this picture, however, it appeared that early openness was found to be of most value in predicting high innovative outcomes. All of the externally focused openness behaviours were found to be positively associated with innovation in the first quartile, but less so in the rest of the task. Similarly, internal team questioning behaviour was found to be important for innovation early in the task, in the second quartile, but after the midpoint its' impact was reversed.

In support of this proposal, early goal setting, which could be regarded as a form of closure was negatively associated with the quality of innovation. This adds corroboration to the idea that premature closure has a stifling impact on ideation. This is the premise that underlies brainstorming approaches to idea generation. The current study offers some support for West's (1990) cyclical model of innovation, but suggests that openness was important far earlier in the process. If we look for examples of types of closure behaviour, this research has indicated that innovation was also predicted by goal related behaviour, but that it occurred later in the task. For example, attention to the process a team would follow did not emerge as important in predicting innovation until the third quartile. Similarly, leadership was not predictive of *novelty of layout* until the second quartile. Unlike the proposed team openness measures, however, these two categories of behaviour predict variance for a limited number of innovation measures, and there was no evidence to suggest that the presence of these behaviours was negatively associated with innovation outcome. This was not the case of the openness behaviours.

Finally, and possibly related to the issue of closure, the study offered some clarification regarding Gersick's (1988; 1989) findings concerning time awareness. Gersick (ibid.) found the re-emergence of attention towards time at the midpoint. This study suggests that this time sensitive behaviour has a detrimental impact on innovation. Time awareness comprised attention to the end of the task and, as such, could be regarded as a form of closure behaviour. As noted before, however, there was a complex impact from openness behaviours. The presence of this behaviour had both positive and detrimental impacts on innovation outcomes dependent on the time during the task it occurred.

Attention to the external revealed a complex role. The within-quartile regressions showed the predictive value of the use of the external as an information resource for teams, with clarification of the objectives of external interaction predicting innovative *quality, radicalness* and *novelty of content* dimensions. The importance of the early emergence of this behaviour in predicting innovative outcome was confirmed in the across-quartile analysis. A more complex picture, however, was found for actual contact. This emerged as negatively associated with all except *radicalness* in the third quartile and with *clarity* and *novelty of layout* outcomes in the final quartile. In looking at behaviour across time a more crucial impact emerged; the behavioural model predicting *novelty of content* levels identifyed actual external contact, together with eight other behaviours as accounting for seventy-three percent of the variance. After quartile one, however, the re-emergence of this behaviour was negatively associated with different innovative outcomes. Only *radicalness* showed no significant impact from this behaviour. This finding offers partial support for Gersick's (1988; 1989) work on teams. It indicated the value of early external contact for teams, but revealed that later contact may be detrimental to the innovation impact. Although Gersick (1988) noted the behaviour, she did not attempt to measure its impact in any way.

The value of looking at temporal aspects of the teams' behaviour was found in the examination of interpersonal behaviours. In accordance with West and Anderson (1996) the current study showed that support for innovation from within the team was an important predictor of innovation. Within-quartile analysis had found some predictive value of these behaviours for different aspects of innovation outcome; in quartile two for task based questioning, for positive feedback in quartile three and for personal disclosure in quartile four. The temporal regression indicated a more elaborate picture. It showed highly predictive levels of innovation from positive feedback around the mid-point. It suggested the value of personal disclosure in the second and final quartiles for predicting *quality* and *novelty of layout* respectively. It also suggested that task based questioning was important before the mid-point, but more detrimental in the third quartile. This pattern, however, was confined to two different aspects of innovation outcome, *clarity* in quartile two and *novelty of content* in quartile three.

In terms of directive behaviour predicating innovation, early goal setting was found to be negatively associated with *quality* of innovation, in both the within and across quartile regressions. Attention to team processes in quartile three was confirmed, again in both analyses, as positively impacting on *radicalness* of innovation outcome. The temporal analysis also indicated a role in the same time frame for the behaviour in *novelty of content* outcomes. Finally, the temporal analysis identified leadership behaviour in quartile two as a predictor of *quality*.

The analysis regarding resources based aspects of behaviour confirmed, from both regressions, the detrimental impact on innovation levels of time awareness in the third quartile. The temporal regression also suggested a negative impact of this behaviour if it occurred in the final quartile for *clarity* outcomes. Attention towards resources themselves showed a complex and important effect, with a positive effect in quartile two impact on innovation and a negative final quartile impact.

The regressions indicate that some behaviours may alter in their impact as time goes by. This may confirm the apparent contradictions that appeared to emerge from studies into team processes and innovation.

The study also showed how some behaviours are more widespread in their impact across the innovation measures, for example, actual external contact, or positive feedback. The regressions revealed that combinations of between three and eight behaviours across different quartiles were required to increased prediction levels. There was a relatively consistent group of behaviours which emerged as predictive. On closer examination of the inter-correlations between the behaviours there are a few aspects that are correlated, but they are in the minority, suggesting that there are a number of important and distinctive aspects of behaviour here.

The analysis, as suggested earlier, indicated in all except *clarity* over fifty percent of the variance in innovation levels could be accounted for by behavioural aspects alone. Predictions of both the novelty measures were above seventy percent. This suggests that behavioural factors may be of more value in predicting these types of innovation measures, in comparison with *clarity* of innovation. Table 6.13 below shows the pattern of behaviour that emerges as most important in predicting innovation

Table 6.13: Predicting team behaviours and innovation outcomes by quartile from stepwise temporal regression.

	Type of innovation outcome				
Quartile	Clarity	Novelty of content	Novelty of layout	Quality	Radicalness
one	X	✓Clarifying external objectives	1. ✓Imported ideas 2. ✓Actual external contact	1. ✓Clarifying external objectives 2. ✓Goal setting (-ve)	x
two	✓Task based info. Questioning	✓Attention towards resources	1. ✓Actual external contact (-ve) 2. ✓Leadership	1. ✓Personal info. Disclosure 2. ✓Positive feedback	✓Attention towards resources
three	✓Actual external contact (-ve)	1.✓ Actual external contact (-ve) 2. ✓ Imported ideas (-ve) 3. ✓ Positive feedback 4. ✓Processional aspects 5. ✓Task based info. Questioning (-ve) 6. ✓Time awareness (-ve)	1. ✓ Positive feedback 2. ✓ Time awareness (-ve)	✓ Actual external contact (-ve)	1. ✓ Positive feedback 2. ✓ Processional aspects 3. ✓ Time awareness (-ve)
four	✓ Time awareness (-ve)	x	1. ✓Attention towards resources (-ve) 2. ✓ Personal info. disclosure	✓ Clarifying external objectives (-ve)	✓ Imported ideas (-ve)

(Ordering of behaviour for each model is indicated by the numbers)

(significance level - *italics - five percent level of significance)*

The analysis revealed that different behaviours, at different times, predict different facets of innovation. In terms of *clarity* of innovation outcome no early behaviours were found to indicate any predictive relationship. In subsequent quartiles, information gaining, external need articulation and time awareness were the only predictive behaviours. Only behaviours aimed at gathering information from the group showed a positive impact on innovation. Looking outside for potential information or attention to time were both counter-productive behaviours in terms of raising *clarity* of innovation levels.

Novelty of content was found to be predicted by early clarification of external goal and attention towards resources. After the mid-point, positive feedback and team processes behaviours were positively associated with this innovation dimension. In contrast, imported ideas, attempts to contact the external, task based questioning and time sensitivity all emerged as having a significantly detrimental impact. There were no final behaviours that were statistically predictive of this dimension.

In terms of *layout novelty*, following the positively associated importation of ideas and actual external contact, later attempts at external contact proved counter productive for this innovation measure. Leadership was found to have a positive association in the second quartile. After the midpoint, relationship aspects were indicated to be of positive value, with the emergence of positive feedback and then finally personal disclosure in predicting this dimension. The presence of post mid-point time awareness, and then attention towards resources, however, was negatively associated with this type of innovation.

Quality of teams' output was found to suffer from early attempts at team internal goal setting. The emergence of external goal setting in the first quartile was positive, whilst in the final quartile an opposite negative effect was produced. During the pre-midpoint relationship based behaviours, like personal disclosure and positive feedback, became important. These were the last positively associated behaviours. After the mid-point actual contact and external goal setting were found to have deleterious impacts.

Radicalness could not be predicted by any of the behaviours at the onset. In the second quartile, attention towards resources was positively associated with radicalness. Attention following the mid-point towards intra-team activities, like positive feedback and processual aspects, emerged as positively associated, with over attention towards time reducing radicalness. In the final quartile attempts by the team to re-engage with importing ideas was found to reduce radicalness.

In examining the details of the predictive behaviours and innovative dimensions several patterns are found. First, there are very few behaviours that re-emerged at different times in the process. The behaviours that were found to be predicative of innovation in different quartiles were externally focused behaviours, actual external contact, clarification of external goals and attention to resources. All of these behaviours later re-emergence were found to have a distinctly different type of impact on outcome. Their initial presence was positively associated, but this changed after quartile one. Second, behaviours elicited by teams in quartile one were only important in predicting *novelty* and *quality*. In each case the behaviours were positively linked to these innovation measures. Third, there was an evident switch in important behaviours around the midpoint. From quartile two *quality* aspects began to be predicted more by relationship behaviours. This pattern spread over the remainder of the task to *novelty* and *radicalness* measures. Fourth, in the third quartile far more behaviours were predictive of innovation. Their presence was not, however, necessarily associated with increasing innovation. As the task progressed more behaviours were negatively associated with innovative dimensions. The impact of these findings on organisations and teams will be discussed in the next chapter.

Chapter 7
Conclusions

7.1 Overview of the research

This study has examined innovation at the team level. It utilised a pilot as a means of confirming aspects raised in the literature pertaining to team innovation and then explored these issues by a longitudinal experimentally based observation of teams. It combined team operating within real organisations with a second experimental design, which attempted to examine in more detail emergent issues identified via the first study by reducing some of the complexities of real life teams. The second study enabled many more teams to be observed than would have been possible in an organisation and reduced disparity between the innovation tasks allowing more direct comparisons.

The research began with a pilot study exploring the experiences of team members within two organisations in the automotive sector. The purpose of the pilot was to identify pertinent features and teams' behaviours to be included into the design of a subsequent experimental study. After a brief introduction providing some context to these organisations, the findings from each organisation, collected using a qualitative interview method, are analysed. This chapter ends with a direct comparison between the two organisations and their links into the design and behavioural code to be used in the experimental design

The experimental study was then conducted building on the information provided from the two organisations. This utilised a longitudinal observation experimental design, developing themes, which the interviews had identified and involving forty-eight teams arranged in one of six conditions. The team conditions included three different types of innovation category and a time constraint. The teams were given a common innovation task to perform, and their output assessed on five innovation dimensions by a panel comprising five experts. From the aforementioned interviews and a study of the literature, a twenty item code book was generated to analyse the resultant behaviour of the teams.

The data from the experimental study were analysed in two distinctive ways. First, as reported in chapter five; analysis of variance was used to examine whether teams with different types of time constraints and innovation category showed distinctive types of behaviours. Initially, aggregated behavioural differences were examined, and then data were broken down into quartiles to compare behavioural differences within them. To establish the robustness of the coding system, careful inter-rater reliability tests were carried out. Repeated measure analysis of variance was performed to identify distinctive patterns across the teams as a whole, and for different conditions. This showed limited support for clear behavioural differences across all six categories of team.

The second analysis examined the importance of the teams' behaviours in terms of innovative outcomes. The outcomes of the posters were analysed for inter-rater reliability. Acceptable levels of reliability were achieved, so a correlation was performed to look at the relationship within, and between, the different outcome dimensions and the twenty coded behaviour aspects. These were reported and discussed.

Stepwise regression analyses were then performed to establish which of the behaviours were predictive of the outcome dimensions. This was undertaken at three levels. First, gross behavioural counts were analysed to see if any broad aspect of important behaviour could be identified. Second, a regression was undertaken at each of the quartiles to see if different behaviours emerged from each stage of the innovation task. Finally, a regression looking at all the behaviour at every point was undertaken, to identify which were the most important behaviours for team innovation, regardless of the time frame in which they fell. This analysis indicated the importance of early actual contact and also showed changes in the impact of behaviours at different times, for example, the detrimental impact of ideas *imported* later on innovative outcome.

Thus, this study has shown that different types of behaviour are important to the innovative success of teams, and more importantly, that these behaviours may have very different impacts during the course of the innovative activity.

7.2 Review of the literature and the data

This section discusses the research in the context of the literature. It highlights the main findings from across both of the studies and comments on their contrasts and similarities. They fall into a number of areas, including ideation, external and internal foci of activities and relationships. Each of these findings will be discussed in turn, and put into a research context.

The studies have confirmed the assertions of others regarding the complexities of team behaviours (for example, Gersick (1988, 1989) and Fisher (1970)). In attempting to summarise the findings, they suggest that teams' behaviours are important and play a significant role in innovation outcomes, however, this study has found it is not the specific behaviours *per se*, but their combination that is more significant.

These studies have confirmed innovation within teams as a co-active process (Weingart, 1997). The reconstruction interviews showed that innovation was an activity in which many people were involved. This was confirmed by the longitudinal research which concentrated on aggregated behaviours (McIntre and Salas, 1995). The interviews suggested that individual attributes may be important in increasing the personal contributions within the team, however, they also showed that everyone has something to contribute. These are aspects bornen out by the observational study. The co-active nature of teams highlights the fact that this level of research is different from individual based studies.

Organisational support and strategy were found to be distinctive in each of the organisations. The study revealed differences that emerged in terms of both the management and enhancement of innovation. The findings revealed areas where both firms appeared to be operating successful systems, for example, in the implementation and dissemination of innovation. There appeared to be a negative impact of formal innovation processes on ideation. In particular, it seemed to result in the self censorship of ideators. It is unclear, however, whether this was due to the process *per se*, or the time constraint under which the teams were operating.

A strategy of involving the entire organisation, rather than keeping innovation in one department appeared to have succeeded. On close inspection, however, a small community of innovators did appear to act as an information and support unit that resulted in more radical outcomes for the organisation. The strategies may be aimed at two distinctive outcomes: one that makes change something every employee is involved in and is low in its radicality, and the other which creates radical changes that are enacted by the rest of the organisation.

In examining the dissemination processes, the formal system appeared to create a climate more supportive to innovation across the organisation as a whole. It also ensured that ideas were being transferred in a more systematic fashion across the entire organisation, thus, there were gains from both systems. The study also indicated aspects within both organisations that the participants perceived as having a detrimental impact on team innovation. There were, therefore, advantages and disadvantages to be found within each of the organisation strategies and systems.

In looking at specific aspects of the teams' behaviour both studies have highlighted a number which are significant for innovation. These will be discussed separately, but, it should be noted that in examining the results of both the analysis of variance and the regression analysis from the longitudinal study, that it was the combination of behaviours that led to increased innovation levels, not one specific behaviour. These analyses have confirmed the necessity to look at multiple aspects of team behaviour and also of examining behaviour over time. The results reveal a very complex picture of team innovation.
Direct behaviours emerge as important at particular times and also in combination with each other. Thus, it is not possible to say that it is one

behaviour alone that results in high innovation outcome. The different types of behaviour that emerged as important for team innovation will be discussed in more detail below. These include ideation, internal and external contact, information sharing, interpersonal relationships (trust), goal setting, leadership, and resources.

The focus of the study was innovative activity and from the research, ideative behaviours emerged as significant. The research did not find that there were different levels of innovation associated with three distinctive types of innovation, *emergent, imported* or *imposed*, as King and Anderson (1990) had suggested. There were statistically significant differences between these different types of innovation, but not sufficient for each to be deemed as having distinctive classes of behaviour associated with them. Nor did the research identify any impact of deadlines on innovation levels. Instead, the study revealed the influence of time sensitive behaviour that will be discussed in more detail later in this chapter.

The research confirmed the importance of both internal and external idea sources. These are aspects that Rothwell (1992) includes within his model of innovation processes, while Schroeder *et al* (1986) highlights an external focus for innovation. This study expands the organisation level of analysis of the two aforementioned studies. The interviews revealed the complexities of the idea sources, verifying Slappendel's (1996) assertion of the different roles of the external in the form of customers, suppliers, rivals and government in innovation. There was also corroboration of the role of engineers in this boundary spanning role (Allen, 1970;1977). The longitudinal study revealed the importance of ideas imported from outside the team for improving innovation. This confirms Tushman and Scanlan's (1981) assertion of the role of boundary spanning in enhancing innovation level. It offers tentative support for the link between the increased value of innovation found in the boundary spanning U.S. team rather than in the more inwardly focused Japanese teams.

Importation was also shown by the experimental study to have a significant temporal dimension. Importation of ideas was of more value at the onset of the task than following the mid-point; those behaviours occurring after the mid-point were found to have a detrimental impact on innovation. This finding reveals the importance of longitudinal studies of teams' behaviour, rather than recall of past events. This concurs with Gersick's (1988) suggestion of the significance of early external focus, but extends their role to include ideas.

Intra-team ideation was also found to be important, but, again there was a complex relationship with temporal aspects of the task. The interviews revealed the importance of idea sharing and development within all of the teams. The longitudinal study indicated that there were significant differences in ideative behaviour over the duration of the task. Ideas building activities reduced through the task, and more significantly, were found to have a detrimental impact on ideation levels in the second quartile. Final ideative behaviours also varied over time. In contrast, however, with Gersick's (1989,1988) findings these behaviours were not confined to the last part of the task. Final idea content occurring within the last quartile resulted in an improvement to innovation outcome levels. This provides partial support and some clarification for Gersick's (ibid.) assertion on the importance of later final ideative behaviour within teams. Final detail related behaviour that occurred in the same last quartile was found to be related negatively to innovation *clarity*. Neither final idea format, nor constructive controversy, were found to impact on innovation level.

There were mixed results concerning the distinctiveness of emergent, imported and imposed behaviours. The interviews indicated a melding of imported and emergent ideas within teams, whilst there was only one clear example of an imposed innovation in the sample. This imposed innovation, however, suggested a very different type of team behaviour. The longitudinal study indicated that distinctions between all three categories were not clear. The analysis of variance between the different types of teams did not suggest consistent differences in some behaviours. Some differences were found between imposed and the other two types of team with regard to innovation activities. Imposed teams were found to be much quicker than any other type of team to commence final idea related activities. In contrast, imported teams' ideative behaviour increased in the third quartile, whilst emergent teams did not differ in this regard until the last quartile. There were, however, no differences in terms of innovation outcome levels, and only partial differences between the behaviours. Thus, there is only partial support for King and Anderson's (1990) three categories of team innovation.

A very important aspect to emerge from this research was the differing external and internal focus of teams' behaviours. The interviews identified these as distinguishing features of the two organisations involved in the study. Within the second study, the different types of innovation team were found to have significantly different focuses. Emergent teams were found to have both an external and an internal focus, whilst imported teams looked more within the team and imposed teams were more concerned with those outside the team. This is a significant distinction. It relates to both ideative and communication styles of the teams, and more importantly, their impact on innovation outcome. The external focus of ideative behaviours was highlighted above, with regard to the significance of imported ideas.

The second aspect of external behaviours were those involved with external contacts. The interviews suggested the range of contacts which teams used are important. Lower levels of external contact were found within the Japanese teams, who used their own internal advisors as a potential surrogate for actual external contact. The first study also suggested the importance of good internal communication between the team and the rest of the organisation for innovation. This corroborates Sundstrom *et al*'s (1990) assertion of the importance of team integration and differentiation from the rest of the organisation. The importance of their external behaviour for innovation outcome was, however, confirmed in the experimental research. The significance of actual external contact emerged as complex. A regression analysis, examining this behaviour within each quartile separately, indicated that late external contact was negatively associated with every innovation dimension except for *radicalness,* whilst a regression analysis looking at every aspect of behaviour over the duration of the task revealed that early external contact was associated positively with *novelty of layout.* In exploring Gersick's (1989, 1988) findings these results at first confirm the importance of initial external contact for teams, however, the results suggest the re-engagement she found with the external world actually has a detrimental impact on innovation outcome. Initial external contact, although common to all types of teams, was more prevalent within imposed groups.

The results also indicated that the increased attention towards clarifying the goals of those external to the team was important. Sensitivity towards the external customer was a distinguishing feature of imposed teams. The analysis showed that early external goal clarification was important for higher innovation outcome. Re-emergence in the final quartile of this behaviour was again linked to a reduction in innovation levels. External goal setting was found to correlate with final idea content.

Externality of focus concerns the openness of teams to their outside world. Zaltman and Wallendorf (1979) argue that openness was important to organisations in seeking out new ideas. This work expands their view to include openness within teams as necessary for higher levels of innovation. This study, however, indicates more complexity with a differentiation of foci for teams emerging as a significant issue, related to their categorisation regarding time deadlines and type of innovation teams. Imposed teams with a deadline were far more customer focused than others. This related to Kelly's (1993) argument that more task requirements increased task related behaviours. His findings certainly concur with the present study. There were, however, no differences in innovation level from this type of team. The lack of differentiation in innovation outcome between different types of team is an indicator of the complex inter-relationship of behaviours over the duration of the task in which potentially negative aspects are countered by more positive ones.

In examining internal communication three important aspects of behaviour emerged from the study. The interviews suggested the value of effective internal communication within the team. They also indicated the role of supportive and trusting relationships. Boleman and Deal's (1982) findings concerning the emergence of team specific "languages" was confirmed by these interviews. The longitudinal analysis indicated that, during the second quartile, the focus of successful teams switched from information concerning external customers to that available inside the teams. The first important team behaviour revealed in this quartile was task-based information questioning, which was predictive of innovation *clarity*. In this case, however, it was focused on those inside the team. This behaviour was, therefore, another form of openness, but on an intra- not inter-team basis. A further level of complexity was, however, found with the re-emergence of intra-team task based questioning after the mid-point, which had a very different impact; it diminished the *novelty of content* of the innovation. Task based information sharing activities were found to differ across the teams, with teams operating under most constraint, (i.e. imposed and with a deadline), showing lower openness to their internal team, than to the external world.

Two other aspects of interpersonal behaviours were also found to be significant in improving innovation success: personal information sharing and positive feedback. Humour did not emerge as a useful behavioural measure in this analysis, but there was a link between this research and the literature on the role of trust for innovation. This offers corroboration to the work of West (1990). The frequency of both personal information sharing and positive feedback was found to increase throughout the task. Positive feedback was predictive of the achievement of *radical, quality* and *novelty of content* levels of innovation in the second and third quartiles, whilst information sharing was important for the *quality* and *novelty of content* of the innovation. These behaviours emerged after the externally focused first quartile and appeared to be important in creating an accepting and supportive internal innovation environment for teams. There are direct links here to the work of West (1990) and the ideation phase of his innovation climate. The research also corroborates the ideas of Sundstrom *et al* (1990) on the emergence of norms within teams. This study suggests the generation by teams of behavioural norms, like positive feedback, which will in turn improve innovation. Imposed teams were found to have significantly more personal information sharing than the others. This links to Kelly's (1993) previously mentioned finding that increased task requirements increase task focus. This research suggests that increased task requirements may also accelerate the teams' interpersonal effort too. There was no corresponding increase in task based sharing, in fact the reverse was found. The significance of interpersonal sharing relates back to findings from the U.S. team interviews and corroborates the suggestion of Tannenbaum *et al* (1992) that team-build was important to increase the support for innovation.

A complex relationship was found with regard to directiness behaviours and the teams' innovation. In the first part of the research, the interviews suggested that clear goals were a feature of most teams. The Japanese teams revealed clear goals and processes, it was suggested that this might produce self censorship within the teams, but this was a tentative finding. The longitudinal study found that initial goal setting behaviour had a detrimental impact on the *quality* of the final outcome. This may be linked to the issue of openness, in which early objective clarification may actually be a premature closure of innovation. Goal setting was a behaviour that reduced significantly over the duration of the task. It was found to re-emerge in the final quartile for non-time constrained teams, but this time with no adverse impact on their innovation levels. The finding does not concur with West's (1990) innovation cycle, in which goal clarity is seen as an important initial behaviour.

Leadership behaviour was identified both in the interviews and the experimental study as playing an important role in innovation. This concurs with much of the literature (for example, Anderson, 1992; Kanter, 1988; Nystrom, 1979; Plunkett, 1990; Cooper, 1984).

Leadership emerged as a differentiating factor between teams but also, more importantly, as a significant second quartile innovation activity. Leadership was found to be important at the same point as interpersonal behaviours were identified, tying it into a phase similar to that suggested by West (1990): that of "participative safety" in which idea generation is produced. The link between these two types of behaviours may be significant. Leadership was found to be predictive of *novelty of content*. The importance of leadership as an enabler for teams was suggested in the interviews. In the experimental study a code identifying directive task orientated behaviours was used; the code recorded attempts to instruct individuals within the team to do certain activities. It was a behaviour that changed significantly over the duration of the task, reaching its peak in the final quartile. No impact on innovation occurred at this late stage. It was also a mode of behaviour that differentiated imposed teams from the others during the first half of the task. There were, however, significant correlations between this behaviour and positive feedback, resource awareness, humour, information sharing, constructive controversy and idea building. Further work is needed regarding linkages between behaviour before it is possible to comment on the significance of these inter-correlations.

The final type of directive behaviour that was found to be significant for innovation was the process aspect. This emerged during the interviews as a differentiating factor between the two organisations. From the interviews there was the suggestion that an overemphasis on formalised imposed processes may stifle innovation. At first glance, the longitudinal research did not appear to support this view. Instead, it indicated that attention by the teams toward their processes, only within the third quartile, was predictive of increased innovation outcome, for *novelty of content* and *radicalness* measures. In reviewing the regression of total behaviour frequency and this behaviour, it was found to predict *radicalness*. Examining the behavioural code more closely, however, process team behaviour was recording only team imposed process. It may, therefore, have been identifying teams' autonomy in determining their own approach to the task, and thus may be seen as an attempt by the team to impose their own structure on their activities. This was also a form of directive behaviour, but linked into closure with regard to the process, not the outcome of the task, as goal setting does. There was a connection with a more empowered and democratic style of team behaviour mentioned in the leadership literature. This form of activity allowed the differentiation of teams from the onset of the task, with emergent teams showing higher process behaviours than the others. This finding confirmed the more participative style of this type of team, in comparison to the more directive approach of the imposed teams.

The final set of behaviours, which were found to be significantly related to innovation were those connected to resources. The interviews highlighted the importance of materials and expertise in generating and implementing ideas. Whilst the consequences of inadequate resources indicated the resourcefulness of employees, it also revealed a potentially stifling impact on innovation as staff self-censored their ideas. The longitudinal study showed resource-related behaviour had a complex relationship with innovation. There was a build up in resource-related behaviour, with significantly lower attention towards resources in quartile one than at any other time. Early alertness towards resources within the second quartile was found to have a positive impact on the *novelty of content* and the *radicalness* of the ideas. The later re-emergence, however, of this behaviour in the final quartile had an adverse effect on *novelty of content* alone. Attention to resources can be regarded as another form of open behaviour by team members. It was indicative of teams engaging with their environment and ensuring that their ideas could be implemented using the equipment they had to hand. They may also have used their resources internally as a source of ideation. The later attention towards resources may be at a belated stage for teams to be able to do anything about it, and hence the reason for its adverse consequences on innovation.

Time as a resource was found to have a profound effect on teams' behaviour. The interviews indicated that inadequate time frustrated and stifled teams' innovation. The second study revealed a complex interaction. Teams operating under a deadline were more aware of the passing of time than any other type of team. There was, however, no direct reduction in innovation levels for teams with a deadline. Behaviour related to attention to time after the mid-point was found to have a detrimental impact on the *novelty of content*, *clarity* and *radicalness* of outcome. There was a differentiation between the different types of team as they revealed differences in their behaviours regarding time. Imposed deadline teams were the most sensitised to the passing of time during the task. Time related behaviours did vary throughout the task. During the second quartile there were no differences between teams, however, emergent teams were reported as being the least aware of time. Those operating under a deadline showed other behavioural changes, especially after the mid-point. These included a reduction in final idea content, task based information exchange and goal setting. In contrast with Gersick's (1988) findings, deadlines did not improve performance or act as an "alarm clock" for change, instead it appeared to distract attention from other more valuable activities of teams.

The study revealed a complex interaction of behaviours throughout the duration of the task. Some corroboration has been indicated for the findings of others, but some questions are also raised. This research has shown that it is naïve to regard the behaviours of teams as single entities, rather, they must be seen as a complex intertwining of activities by multiple actors. Ideative behaviours are an important set of activities, but they must be seen in relation to others, such as information exchange and trust building activities. As a result of these interactions, the potentially negative impacts of some behaviours can be offset, or even neutralised, by others. The study suggests, more crucially, that attention needs to be shifted to a more detailed examination of the issue of team boundaries and an exploration of their role in team innovation.

A model summarising the findings is suggested (see figure 7.1), however, this should be regarded as only an initial step. Researchers need more understanding of the inter-relationships between behaviours and to look at the patterns of interacting behaviours. This is the major difference between the study of individuals, organisations and teams. Teams are the main location where individuals reside in organisations. The interaction patterns which team members as individuals initiate and develop with the rest of the team, the organisation, and the wider world are the key to understanding team innovation. The establishment of these patterns of behaviours creates the norms for group interaction, which in turn lead to the establishment of climates which are either supportive, or not, to innovation. The different external interactions of teams may play a very important part in moderating the impact of adverse organisational climates. As was observed in the U.S. team, the role of the external can help to buffer the team against the adverse comments and behaviour of the rest of the organisation. The model (figure 7.1) is a summary of the important behaviours identified in the experimental study. It should not be seen as an attempt to reduce team activity to fixed stages, instead it is an endeavour to show the significant shifts in focus of innovative teams.

7.3 A process model for team innovation

This research has contributed to our knowledge of teams and innovation by identifying a pattern of behaviours that was associated with highly innovative team outcomes. The model, in line with the research, focuses on quartiles of teams' activity, and distinguishes behaviours that lead and also inhibit innovative outcomes.

The first two quartiles emerge as linked to openness but, as the model following (figure 7.1) indicates, there are two distinctive aspects of openness. In the first quartile of activity teams' focus should be on the world external to them. Three types of behaviour are identified. These include external contact in the form of both active engagement, and also, more passive consideration within the team of the information they require from those outside. This is the only stage in teams' progression in which actual contact with the external is positively associated with innovation levels. The third aspect of behaviour that emerges is ideative, but based on taking previously successful ideas from elsewhere and bringing them into the team. In this quartile, therefore, the innovative team is concerned with two aspects of openness; sensitivity to the demands and requirements of their "customers", and to ideas that already exist elsewhere. In contrast a behaviour that inhibits innovation is internal goal setting. This can be associated with premature closure of options. In this quartile the team is open to possible ideas and is setting the scene for their later activity.

Figure 7.1: Summary of significant behaviours and focus for innovative teams.

Quartile 4: SUPPORTIVE & IDEATIVE ACTIVITY *Final idea content* *Personal disclosure* *(external goal setting)* *(resources)* *(time awareness)*	**Quartile 1:EXTERNAL FOCUS - OPEN** *Import ideas* *External goal awareness -Clarify requirements of and from external* *Actual contact with externals* *(internal goal setting)*
Quartile 3:INTERNAL FOCUS - CLOSING *Attention to team's processes* *Positive feedback to others' ideas* *(actual contact with externals)* *(task based information questioning)* *(time awareness)*	**Quartile 2:INTERNAL FOCUS - OPEN** *Task based information sharing* *Positive feedback to others' ideas* *Personal disclosure* *Resources awareness* *Leadership* *(actual contact with externals)*

Key: Negative behaviour are in brackets

In the second quartile successful teams switch attention to their own internal resources. Behaviours here that are associated with innovation include sharing by team members their prior task based information and knowledge and the development of a supportive environment. This environment is characterised by positive feedback between team members and a willingness to disclose personal information to each other. In high innovation teams leadership behaviour also emerges as important, with team members directing each other. They also pay attention to the resources that they have available in order to achieve their objective. One behaviour teams should avoid in this quartile, however, is any re-engagement with their external world as this is associated with lower innovation outcomes.

After the mid-point, the more highly innovative teams' behaviour switches to more closure based activities. At this stage, two behaviours are significant for innovation. These include attention to how the team should approach their objective, in terms of what processes they should employ, and the continuation of the positive feedback between team members developed in the previous stage. Contrary to Gersick's (1988, 1989) work, teams should not actively re-engage with those outside, nor should they gather further information, or pay attention to time. This final point again questions the value of behaviour Gersick (ibid.) indicated as important in pacing teams. This quartile shows the continued value, whether positive or negative, of some behaviours and the changing impact of others.

In the final quartile successful teams are characterised by final ideative behaviour. This is a form of closure behaviour, focusing on ideative behaviour related explicitly to the final output. Importantly, there is also the re-emergence of personal information sharing. This replaces positive feedback as the social behaviour for innovative teams. In this quartile a paradox emerges between highly task focused ideative behaviour, and what some could term "distracting social discussion". The model clearly identifies both ideation and social activity within the same innovation progression stage. This confirms the role of social activity as being related to innovation as Edmondson (1998) and West (1990) have suggested. The model indicates that attempts by teams to attend to resource issues at this stage are negatively associated with innovation, showing a change in the impact of this behaviour. Attention to time remains an inhibitor to innovation and any re-engagement by the team with the external, especially in a passive sense, has detrimental impacts on innovation outcome. This model, therefore, suggests that successful ideation is an activity which occurs outside the confines of organisational constraints in the form of deadlines, limited resources and objectives. What is most striking about the model to emerge from this study is the dynamic impact of behaviour on innovation. It is not the behaviour *per se*, but when it occurs within the teams' progression through their innovative task that is most striking. The research shows that some behaviours, which are repeated, have completely opposite impacts on innovation levels. The model also offers some confirmation of existing literature with regard to aspects like external boundaries, ideation, social, and resources. The model is generated from an experimental context and requires more validation within real organisational settings, but it does raise some important issues for teams' processes in directing where teams' attention should be focused to maximise innovation outcome.

7.4 Limitations of the research

The findings of this study arise from two different methods of analysing team activities. The interviews involved asking people to recall past experiences and there may be biases within the individuals' recall that distort the findings. Attempts were made to gain corroboration for the views of team innovators, as a means of reducing the impact of bias. The later part of the study, however, has suggested that the significance of behaviours may change over time. It is unlikely that an interview would be able to identify these subtle temporal changes.

The adoption of Gersick's (1989) methodology and the different time parameters under which teams were operating introduced certain constraints to the presentation and the analysis of the data. The longitudinal data had to be reduced to a standardised unit of analysis to allow statistical tests to be performed on it. Thus, a decision was made first to express the individual types of behaviour as a proportion of their total activity. This had the advantage of allowing behaviours to be assessed in relation to the other activities and it, therefore, identified changes in the frequency of behavioural expression, allowing different types of behaviour to be compared in terms of the context of other behaviours that were being generated within a similar time frame.

Gersick (1989) utilised a meeting map analysis to look at changes in the behaviours. The analysis adopted here identified more than twice the number of behaviours Gersick (ibid.) had used, and sought to look at changes in the activities of teams. The meeting map approach could not be adopted for this number of teams, nor could it be used to analyse statistically the teams' behaviour.

The second decision was to divide teams' activities into standard units of measurement. Gersick's (ibid.) work had suggested that teams' tasks could be divided into distinctive temporal stages, dependent on the total time which they took with their task. The division of team activity into quartiles ensured a standardised unit of assessment was developed in which the behaviour of non-timed teams operating under either a shorter or longer time frame could be directly compared against those operating under a fixed time. This unit ensured that identical stages in a team's process could be compared easily. The objective of the exercise was to examine how teams' behaviour differed over time, therefore, the quartiles were used to capture in a standardised unit teams' activities. Attempts were made to break the units down into smaller time periods, but as some of the teams took thirty-five minutes to perform the task, quartiles were considered to be the smallest meaningful standard unit of analysis that could be generated.

The longitudinal study sought to draw on earlier work (Gersick, 1989; Arrow and McGrath, 1995) that showed how experimental approaches to research can take previous findings, and reduce particular aspects so that they can be analysed and studied in a simplified form. This work reduced complexities and uncertainties in terms of eventual innovation outcome of team innovation, as such it used what some have chosen to call "artificial teams" (McGrath and Grunenfeld, 1993). It placed individuals randomly in teams to complete a task. Whilst for some this might be regarded as inadequate, care was taken to use the experiences of Arrow and McGrath (1995) and Gersick (1989) to ensure that the task which the teams were asked to complete was made more realistic, and also that some context was provided.

The experimental study, whilst it had the disadvantage of looking at contrived situations, gave the researcher an opportunity to look at team innovation in a more systematic way and, therefore, provided a number of definite advantages. The study was based on aspects that the initial organisationally based interviews had indicated were important. These findings corroborated the literature. This focused and informed the study allowing the number of intervening variables that often complicates organisationally based research to be limited. Attempts at looking at teams within a real setting would have meant standardising innovation teams. This was done for the first study within one organisation sector in order to provide comparability of results. Real time observations would have involved trying to watch teams at the times they were innovating. It is frequently the case, unless using an ethnomethodological based study, that the researcher may not be there for the entire duration of the task and, therefore, miss key interactions between team members. This adapted approach gave the assurance of complete observation of the teams and a definite innovation outcome, which in field based research, is never a certainty. The study involved a larger number of teams than it would have been possible to observe in a real setting. Finally, the population for the experiment was chosen because as a group it has higher personal and educational knowledge about the subject than other general populations and was nearer the age group of the intended audience. These factors all contributed to increasing the face validity of the task. Although the targeted sample population for this work all had some work experience, they may not have had sufficient exposure to different approaches to innovation. The current findings need to be confirmed within a real organisational setting.

An inherent problem of simulations of the real world is how much 'reality' to involve. The longitudinal study artificially limited the teams' external network to two sources of advice as a means of simplifying "the world". The interviews have suggested that a wide network is built up by innovation teams to assist them in their activities. These are built up over time and dependent on the skills, interests, opportunities and abilities of those involved. It was not possible to create an individualised network, however, the individuals within the longitudinal study did act as resources for each other.

Finally, although care was taken to use existing measures of innovation outcome, there were high correlations between the five distinct dimensions. This suggests that either the task of judges' assessments based on five dimensions is cognitively too complex and they have, at worst reduced their assessments to two factors. This may be indicative of the large overlaps between the dimensions, which requires further exploration. In looking at the behaviours that correlate with each of the dimensions there are some common themes, (see below: Table 7.1).

Table 7.1: Correlations between behaviours and innovation ratings

Type of outcome	Total innovation	*Novelty of content*	*Novelty of layout*	*Quality*	Radicalness
Behaviours that correlate	External goal setting Positive feedback Task based information sharing	External goal setting Positive feedback Final idea format	External goal setting Actual external contact	External goal setting Actual external contact Task based information sharing	External goal setting Positive feedback Processual Idea building

The study tried to adopt two different approaches to studying team innovation as a means of looking at first, a pilot study based in real organisations which analysed team members' experiences of innovation, and second an experimental study to examine team processes in detail. The findings do reveal much support for the work others have conducted. Future research topics are indicated in the next section which include using the same framework as that established within the second study, but using it within an organisational setting as a means of testing the results.

7.5 Future research

In this final section the future research agenda that emerges from the current studies will be outlined. This study indicates the need to look more closely at innovation teams and a number of important directions for future research emerge.

7.5.1 Team structure

An initial area that requires further attention emerges both from the current literature and from this work, and should focus on the more structural aspects of the team composition. The work of Patterson (1999) provides evidence of personality factors playing a role at the individual level. Certainly, the interviews suggested that, within the U.S. team, picking the right people for the team was crucial. The Japanese teams, in contrast, suggested that everyone could have had something to add to a team process. None of the work to date on personality dimensions has examined the personality of boundary spanners. Allen (1977) and other have suggested that certain job roles may link to this behaviour. Examples of the role of engineering tend to dominate the literature. The pilot study corroborated the importance of this role. This study, however, indicated that boundary spanners behave in different ways and, therefore, we need to identify to what extent it is a personality characteristic, and how far a characteristic of certain teams and organisations. Future work should be directed first at looking at personality factors in the composition of teams, then, to see if there are different innovative performance outcomes of teams dependent on the inclusion of team members with different personality types. This work could also test Anderson and West's (1993) suggestion that a team's outcome is greater than the sum of their parts. Using a structural approach, it could be possible to examine whether teams comprising either high or low innovators resulted in different innovation outcomes. Replicating the experimental study approach adopted here, teams comprising individuals scoring high, low and a random grouping on an innovation measure could be studied as they worked through a task and their outcome measured using the innovation scale adopted in the current work.

7.5.2 Complexity of approach

This work has indicated the need for researchers to look at multiple aspects of behaviour if team level innovation is to be understood in any depth. Gersick's (1988, 1989) work focused on final innovative behaviour, which the current study suggested is merely a small part of teams' behaviour that leads to high innovation outcome. Instead it is important to include such aspects as information sharing, feedback and externally focused behaviour. The complexities of the relationship between team behaviours and innovation highlights two further pieces of analysis that follow from this work. First, the need to examine real organisational teams as they work through an innovation, to see if the experimentally tested behaviours found in the longitudinal study are replicated within organisationally based teams, second, the need to look at linkages between behaviours. Weingart (1997) has noted the application of chain analysis as a means of exploring the relationship between behaviours in more detail. This provides a means of studying linkages between different aspects of teams' behaviours. Team behaviour could also be examined using probability analysis of behaviours to see those that are statistically likely to follow each other. Thus, we could explore teams' behaviour as sequences, adding to our understanding of the behavioural patterns that might lead to high innovation outcomes.

7.5.3 External focus

The importance of external and internal idea sources for innovation highlights the necessity in the psychological study of teams to include the wider context so that the external interface is included. Gersick (1988) identified the potential role that the external may have with teams' behaviour, this study has confirmed the importance of such aspects. Previous research has tended to focus only on teams and has, therefore, failed to appreciate the wider context within which they operate. This research has highlighted the role of the external as an important source and influence on teams' innovation. The study was limited in the type of external that the teams could use. Future work should explore in more detail teams within organisational contexts to understand the range of external inputs which they utilise, whether there are different temporal dynamics at play in this use and how this might impact on their effective deployment to raise innovation performance of teams. One approach could be longitudinal case studies of organisationally based teams to explore the external interface in more detail. At a simpler level, this work identified the need to include an external resource for teams to utilise when designing experimental studies of their behaviour.

This latter aspect also shows the importance of longitudinal approaches to research if researchers are to gain a better understanding of the complex inter-relationship between behaviours at different points during innovative tasks.

New research could seek to establish how far innovation levels of teams can be changed by the inclusion of external contacts. This study has shown that the interaction with the external should expand to examine whether their role is primarily focused on idea generation, or whether it is providing more complex support. The U.S. analysis here suggested teams utilise the external, as Bouwen *et al* (1992) have suggested, as a means of considering new logics, or ways of thinking within the organisation. As such, the external interface may offer an accelerated learning about idea development and implementation issues for teams and organisations. Attention should also be paid to the temporal parameters of external interaction to identify the impact of later contact. Researchers do not yet fully understand the temporal dynamics involved in this external interface. All they can be certain of is the importance of the boundary in teams' innovative activities.

7.5.4 Replication in different sectors

The interviews focused on the automotive sector alone. Future studies should examine how far the team behaviours that emerged from this study are indicative of other organisations or other sectors. The applications of this rich qualitative technique yielded much insight into teams and the context in which they were operating. Further research needs to examine how far the automotive sector is a special case for innovative teams. Do we find the motor industry's approach to innovation different from other sectors that want to innovate? Secondly, how far are the experiences of team innovations recorded here typical for a range of organisations and sectors. Is it something about, for example, the utilisation of teams to innovate that creates common findings? Each of these questions could be explored by widening the current pilot study to include different sectors.

7.5.5 Specific team behaviours

The study identified a number of distinctive behaviours that may be linked to innovation. It is important for future research that these are included. Different types of communication bias within the teams emerged as an important set of behaviours. Future research should examine whether real organisational teams involved in different categories of innovation reflect the same internal and external information biases as those found here. This may be a means of distinguishing between emergent, imported and imposed types of innovation. There is a need to examine in more detail the difference between intra-team task and interpersonal communication. It is important that researchers explore the role of aspects, such as trust, which may emerge from inter-personal sharing and the part they play in innovative behaviour (West, 1990; Edmonson, 1998). The results suggest that both are important, is this the case in organisationally based teams? A small experimental investigation replicating the approach taken in the second study could be adopted and some teams instructed that they must only focus on task information for one condition, and the other be left free to discuss what they liked, including personal aspects. Team outcomes could be collected and compared in order to examine any link to innovation outcome.

Creating a supportive and trusting environment for team innovation is revealed as important. The study, in focusing on distinctive behaviours in this regard, identified that imposed teams show more supportive behaviours. This, therefore suggests that the type of task may accelerate these processes. Care should be taken in the future by researchers in the choice of task for any experimental designed research in this area. It also invites more examination of interpersonal relations and type of innovation tasks in organisations. Researchers must question the extent to which an imposed task requires more coherence from the team or whether this type of activity reduces the task requirements of the group so that more interpersonal time is freed up. This research adds support to Tannenbaum *et al*'s (1992) suggestion that team building may have a valuable role to play in innovation with organisations. We must ask how far can team building be used to enhance teams' innovation levels?

A perplexing finding regarding the adverse impact of teams' goal setting on innovation requires further analysis. Gersick (1988, 1989) argues for the re-emergence of goal related behaviours following the mid point. This study did not find this, but it has suggested that initial goal setting behaviour by teams may be linked to lower innovation *quality* outcomes. This finding needs to be explored within an organisational setting to see what impact goal setting behaviour has on the final innovation outcome. How far is goal setting the premature closure of ideas for teams, or do goals, in fact, change throughout the task?

7.5.6 Techniques for improving innovation

In the pilot study, ideative behaviours themselves were not found to be predictive of innovation levels. This issue requires more study within an organisational context to examine how far different ideative techniques may boost innovation levels. Both of the organisations had trained their staff in innovation techniques. How far do these techniques in themselves work, or, is it the context and support for the training that emerges as more important? These remain unanswered issues. Both of the organisations showed how different approaches towards the management of innovation may enhance, and also, limit innovation of teams. The interviews indicated that deadlines and processes may have an adverse impact on teams' innovative activities. This was not found to be the case in the experimental work. Researchers need to build on this work and that of Sundstrom *et al* (1990) to conduct further examination of the impact and effectiveness of these different techniques, so that organisations can implement best practise.

The future research agenda is varied. An overarching concern of all studies of team innovation is the accurate assessment of team innovation outcome. Continued work needs to be done to ensure that the behaviours of individuals and teams are identified and assessed within organisational context. As highlighted in chapter seven, we need to ensure that tools are used which allow the reliable and valid measurement of innovation. Much attention has been directed at financial savings as a surrogate for the innovation, however, we must question how far is this a suitable measure. Some of the changes indicated in the pilot study made radical changes to production, but their financial value would be difficult to calculate. The use of ratings does offer the utilisation of an expert panel of judges as a means of measuring innovation outcome. Two aspects of this are important; first, the choice of expert, to ensure a full range of experiences is included. Second, is the measurement system itself. West and Anderson's (1996) rating assessment does offer researchers an important opportunity of distinguishing between different dimensions of innovation, rather than seeing innovation as a unitary concept. Care needs to be taken in ensuring the reliability of such measures, which can be enhanced through attention to findings from other areas of research that utilise similar approaches, for example, assessment centre research (Woodruffe, 1993). Researchers should actively ensure that they continue to re-examine and adjust their measurement criteria as organisations and teams continue to advance and change.

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Appendix A. Semi structured interview questions for study one

Introduction
INITIAL REQUEST TO USE TAPE MACHINE

QUESTION AREAS TO ENSURE ARE COVERED

1. WHAT WAS THE INNOVATION - CLARIFY TO ENSURE GROUP CONSISTENCY

SPECIFY TYPE OF INNOVATION - imported, imposed, generated

SOURCE OF INNOVATION - where did it come from

TIME PLAN FOR INNOVATION - what timing - any limits

- where timing came from?

Process - 1st MEETING

WHAT HAPPENED - idea development, processes

WHO LEAD - all the time?

HOW DECIDED TO PROCEED - process

CLARITY OF WHAT YOU WERE DOING - what were you trying to achieve

PROGRESS OF IDEA HOW THE GROUP WORKED - trust, safety, info sharing

MEETING FREQUENCY - formal, informal, pre-arranged

SUPPORT FOR IDEA - enacted/articulated

AREAS OF DISCUSSION - other considerations & suggested solutions

MEASURMENT OF PROGRESS - how did you know where you had go to

SUCCESSES - why

PROBLEMS - why

EXTERNAL INFLUENCES - SOURCES - other dept, own mang, other mang, outside firm

IMPLEMENTATION/ PUTTING IT INTO PRACTICE

SUCCESSES

PROBLEMS

Appendix B: Coding descriptions for the Japanese and American organisations

a. Japanese organisation code book descriptions

4.2.4.1 Process

These codes focused on different processes that were identified by the participants. These included talk regarding the clarification of their goals or objectives, the process by which ideas were generated and developed.

4.2.4.1.1 Goal setting

This code included talk that indicated attempts by the team to develop clear objectives, or demonstration of a clear understanding of the aims and direction of the team involved in the innovation. Negative examples of talk that identified either inappropriate goals, or those goals which team members were unable to achieve were also identified to show ineffective goal setting behaviour.

Examples of this type of talk included:

a positive example was

> "it was to see if there was any way it could get done quicker. To see if there was any way of improving the job that would be easier for the lads in the body shop palletising and less bending down. Easier for me. 'erm"

whereas a negative example was

> "There is still scope for improving"

Related to goal setting were comments that identified the need for positive outcomes. These were more impression management types of behaviour aimed at changing things so they look positive, the need for things to work, perception as important as success. An example of this would include:

> "It was the first major Kaisen project in shop, it was important it succeeded"

Ideation emerged at a number of distinctive levels

4.2.4.1.2 Ideas import

Talk referring to ideas that the participant identifies as taken from outside team or organisation captures this coding cluster. The impetus for this was from both

the literature (King and Anderson, 1990) and also the transcripts themselves.
An example of a statement would be

> "I'm not certain as to whether they did come from different sites, I know that one, definitely did because, erm we use it on the E.C. (name of an area of the factory) to lift the batteries, it's like a vacuum lifter"

4.2.4.1.3 Generation of ideas

The focus of this coding category is discourse from the participant about the idea generation.
An example of this would include:

> "That recent idea came from shop floor"

4.2.4.1.4 Development

This code highlighted evidence of time spent by teams improving and developing ideas. An example of this code would include:

> "There is people in all the time trying new things out"

4.2.4.1.5 Progress thought process

This code included participants' comment regarding the following of a formal process. This might include brainstorming, or the following of a schedule of activity. A typical example of this category is found below:

> "Somebody came up with the idea of using risk management approach"

One further aspect of the coding was an emphasis that emerged of processes being driven by data. This coding, therefore, included talk of time spent collecting data or evidence. An example of this talk would include:

> "Overnight Kevin drew up data collection sheet"

4.2.4.1.6 Time

This is a category related to process in terms of the identification by participants of any time parameters being given for their process. The code differentiated examples of both positive attention to ensuring adequate time was given to the process and also more negative examples of poor attention to time deadlines
An example of positive aspects includes:

> "you would have a time limit of when you wanted the activity done"

Whilst a negative example would be:

"I don't think at the time there was any deadline, it was a case of come back and tell us in a month how you're progressing."

4.2.4.2. Internal intra-team focus

This cluster of codes emerged as those focusing within the team itself. All of this group of codes emerged from the literature as important; the transcripts confirmed their importance. The codes defined what each of the three aspects of roles, communication and interaction meant within this context. This group of codes were seen as important indicators of intra-team behaviour and used in the code-book for the experimental study.

4.2.4.2.1 Role

A category of code regarding the allocation or defining of roles for innovation emerged. This included both allocating to others, or evidence of individuals being selected for their specific skills, including leadership skills. An example follows:

"we've got the knowledge and we've got the skills, we've got the different background experience"

A sub-category of this was also identified that was more focused on the role of supervisors. Codes here identified the supervisor's view of their role. One factor that emerged from this talk was that of their autonomy regarding decision making. An example of this code includes:

"Any time above that, the supervisor, at his own discretion uses time as he wants"

4.2.4.2.2 Communication

This was a very important coding category and encompassed a number of distinctive aspects. These included comments regarding positive communication with others in the team, questioning behaviour, looking to get ideas, sharing information and communicating from others, on one side, and on the obverse examples relating to more negative aspects like disagreements, poor or lack of information and communication for others. Example of both the positive and negative aspects of this type of code included:

"I always talks to everyone"

> "I probably go straight ahead and do it. Depending on the impact of the change obviously. But any minor changes, just go and put straight in"

A further sub-category was related to the quality of their communication. This code identified the use of humour deliberately within communication, talk referring to banter and joking behaviour

An example of this talk would include:

> "We were teasing Kevin about thinking about work off-site"

4.2.4.2.3 Interaction and Involvement

This coding category focused on talk related to involving deliberately team members in decision and implementation. It included taking time to be with each other and to build relationships as deliberate policy. An example of this would include:

> "We decided as a group"

4.2.4.2 External, inter-team and organisation

4.2.4.3.1. Communication with the external

The code regarding those outside the team, the externals, included identifying talk about communication on an extra-team basis. Codes identified examples of communication with those outside team or organisation, or having to provide information to others outside the team concerning changes. Attempts were made to collect negative examples of communication also. This involved stopping external communication or not informing those outside the team. This code identified more qualitative aspects of the communication noting comments about external political activity. Examples of codes for both types of communication includes:

> "There were always getting feedback into our team from the maintenance department, even from myself, there's a lot of questions from the shop floor"
> "erm the packaging has changed! So it was in effect for a period of time, you've got your man power and cost saving over a period of time and that's been changed 'cos of the packaging change on the parts"

This feature of behaviour was the utilisation of those external to the team and was identified as an important aspect of the team's behaviour. As a result of this pilot, the experimental study's design included external advisors who cold be a resource to the team.

4.2.4.3.2 Prior communication and consultation with others

An aspect that emerged from the transcripts was the importance of external communication in letting others know of plans, changing the plans before problems occurred, and trying to identify the impact on others of changes. There was also an attempt to identify negative examples of this. An example of this code might include:

> "cos you need to speak to while you're doing your activity you need to make sure everyone is aware of what you're doing, everyone happy with what your doing. Last thing you want to do is introduce something that somebody hasn't had a say in"

4.2.4.3.3 Role of the external

Attention was paid to identifying talk relating to the perceptions of the role of the external within the team. An example of this code is:

> "one of the members suggested why don't we take outside advice, we've got a stumbling block here.... Why don't we get somebody from there to come and help us out, to come and explain to us what the requirements are. In hindsight, I thought that was a pretty good idea."

4.2.4.3.4 Japanese relationship

Special attention was paid to identifying the role of the members of Japanese organisation for the teams. A typical comments includes:

> "Lack of sharing of information with Japan hampers the ideas development - poor use of two way transfer expected from advisors, as it often does"

4.2.4.4 Attitudes

This cluster of codes focused on the identification of different attitudes by the team member. Attitudes included talk relating to relatively stable affective, or evaluative comments. All of these attitudes emerged as *a posteriori* codes. There were four sub-categories in this cluster outlined below, however, none of these aspects feature in the experimental study due to the complicated role the organisational context may play in their formation.

4.2.4.4.1. Striving to improve

The first code attempts to identify talk from participants related to their striving to improve all the time. Negative comments were also recorded. This latter aspect focused on talk regarding the failure of things to improve despite attempts to change. Examples of this code included:

> "Your continually improving your standard operations, improving either working environment or improving the layout of the area erm you're improving operator care"
>
> "One of the criticisms is from some of the managers is that they see the two-day improvement forms and say it's a 10% improvement, then they go down and look at one of the lads actually doing it, they don't see much improvement."

4.2.4.4.2. Openness

What was very striking about the participants' talk were comments related to the importance of not having preconceptions about the outcomes of the innovation, of being open to team's outcome. The opposite aspect of this was also identified, focusing on talk regarding any lack of exploration, willingness to change, jumping to conclusions by teams. Examples of this code included:

> "You shouldn't actually go in with any preconceived idea. Yes you should know what improvement you're looking for, but exactly how gonna do it is a decision for the two-day improvement team not for you beforehand. You generally find if you do go in with preconceived idea, it's not actually the best route"
>
> "We jumped to a conclusion"

4.2.4.4.3 Development

The third code to emerge relates to comments regarding the positive nature of development and its importance as an opportunity to learn and develop. Evidence of failures to develop and improve were also identified. Examples of this code include:

> "I've learnt a lot technically as well as about the actual specific subject. I've learnt a lot about the site and the company. And I've learnt a lot about other people. It's been good"

4.2.4.4.4 Feelings

This final aspect of coding looked at identify negative feelings, like talk of frustration, or annoyance. Although there was an attempt to identify positive feelings no specific talk of this emerged. Examples of this coding category included:

"At the end of day 1 people felt annoyed and not happy"

4.2.4.5 Organisational specifics

4.2.4.5.1 Resources

This cluster of codes focused on identification of resource issues. Several specific aspects emerged as distinctive categories, and attempts were made to collect both positive and negative comments. These included support of a financial, time, skills and materials nature. Typical examples of comments from each category include:

> "If it saves money, just do it! Don't get caught or whatever I suppose it's all the same for supervisors, otherwise keep your bill down for the month with the budget."

Attention towards resources, both material and temporal was a further aspect to be included in the code book in the experimental study.

4.2.4.5.2 Organisational context

This final code identified talk that referred to organisational tools being used to support innovation. This category related to Sundstrom, *et al*'s (1990) ecology model. Aspects like the use of the appraisal system to control and encourage innovation. An example of this code includes:

> "It is appraised, it is taken into account in your appraisal"

B. American organisation code book descriptions

In exploring the transcribed material, it is possible to establish some higher order categories together that relate to the innovation process as it occurs in this organisation. The main factors identified include the recognition and focus on goals of the team; the generation and development of ideas; the use of processes and procedures to assist innovation; intra-team behaviour and attitudes, external behaviour and organisational factors. These can be divided into further categories which are identified below.

4.3.4.1.1 Recognition & focus on goals

This coding cluster highlights attention towards goals and clarity of objective for the team. It divided goals into five sub-factors. Only two of these factors appeared to be useable in the experimental study. The others were more organisationally based features and thus, did not lend themselves directly to an organisational setting.

4.3.4.1.1. Team goals

This code identified talk refereeing towards the goal of the team. They indicate the level of understanding from the team regarding their objectives. This category was *a priori* stemming from the literature regarding goal setting (for example, West, 1990) A typical example of a comments coded for this would include the following:

> "The role of the [team name] is very simple. It's responsible for the current model and it has two objectives: to improve the quality in line with customer requirements and to reduce the costs in line with business needs. They're its only two objectives really"

4.3.4.1.2 Cost focus

This code emerged from *a posteriori* category, identified as the talk clustered around a specific category of goal, namely that of financial management. It is related to the above quote. The role of money in focusing the objective was identified as an important sub-theme. A typical coding would include the following:

> "Our job was to come up with ...... The cheapest way"

4.3.4.1.3 Customer focus

A second category of objectives that was identified related to external customers and ensuring they were satisfied. This was an *a posteriori* code. An example of this type of code from the transcripts would include the following:

> "We influence the whole company because we are closest to the customer"

4.3.4.1.4 Quality focus

A third type of objective that emerged is based on quality aspects of the product. This is emphasised also by a formal meeting that focuses on these aspects. This was also an *a posteriori* code. An example of this type of code includes:

> "We have a weekly review of the quality"

4.3.4.1.5 Time

The team continually referred to the time deadlines they were operating under. Thus, the final objective category captures this. This code category was an *a priori* category identified from the literature (for example, Gersick, 1988). A typical example of this code would include:

> "Now we've got this 90 day time problem [opening]"

The emergence of the role of time as important to innovating teams was taken up and included in the experimental study's design.

4.3.4.2 Ideation

Ideation was the second main category of codes to emerge from the team. These include three aspects of ideation from idea source or to idea generation and development. All three of these features of ideative behaviour were seen as important and included in the code book for the experimental design.

4.3.4.2.1 Idea importation

This coding category emerged as an important aspects of ideation. It captures both the boundary crossing issue for this team involving ideas from outside the team being frequently sited as a major source of the innovation, and the importation of different applications for ideas. The impetus for this was from both the literature (King and Anderson, 1990) and also the transcripts themselves. A typical example would include:

> "It's similar, it's not the same. It has to be a different shape to suit the different cars but it's a similar principle"

4.3.4.2.2 Idea generation and development

This coding category identified the talk of the team regarding new ideas. This focuses specifically on generation of ideas. This was an *a priori* code. A typical example would include:

> "It was my idea for the design, I designed it"

4.3.4.3 Use of processes

This code included talk relating to the use of formal processes to assist innovation. This category of code emerged on an *a posteriori* basis. An example of this type of comment is:

> "So by experimentation we knew that there could be a potential problem with the fog rubber."

The role of process as an important factor for innovating teams was found. It is an aspect that was carried over into the experimental study's code-book.

4.3.4.4 Intra-team behaviour

A set of codes were identify to highlighted intra-team behaviour. These included two categories of roles, team communication and the focus on this team's activities. Two codes for the intra-team communication and leadership were identified in this section as pertinent for the code book used in the experimental study.

4.3.4.4.1 Team focus

In reading and listening to the interviews there emerged a category called team focus. This coding was designed to capture the positive comments from the participants regarding membership of the team. This was a good example of an *a posteriori* code. A typical type of comment might include:

> "For me it was a good exercise you know"

4.3.4.4.2. Use of roles

Team members frequently commented on their role in the team. This therefore was an important feature of team life for them and required a code. An example of their talk in this regard is found below:

> "In manufacturing engineering my job was to process production, like to tell them how to build it."

4.3.4.4.3 Leadership role

The role of leadership is highlighted in the literature on innovation teams, (West, 1990) and was included here. A typical comment would be:

> "So I went to [team-leader's name] and that's what [team-leader's name] said yes we'll do. I mean, he's the governor, he said okay we'll do that."

The role of the team's leader is identified from the transcripts as important and thus, will be included in the experimental study's code book.

4.3.4.4.4 Communication

An important aspect of the team's behaviour was evident in their talk relating to their communication with each other. This code was generated on an *a priori* basis. A typical example includes:

> "mean even if someone said, like Andrew, we'd be talking about it. Andrew's over there and he'd say 'oh I wouldn't do that' or I'd something else, and I'd say why not. I mean everybody has an input"

This suggests that team communication may play a role in innovation in relation to teams' task. It will therefore be a feature of the code book.

4.3.4.5 Attitudes

As in the Japanese case several examples of talk relating to relatively stable affective, or evaluative comments emerged. These were classed as a cluster of attitude code. All three of these sub-codes emerged on an *a posteriori* basis. It was decided that it would not be possible to assess these behaviours within the experimental study.

4.3.4.5.1 Striving to improve

This was a code highlighting attention towards improvements in innovation and the task that team members were performing. An example of this would include:

> "My challenge is that I think it could be cheaper"

4.3.4.5.2 Development and training

These codes emerged as the team talked about both formal and informal development opportunities. A typical example of these codes would include:

> "Now that's something I've learnt from it"

4.3.4.5.3 Openness

This category emerged from the team's comments relating their openness to alternative ideas, concepts and application. An example of this code is:

> "I mean they'll come and ask me, they're not scared to ask"

4.3.4.6 External behaviour

A specific cluster of codes emerged relating to external communication. These two codes were *a posteriori* in their identification. The issue of external involvement had being indicated earlier in the literature (for example, Gersick, 1988).

4.3.4.6.1 Intra-organisational

This code focused on communication and interaction with the team and those in the rest of the organisation. A typical example would include:

> "Normally we go down on the line and check what the problem is, talk to the people down there"

4.3.4.6.2 Inter-organisational

This second sub-category was much more concerned with interaction that crossed the formal organisational boundary. This code refers to boundary spanning activity as for example Allen, (1977) identified. An example of this is:

> "We're always on the phone, faxing sketches and schemes through and saying go and look at the design the scheme and they're bringing schemes in."

4.3.4.7. Organisational specifics

These codes highlight internal organisational factors affecting innovation for the team. They are all *a posteriori* in their generation. The only code within this category that lent itself to the experimental study was resource aspects. The others were too organisationally specific.

4.3.4.7. 1. Subvention of problems

This relates to Pascal's (1990) idea of problems being hidden within organisations. The code emerged as the participants talked of how they saw the organisation around them operate. A typical example of this would include:

> "I was too late in involving the plant in the issue, they all knew what was going on, everybody was aware and informed, but we didn't have a formal meeting until it was too late"

4.3.4.7.2 Barriers to ideas

The team talked of a number of blockages they found for their innovations. This code sought to identify talk relating to this. As example of this code is shown below:

> "There's another thing that you come across, you may hear mentioned, there's a 'non-invented here' syndrome."

4.3.4.7.3 Application of training

This category emerged as the team discussed a recent training programme which they had all attended. It was designed partly as a team building exercise, but also included technical and applications aspects to assist them in their innovation tasks. An example of this code is:

> "[On the] training course, [I] learnt how to do it, how to manipulate the system. How to start with the design result and work backwards"

4.3.4.7.4 Resources

The final code collected includes comments relating to resources for the team. These included financial, material and manpower aspects. A typical example would be:

> "We had to get them out of a block of nylon, couldn't afford to mould it, couldn't afford the moulding tool so we had to machine it out of a block of nylon"

Appendix C. Judges rating sheet

Assessor name: _______________ poster no. ____________

a.) Radicalness - the extent to which this poster is a **significant departure** from previous campaigns

Highly radical						Not at all radical
7	6	5	4	3	2	1

b.) Novelty of content - the extent to which this poster's **<u>content</u>** is **new & innovative**

Highly original content						No novelty at all in content
7	6	5	4	3	2	1

Please comment on any aspects of **content** you considered novel in giving this rating:

c.) Novelty of layout - the extent to which this poster **<u>lay-out</u>** is **new and innovative**

Very original layout						No novelty at all in the layout
7	6	5	4	3	2	1

Please comment on any aspects of **layout** you considered novel in giving this rating:

d.) Clarity of message - the extent to which the **<u>message</u>** of this poster's is **clearly understood** - warning children of the dangers of drug abuse

Very clear message						Complete lack of clarity for message
7	6	5	4	3	2	1

e.) Quality of presentation the extent to which this poster is **well presented**

High quality of poster						No attempt to produce quality
7	6	5	4	3	2	1

Appendix D. Examples of completed poster

Aston University

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