UNIVERSIDADE DE LISBOA

FACULDADE DE PSICOLOGIA E DE CIÊNCIAS DA EDUCAÇÃO

SHAREDNESS IN WORK TEAM INNOVATION: A PROCESS MODEL OF TEAM REGULATION

Luis Alberto Santos Curral

DOUTORAMENTO EM PSICOLOGIA

(Psicologia Social)

2005

UNIVERSIDADE DE LISBOA

FACULDADE DE PSICOLOGIA E DE CIÊNCIAS DA EDUCAÇÃO

UNIVERSIDADE
DE LISBOA

SHAREDNESS IN WORK TEAM INNOVATION: A PROCESS MODEL OF TEAM REGULATION

Luis Alberto Santos Curral

DOUTORAMENTO EM PSICOLOGIA

(Psicologia Social)

Tese orientada pelos Profs. Doutores Michael A. West e Maria José Chambel

2005

A presente dissertação teve o apoio financeiro da Fundação Para a Ciência e a Tecnologia (FCT) e do Fundo Social Europeu (FSE) no âmbito do III Quadro Comunitário de Apoio.

Dissertação de doutoramento em Psicologia (Psicologia Social), apresentada à Faculdade de Psicologia e de Ciências da Educação da Universidade de Lisboa.

Orientação científica:

Professor Michael A. West

Aston Business School, of

Aston University. Birmingham, UK.

Professora Maria José Chambel

Faculdade de Psicologia e de Ciências da Educação da Universidade de Lisboa, Portugal.

À memória da minha mãe

À minha mulher, aos meus filhos e ao meu pai.

Acknowledgements

A dissertation is always innovation at team level. An immensurable network of complicity laid ground to the path of discovery that ended up in this simple booklet of facts. It is the moment and the place to pay tribute to those of you who honored me with being part of that network. Everyone made a unique contribution to the final outcome. Some offered ideas, others questioned them. Some gave sweat, others gave tears. Fortunately nobody had to give blood. Some devoted time others made good time happen. Some provided food for thought, others bestowed enlightenment. Some exhorted to move forward, other made me pause and think.

I could never express enough gratitude to Professor Michael West for endowing with me with guidance and enlightenment. Michael received me with his arms wide open and put all is patience and wisdom at my service. Michael is a pragmatic scientist and one of the most knowledgeable scholars on teams and innovation, which is one of the reasons why working with him was challenging and reassuring. I thank Michael for his friendship and for being a fine role model as a professor, a scholar, and a friend. I wish I could apply all the lessons I learned from him to my conduct as a professor

I am beholden to my advisor Professor Maria José Chambel for providing the context in which I discovered the work that I love. Over the last seventeen years I worked almost daily with Maria José. She both challenged and changed my perception of countless things. Through my work with Maria José I grew as a scholar, but more importantly, as a thoughtful person. Throughout this dissertation she provided me with the safety and peace of mind I needed; but she also challenged me and made me rethink some things I had taken for granted. In the deepest of my heart (or is it brain?) I knew she was right. There is much more I could say, but I will let my work be my tribute to her.

I also would like to express my gratitude to Professor Francisco Pina Prata for his wise words of encouragement. Professor Pina Prata is a brilliant scholar and I thank him for sharing with me the tricks of the mind.

I am also indebted to my friends in Aston Business School, Andreas Richter, Giles Hirst, Claudia Sacramento, Doris Fay, and Jeremy Dawson for their valuable contribution to my work but also for always making me feel at home. And I really mean at home, for Claudia, Giles and Andreas have been magnificent hosts during the time I spent in Birmingham. A very special aknowledgement is due to Claudia for her patient and accurate proofreading of this thesis. I would like to leave special thanks for Jeremy for his advise in statistical matters.

My colleagues and staff in the Faculty were always supportive and encouraging, and to all of them I owe an expression of gratitude. Still, a very special thanks is due to Filipa Castanheira for putting some of her time and effort in my work, covering for me when I was away, and being a terrific office mate (even if she did not always complied to my commands). Another special thanks goes to Mário Ferreira, Frederico Marques and Alexandra Marques Pinto for listening to my doubts, discussing all the matters except work, and knocking on my door every day in and out asking if I had already submitted the dissertation. Annoying as it may seem it constituted an incredible thrust (I think they called it social comparison).

One special appreciation is due to all the scientist and technicians at INETI and IGC who gave part of their valuable time to participate in this study.

My parents, Fernanda and Alberto for they instilled in me the belief that I could do anything I put my mind to. I am grateful to them for giving me unconditional support in realizing things that go beyond their understanding.

My lovely wife Isabel who embarked with me in this voyage. Through it all, Isabel has been a marvelous traveling companion. Over the last five years we have worked as a team raising two children and earning a Ph.D., and we loved every minute of it. Isabel's support and willingness to step in and cover for me enabled me to complete my dissertation. I cannot thank her enough for the love and

encouragement she provides, and I am looking forward to be there for her when she commences a similar journey.

Finally, this dissertation is dedicated to my children Eva and David. While they were only a dream when I started down this journey, they have become my reason for being. As the end of the dissertation process approached, my wife asked if I wished I had finished earlier. My answer was no. I am glad to have had the opportunity to share the process with them. They know that while my best and most important job is taking care of them, there are other things I do, my research and teaching, which make me a whole and better person.

Contents

SUMÁRIO

Esta tese examina a relação entre processos grupais e inovação em equipas de investigação e desenvolvimento (I&D). O modelo e as hipóteses dele derivadas são baseados em duas perspectivas teóricas bem estabelecidas na literatura: uma perspectiva funcionalista do funcionamento das equipas, e uma perspectiva dos grupos como processadores de informação. A abordagem funcionalista guiou a minha procura dos factores que distinguem equipas eficazes de equipas ineficazes na produção de inovação. Esta perspectiva ajudou-me a focar o meu trabalho no papel que os *inputs* e os processos de interacção desempenham na performance inovadora das equipas

A perspectiva dos grupos como processadores de informação, ajudou-me a clarificar a especificidade de certos processos grupais na promoção da partilha de ideias, informação, e representação da tarefa entre os membros de uma equipa. Assim, é proposto um modelo de partilha de informação e de regulação da equipa, e testado com base numa amostra de equipas cuja principal tarefa pode ser criar novos conhecimentos que possam ser aplicados a um problema específico, e produzir novos produtos ou processos ou melhorar produtos e processos já existentes. O modelo prevê que quatro processos grupais – clareza e compromisso com os objectivos da equipa, participação na tomada-de-decisão, apoio à inovação, e segurança intragrupal – promovem a partilha de ideias, conhecimentos, e representações da tarefa entre os membros da equipa. Esta partilha, por sua vez, é facilitadora da geração e

implementação de ideias pela equipa. O modelo prevê ainda que a reflexividade desempenha um papel regulador da performance da equipa. O estudo aqui apresentado segue um desenho transversal com diversificads fontes de informação e avaliação da inovação das equipas por avaliadores independentes.

A dissertação está dividida em sete capítulos. O Capítulo 1 apresenta o problema de investigação e discute à relevância da mesma, salientando a importância da inovação para o crescimento económico, bem como as vantagens da inovação produzida por equipas. Neste Capítulo argumento que o desenvolvimento de novos e melhorados processos e produtos está na base da invenção, que por sua vez está associada positivamente ao desenvolvimento económico e social. Termino o Capítulo salientando a necessidade de estudar a inovação ao nível gripal, e em particular compreender o funcionamento de equipas de I&D eficazes.

O Capítulo 2 analisa a literatura sobre o estudo dos grupos em contexto de trabalho. Na primeira parte são discutidas definições de equipa de trabalho e são feitas comparações entre os conceitos de grupo e de equipa no contexto organizacional. Em seguida, é adoptada uma perspectiva funcionalista para analisar e discutir os *inputs* e processos grupais mais estudados, bem como a sua relação com diversos resultados produzidos pelas equipas de trabalho. As principais descobertas são discutidas e são propostas linhas de orientação para a investigação futura.

No Capítulo 3 é revista a investigação sobre inovação em equipa, sendo discutidos os principais resultados e as suas implicações para a investigação

futura nesta área. Neste Capítulo é proposto um modelo de inovação em equipa baseado numa perspectiva de grupos como processadores de informação, a qual enfatiza a relevância de determinados processos de interacção para a partilha de ideias, conhecimentos e representações da tarefa e do contexto, e desta para os resultados inovadores das equipas. Este modelo salienta igualmente a função que a reflexividade da equipa tem na regulação da sua performance. Partindo deste modelo, são propostas dez hipóteses de investigação. Duas hipóteses relacionam os quatro processos conducentes à partilha – clareza e compromisso com os objectivos da equipa, participação na tomada-de-decisão, apoio à inovação, e segurança intragrupal – com as fases de geração de ideias e de implementação de ideias do processo criativo. Quatro hipóteses descrevem a interacção entre os processos de partilha e a reflexividade na predição da criatividade das equipas; isto é, a geração de ideias pela equipa. As restantes quatro hipóteses descrevem a interacção entre os processos de partilha e a reflexividade na predição da implementação de ideias pela equipa Estas hipóteses foram testadas numa amostra de 50 equipas de I&D de dois institutos de investigação portugueses.

No Capítulo 4 é delineada a metodologia do estudo. Na primeira parte a amostra é descrita em detalhe, bem como os procedimentos de selecção da mesma. Em seguida, são apresentadas as características psicométricas das medidas usadas para operacionalizar o modelo proposto. Por fim, são discutidos aspectos metodológicos respeitantes à agregação de dados, à análise de dados ao nível grupal em modelos de composição, e ainda aos rácios de amostragem.

No Capítulo 5 são apresentados os resultados das análises estatísticas efectuadas para testar o modelo proposto anteriormente. Análises de regressão foram realizadas para examinar a relação entre os processos de partilha e a performance inovadora das equipas, e para estabelecer quais os processos que tinham maior influência na geração de ideias e na implementação de ideias. Análises de regressão moderadas foram realizadas para testar as hipóteses referentes à interacção entre os processos de partilha e a reflexividade na regulação da performance das equipas.

No Capítulo 6 os resultados encontrados são exaustivamente discutidos e são propostas explicações alternativas para os mesmos. Os resultados suportam a ideia que os quatro processos de partilha desempenham papéis diferentes ao longo do processo de inovação. Ou seja, a geração de ideias criativas e úteis está mais dependente de elevados níveis de apoio entre os membros da equipa, e de um tom afectivo positivo no grupo, enquanto o desenvolvimento de ideias em produtos e processos novos está mais dependente de níveis elevados de clareza dos e compromisso com os objectivos da equipa, bem como de elevada participação na tomada-de-decisão. Por último, os resultados suportam a ideia de que a capacidade de uma equipa para reflectir sobre os seus objectivos, estratégias e processos e de os modificar em função das mudanças no contexto é fundamental para o processo de inovação. A reflexividade tem uma função reguladora do funcionamento da equipa que permite a esta corrigir as discrepâncias emergentes entre os objectivos estabelecidos e o seu desempenho ao longo do processo de implementação.

O Capítulo 7 sumariza os objectivos desta investigação, os principais resultados encontrados e aponta algumas limitações deste estudo. O Capítulo termina com a discussão de algumas implicações para a prática e contributos para a teoria e investigação futura

OVERVIEW OF THE STUDY

This thesis investigates the relationship between group processes and teams' innovative performance. I based the theoretical framework and hypotheses on two well-established theoretical perspectives: a functionalist approach to team performance, and a group information processing perspective. The functionalist approach informed my quest for the factors that distinguished successful from unsuccessful teams in producing innovation. It helped me focus on the functions of inputs and processes as predictors of team innovative performance.

The perspective of teams as information processors helped me clarify the specific functions of certain group processes in promoting sharedness of information, idea and task definition among members of a team. A model of sharedness processes and team-regulation is proposed and tested, based on a sample of teams charged with the tasks of creating new knowledge broad-base and for application to a particular problem, and improving or producing new products or processes. The model predicts that four group processes – goal clarity and commitment, participation, support for innovation, and intragroup safety – promote the sharing of ideas, knowledge, and task representations among team members, which in turn is associated with idea generation and idea implementation by the team. The model also predicts that reflexivity plays a regulatory role in team performance. The study follows a cross-sectional design with multiple sources and independent raters of innovative performance.

The dissertation is divided into seven chapters. Chapter 1 states the research problem and discusses the relevance of the research by drawing attention to the importance of innovation for economic growth and the advantages of studying innovation at group level. It is argued that development of new and improved processes and products lay at the basis of invention, which in turn is associated with economic growth. Toward the end, the chapter emphasizes the need for studying innovation at group-level, specially the study of research and development (R&D) teams.

Chapter 2 examines the literature that relates to study of teams in organizational context. In the first section definitions of work team were discussed and comparisons between the concepts of team and group in organizational context were made. In the next section a functionalist perspective was adopted to examine the most studied team inputs and processes and their relationship with diverse team outcomes. The major findings were discussed and some guidelines for future research proposed.

In Chapter 3 research on innovation at the team level is reviewed, discussing the most accepted findings, and discussing the strengths, limitations, and directions for future research. A model of team innovation is proposed based on a perspective of groups as information processors, which emphasizes the relevance of group interaction processes for sharedness, and the importance of knowledge, ideas, and task representation sharing to team innovative outcomes. Moreover, the model stresses the role of reflexivity as a regulatory mechanism of team performance. Drawing on the proposed model, ten hypotheses are put forward. Two hypotheses relate the four sharedness

processes – clarity of and commitment to team goals, participation in decision-making, articulated and enacted support for innovation, and intragroup safety - with the idea generation and idea implementation stages of the innovation process. Four hypotheses depict the interaction between sharedness processes and reflexivity in predicting team-level creativity that is the generation of ideas by the team. The other four hypotheses describe the interaction between sharedness processes and reflexivity in predicting team-level innovation implementation. These hypotheses were tested with a sample of 50 R&D teams from two Portuguese research institutes.

Chapter 4 outlines the study methodology, and survey measures. The psychometric characteristics of the measures used to operationalize the proposed model and the teams' innovative performance are presented. The sample is described in detail, as well as the methodological issues concerning data analysis at group level in composition models. Matters of sampling ratio and aggregation indexes are discussed.

Chapter 5 presents the results of statistical analyses used to test the model proposed earlier. Regression analyses were conducted to determine whether the sharedness processes were significantly associated with team innovative performance, and to establish which processes were the most significant predictors of creativity and innovation implementation. Moderated regression analyses were conducted to test the hypotheses that team reflexivity would moderate the effect of other group processes on team creativity and innovation implementation.

In Chapter 6 the findings are thoroughly discussed and alternative explanations are put forward. Results sustain the idea that the four sharedness processes play a differential role along the innovation process. While the generation of creative and useful ideas is more dependent on high levels of support between team members and a positive affective tone in the team, the development of ideas into novel products, processes, and procedures is more dependent on high levels of goal clarity and commitment, and participation in decision making. Finally, results also bare witness to the idea that a team's ability to reflect upon goals, strategies, and processes and to adapt them to changes in their environment is fundamental to the innovation process. Reflexivity plays a regulatory role that enables teams to correct the surfacing discrepancies between their functioning and goal states along the implementation process.

Chapter 7 summarizes the aims and main findings of the thesis and raises limitations of the study, as well as practical implications and contribution to theory and future research.

CHAPTER 1

THE RESEARCH PROBLEM

Chapter Structure

Chapter one outlines the rationale behind the study of research and development (R&D) teams. This chapter highlights the importance of R&D for economic growth and the need to study innovation at group level.

Statement of the Problem and Relevance of the Research

The nature of work changed dramatically over the second half of the last century and continues to change as we move into the 21st century. A number of internal and external forces are impinging upon organizations, forcing them to shift to alternative work arrangements. New technologies such as computer-based communication systems are being developed and implemented at an exponential rate (Hesketh & Neal, 1999). Combined with the globalization of trade, the increase in technological capability has led to reductions in the size of many organizations. These changes demand that organizations remain flexible and adaptive, ready to expand or contract at a moment's notice while continuingly adopting innovation. In such a fast-paced, ever-changing

environment, employees are often faced with tasks that exceed their capabilities. In order to remain competitive, organizations have begun to assign tasks to teams of employees. Teams have become prevalent in most organizations, for example finance services, hospitals, automobile industry, pharmaceuticals, schools, and these organizations often credit their success to the addition of team-based work structures.

In a meta-analysis study, Pasmore, Francis, Haldeman & Shani (1982) reported that the introduction of teams as a privileged form of work organization was becoming the most common organizational development intervention. A decade later, Lawler, Mohrman & Ledford (1992) found, in a review of employee involvement practices, that 60% of the surveyed companies planned to increase the number of teams in the next two years. One reason for the increasing popularity of teams in organizations may be the unexpected increases in productivity attributable to the implementation of teams, particularly since the Hawthorne studies. Recent empirical evidence showed considerable support to the advantages of teamwork to organizational performance. For example, in a longitudinal study of railway engineering teams Pearson (1992) found that autonomous teams had higher productivity than non-autonomous teams toward the end of the study. In a study comparing teams with different levels of autonomy in the telecommunications industry, Cohen and Ledford (1994) found that ratings of ratings of team effectiveness made by team members and second-level managers were higher for self-managed teams than for traditional teams. However, there were no differences between those two types of teams in ratings made by first line managers. Wall and colleagues found conflicting

results in two different studies. In a manufacturing plant, performance increased after the jobs of shop-floor employees were reorganized following a group-based design (Wall & Clegg, 1981). In contrast, no differences in productivity were found between a plant with autonomous teams and a traditionally structured plant (Wall, Kemp, Jackson & Clegg, 1986). In the same way, Banker, Field, Schroeder and Sinha (1996) found significant productivity improvements in only one of four manufacturing lines after the introduction of autonomous work teams. Also, in a review of 17 studies Beekun (1989) found that organizations implementing autonomous work teams experienced significant increases in productivity as well as significant decreases in withdrawal behaviors. Two other large reviews seem to endorse the idea that teams make an important contribution to overall organizational performance. Cotton (1993) observed that 57 studies reported improvements in productivity after implementation of team based working, whereas only 12 reported no effect or some productivity decline. Macy and Izumi (1993) conducted a meta-analysis of 131 studies on organizational change to conclude that the implementation of autonomous or semi-autonomous work teams was significantly correlated with improvements in financial outcomes. They reported that team working was the fourth strongest predictor of financial performance and the strongest predictor of overall performance out of 18 interventions.

Even if we consider that the influence of team work in financial performance improvement is not compelling, we should also be mindful of other facets of organizational performance that may benefit from the implementation of work teams. For example, the relationship between team work and employee

attitudes such as satisfaction, commitment or involvement, and their relationship with employee well-being, absenteeism, and performance (Parker, Baltes, Young, Huff, Altmann, Lacost & Roberts, 2003) calls for closer examination. Quality of costumer service is another facet of organizational performance that might benefit from team working, especially in health-care organizations, where working in teams may become a matter of life and death. A number of studies in health-care organizations have shown that team working can make work more efficient, reduce errors, implement innovations, and improve the quality of patient care (for a review see West, Brodbeck & Richter, 2004). However, the most impressive findings come from a study that West et al. (2002) conducted in 61 trusts from the British National Health Service, where they examined the relationship between human resource management practices and patient mortality. The study reported a significant and negative relationship between the percentage of staff working in teams and patient mortality. On average, 25% more staff working in teams is associated with 275 fewer deaths per 100,000 following emergency surgery. Other findings revealed a positive relationship between teamwork and health service employees' psychological health, as well as positive relationship between teamwork and externally rated effectiveness and innovation.

Finally, Cordery (2004) also advocates that the decision for introducing work teams is not always related to their potential for directly improving performance. He presents several other reasons that may guide organizations in their intentions to introduce team-based work designs. For example, reducing costs associated with managerial levels and administrative personnel by using

peer-based control instead of hierarchical control; adoption of a high-commitment model of people management based in cooperation and decentralized decision-making; signaling the organization's values to potential employees, costumers, and investors; preventing performance decrements associated with a system change in which technological or environmental interdependence has increased; creating greater flexibility in internal labor allocation; and enhancing learning through knowledge transfer amongst employees, are strong reasons for managers wanting to move to a team-based organization, even if they are aware that the research literature does not provide an unquestionable association between team work and performance improvement (Cordery, 2004, p.482).

The Need for Innovation

In a changing world organizations have to face new challenges in the relations with their external environments. In this century organizations must deal with thorough changes in their social and economic environments. Global competition, growing interorganizational cooperation, fast technological change, more qualified and diversified workforce, increasing costumer demands, and non-economical concerns are some examples of the contingencies that will stir up organizations to rethink the way they do their business. We may expect that new management strategies to deal with the new challenges will include attracting and retaining skilled people, developing information management

systems that will account for information overload, building trust with all the organization stakeholders, encouraging employee involvement, encouraging cooperative working, design work flows that allow a rapid response to rapid environmental change, create an initiative climate and culture that support and reinforce learning and autonomy. In other words, organizations need to innovate in order to stay competitive in a swiftly changing environment. By innovation it is meant the introduction of novel products, production processes or ways of doing the work within an organization that bring about some form of benefit to that organization, which might include employee well-being and personal development, better organizational processes, and economic growth.

Innovation is considered to be the drive for economic growth. The relationship between technological change and productivity has recently attracted a great deal of attention among economists and policy makers, reflecting an increasingly widespread view that technological change is a major driving force behind long-term economic growth. It is by now well recognized that R&D activity is a major source of technological progress and that the productivity benefits from successful innovations diffuse through the rest of the economy, ultimately contributing to rising levels of productivity, standards of living and employment in the economy as a whole. Sakurai, Ioannidis, and Papaconstantinou (1996) examined the empirical evidence on the impact of performed R&D and of technology diffusion (R&D embodied in production inputs purchased domestically or from abroad) on productivity performance in 10 major OECD countries over the 70's and 80's decades. The productivity variables used in this paper are growth indexes of Total Factor Production. The

results from pooled regressions across countries and across industries during the 1970s and 1980s indicated that the rates of return of both R&D variables were positively significant and increasing in the 1980s. The estimated rate of return of direct R&D varied across the countries: in the 1970s Japan showed the highest return (40%) but in the 1980s the rate return was highest in Italy (50%) and Canada (30%). On the other hand, technology diffusion is an important source for productivity growth in services, pointing to very high social returns: on average across the countries it was about 130% in the 1970s and 190% in the 1980s. The Information and Communication Technology (ICT) cluster of industries played a major role in the generation and acquisition of new technologies. In particular, the ICT services sectors in Canada and in small European economies have obtained higher gains from international R&D spillovers than from domestic ones, while domestic R&D was more important in the larger economies like United States, Japan and Germany.

The relationship between university research and local economic growth has also received support from empirical evidence. In a study designed to determine whether university R&D activity affected the local rate of new firm formations and economic growth, Kirchhoff, Armington, Hasan, and Newbert (2005) compared university R&D expenditures by Labor Market Area (LMA) in the U.S. with data on new business formations by LMA. The results show that university R&D expenditures are significantly related to new firm formations in the same LMA. In addition, they found that variations in firm birth rates, which are affected by R&D spending, are strongly associated with the employment growth rates at the LMA level. They conclude by arguing that these findings

lend strength to the argument that government and private sector R&D expenditures made through research universities contribute to economic growth. Furthermore, university R&D spending is also associated with higher levels of local human capital, which also contributes substantially toward generating new firms.

Another compelling example of the relevance of innovation to economic growth comes from a large study conducted by Ulku (2003). The author examined the relations between R&D investment, invention, and economic growth in 36 countries, including Portugal, on the period from 1983 to 1997. R&D spending was used as a measure of endogenous investment in technological change, and successful patent applications as an indicator of the rate of invention resulting from that investment, growth in total factor productivity as an indicator of technological change, and the growth rate of the gross domestic product as a measure of economic grow. The results suggested that there are positive returns to R&D in terms of invention in both developed and developing countries, with the latter exhibiting higher returns. The results also indicated that the relationship between invention and economic growth is positive and significant, and that this relation is stronger in developed countries than in developing countries. These results are consistent with the implications of R&D based growth models, which state that the inventions are created in an economy as a result of the R&D efforts of firms; these inventions are then used in the production process and lead to sustainable economic growth (Ulku, 2003, p.7). At the organization level, we also find support for the relationship between innovation and performance. In a study of 47 mid-size German companies,

Baer and Frese (2003) found that process innovations, defined as deliberate and new organizational attempts to change production and service processes (e.g., Total quality management; Computer-integrated manufacturing, Team-based work), were positively associated with return on assets and goal achievement in firms with high climate for initiative and high climate for safety.

The relationship between innovation and firm effectiveness finds support also at the national level. The third Community Innovation Survey (CIS 3) reports that productivity (volume of sales/number of employees) of innovative firms was superior to that of non-innovative firms for the years of 1998 and 2000, especially for those who invested in R&D. A more detailed analysis by sector referring to the year 2001 (Fonseca, 2004), revealed that firms with R&D activity had superior productivity than the sector where they belonged. The increase in R&D was higher for firms in the medium-high technological intensity sector (2.15 times more) and for firms in the low technological intensity sector (2.36 times more). These observations suggest that product innovation - the introduction of novel products, improvements in existing products and services, or an extension of their application scope - or process innovation – integration and automatization of production processes, improved safety, or improvement of distribution procedures - does make a significant contribution to the overall growth of economical performance at the organizational level.

Thus a clearer understanding of the factors that determine successful innovation can help an organization to develop new and improved processes and products, to concentrate valuable resource allocation, and to operate with enhanced competitiveness and efficiency. An examination of the adoption of

new products and processes in Australian retail banking from 1981 to 1995 revealed that establishing an appealing dominant position depended on a bank's innovative activity. Banks that undertook more active and consistent innovative activity that was some how differentiated from their competitors tended to display superior financial performance (Roberts & Amit, 2003).

Innovation is about the development and implementation of new ideas by people who over time engage in transactions with other people within an organization (Schroeder, Van de Ven, Scudder & Polley, 1989). I would add that these people have diverse knowledge, distinct backgrounds, and most probably dissimilar representations of the task at hand. Diversity of knowledge and perspectives seems to be necessary to develop and implement ideas (Dunbar, 1995; Jackson, 1996; Paulus, 2000) but it may also be detrimental to innovation if those diverse contributions are not pooled together in the same direction through social interaction, trust, motivation and a common ground of understanding. In a study about innovation diffusion in the U.K. health care sector, Ferlie, Fitzgerald, Wood, and Hawkins (2005) present two contrasting examples of innovation processes conducted within teams. Single-profession groups of health care professionals provide powerful communities of practice where face-to-face interaction motivates the exchange of information and experience, and learning regarding health care practices. Such communities often carry out innovations within their boundaries, but also create barriers to learning and change between communities. Ferlie and colleagues found that strong social and cognitive boundaries existed between different professions that inhibited the spread of innovations, even though they were all part of the

same multidisciplinary team. Therefore, teams and innovation may be strongly connected in the sense that the development of novel ideas into useful outcomes is a complex process that can hardly be done by a single person. However, to make people working together toward a common goal is easier said than done, and congregating a group of very diverse people together to create something useful might be a very complex task. Whenever the innovation implementation does not take into account the needs and goals of the people involved in the process, innovations may be more a predicament than a benefit for the organization. As an illustration, Chambel and Peiró (2003) examined the relation between the implementation of novel people-management practices in six Portuguese firms from the ceramic industry, and found a strong negative relationship between HRM innovations and workers satisfaction and intention to leave in the cases where the employees perceived the innovations as a violation of their psychological contract.

The innovation process is somewhat unpredictable and complex as there are multiple elements involved and numerous interactions between them. Hence, if we look at the characteristics of complex decision-making groups the strong link between innovation and teamwork becomes evident. As West, Garrod, and Carletta describe, complex decision-making groups operate in uncertain environments with complex and unpredictable technology, have to deal with tasks which requirements may change frequently, have high team autonomy and high team member interdependence. Given these characteristics, such teams are better placed to deal with technological innovation than any other work unit in the organization.

Work in organizations has increasingly been carried by temporary work groups such as project teams or by more stable groups designated R&D teams. Of all types of teams that pervade the organization, project teams are becoming the most common ones. A recent survey conducted in the U.S. found that project teams accounted for 30-per cent of all the teams working in organizations (Gordon, 1992). Project teams have been implemented to reduce time-to-market by improving coordination and manpower on critical tasks (Eisenhardt & Tabrizi, 1995). Members of project teams come from different parts of the organization and have to move from one task to another on a frequent basis. They are expected to be self-managing, to be able to handle novel tasks without prior training, and to be willing to invest in a continuous learning process (Allred, Snow, & Miles, 1996). These characteristics make project teams the preferred problem-solving tool in a competitive, unpredictable and complex environment.

R&D teams represent a more permanent form of project teams, sharing with them the characteristics of interdisciplinarity and complex problem-solving ability. They are different from project teams on what their members stay together for longer periods, thus developing long-term goals, more stable interaction processes, and enduring interpersonal affective relations. Despite the relevance of R&D, there have been few attempts to systematically identify the factors underlying effective R&D team performance.

Chapter Summary

Chapter 1 highlighted the importance of innovation for economic growth and the advantages of studying innovation at group level. It is argued that development of new and improved processes and products lay at the basis of invention, which in turn is associated with economic growth. Toward the end, the chapter emphasized the need for studying innovation at group-level, specially the study of research and development (R&D) teams.

CHAPTER 2

WORK GROUP RESEARCH

Chapter Structure

Chapter 2 examines the literature on the study of teams in organizational context. The first section covers a definition of work team. Next, the literature on work groups is reviewed and the findings of previous studies that feed into this research are discussed.

A Definition of Work Team

The terms group and team have been used as equivalent in organizational psychology research. However, this is not a consensual position as a some researchers argue that the term group is more appropriate to describe the laboratory settings using tasks and contexts that have little to do with real-world groups, while the term team is better suited to describe groups that work together for extended periods of time in real-world organizations (Paulus & Van der Zee, 2004). In the remaining of the section we will see what are the similarities and differences between groups and teams.

Arrow, McGrath and Berdahl (2000, p.34) define groups as complex, adaptive, coordinated, and bounded set of patterned relations among members, tasks, and tools. They also give a number of criteria to determine the level of groupness a group holds. I will present four of these criteria that, in my opinion, better define a workgroup: (a) whether members coordinate their behavior in pursuing collective projects; (b) whether members coordinate their use of a shared set of tools, knowledge, and other resources; (c) whether members feel connected to the other members and to the projects of the group; and (d) whether members share collective outcomes (both rewards and costs) based on their interdependent activity (p.34-35).

Although other researchers prefer to use the term team to describe groups that perform tasks, they still emphasize all, or part of these criteria, as paramount to teamwork (Mohrman, Cohen & Mohrman, 1995; Sundstrom, DeMeuse & Futrell, 1990). One of the best examples of the sharedness of concepts between group and team is given by West and Markiewicz (2004), who define work teams as social groups embedded in organizations, performing tasks that contribute to achieving the organization's goals (pp. 11). They go on further to specify the characteristics those groups must have to be considered work teams: (1) to share objectives; (2) to have the necessary authority, autonomy and resources to achieve these objectives; (3) to work closely and interdependently to achieve the objectives; (4) to have well-defined and unique roles; (5) to be recognized as a team; and (6) to have more than 3 and less than 15 members (pp. 11). Although both definitions identify very similar characteristics of work groups, they emphasize

two important but distinct features of groups. Arrow and colleagues (2000) stress sharedness as the most salient feature, while West and colleagues (2004) point out that teams in organizations exist to achieve goals in the first place.

Still, the equivalence of the group and team concepts has not always been so evident. Lourenço (2002) argues that group research history has evolved around two ideological trends where groups were seen either as favorable or unfavorable to organizational effectiveness (the good group vs. bad group metaphor). This dichotomy would prompt the emergence of the team as an example of the good group metaphor. Thus, the term team describes a group with an important role in the organization of work and the solution of problems related to organizational effectiveness.

According to Guzzo and Shea (1992) the use of the terms group or team seems to be a matter of preference and these can be used interchangeably. Arrow and colleagues, however, introduce a nuance in distinguishing teams from workgroups. Teams are work groups who have a longer lifetime span and as so their dynamics are slightly different from the ones of other workgroups. For one reason, member of a teams will be working together indefinitely and therefore they need to become cohesive and resourceful in order to be able to tackle effectively a range of projects. Another reason why teams differ from groups is because interpersonal relations in the member network, decision rules, communication protocols, and conflict resolution methods are also different (Arrow, McGrath & Berdahl, 2000, p.84). Some of the most prominent examples of teams are sports teams, top management teams, string quartets, and collaborative research groups.

As described previously, team members must interact with one another in order to achieve their common goals and objectives as each team member is dependent on his colleagues to get the job done. Research shows that the social interaction between team members is an integral part of team decision making and problem solving (Gouran & Hirokawa, 1996), allowing team members to pool information and resources (Zaleska, 1978), to detect errors and reject inaccurate statements, and to influence the decisions of others. As group members interact, certain chemistry is created through the synthesis of ideas and viewpoints that controls much of what the team does within the organization (Poole & Hirokawa, 1996). Although the chemistry can be sometimes faulty (Janis, 1982), social interaction is an essential component of any team. In fact, researchers consider interaction to be the key to understanding team behavior (Hackman & Morris, 1975). Apparently, the terms group and team seem to describe phenomena that are more similar than different, and thus could be used with the same meaning. Still, I think we should make a distinction between the organizational team that is a relatively stable set of people working interdependently to achieve some previously defined and agreed upon goal, and the organizational group that exists only because people interact with one another and establish patterns of relation that go beyond any shared goal. The influence this group has upon its members is clearly portrayed by Kurt Lewin:

No wonder that the group the person is a part of, and the culture in which he lives, determine to a very high degree his behavior and character. These social factors determine what space of free movement he has, and how far he can look

ahead with some clarity into the future. In other words, they determine to a large degree his personal style of living and the direction and productivity of his planning (Lewin, 1939, pp.13).

A Little History of Small Work Group Research

The interest in studying groups in work settings emerged absolutely by chance. When Western Electric Company began, in the 1920's the most ambitious and well founded research on working conditions ever done at its Hawthorne Works plant in Chicago (Chambel & Curral, 1995), their researchers were far from imagining they were setting off a new trend in group and management research. The Hawthorne studies were not, initially, analising groups. Instead, they were interested on the influence of workplace physical conditions, such as lighting, and incentives on individual productivity.

In order to facilitate the study, the authors divided the workers into small groups and placed them is separate rooms for easier observation. They found, to their surprise, that these informal groups of workers developed and imposed strong group norms, which sometimes worked against the higher productivity goals of management, offsetting the expected impact of production incentives, whereas other times it encouraged superior production.

One of the most famous of such observation units was the Bank Wiring

Observation Room. Three small teams of four people wired banks of switching terminals. The three teams were supervised by two inspectors. Unexpectedly, two informal groups emerged. One group included the whole team at the front of the room, one member of the team in the centre of the room, and one inspector. The other group included the team at the back of the room, and one member from the team in the centre. The groups developed different norms. Members of the first group conversed more and maintained a high output. The second group set up lower performance standards and group members enforced that norm by hitting in the arm of a member when he was working too fast (Chambel & Curral, 1995).

The unanticipated findings of the Bank Wiring Room spurred a new approach to management and organizational theory: the mutual relevance of social formal and informal structure, demonstration of informal production norms in work groups, and that group norms can be either supportive of or counterproductive to management goals. Other researchers picked on these findings to deliberately begin to study informal groups in work settings (e.g., Coch & French, 1948; Kahn & Katz, 1953). They confirmed the initial idea that interpersonal relations emerged among coworkers had a strong impact on what formal groups could accomplish and on how they carried out their work.

By that time, formal groups were not very popular in organizations, which were strongly influenced by a scientific management philosophy that preferred job specialization and formalization to flexibility. The study of work groups in organizational contexts did not progress much until the beginning of 1950, when researchers at the Tavistock Institute in London started studying autonomous

workgroups in the field using a sociotechnical approach (Trist & Bamforth, 1951). Within this perspective, groups are intact, holistic systems that include members and their inter-relations, resources, and technology.

Group structure, formal and informal, develops around the task and the particular technology the group uses. Thus, the technical subsystems of any group must be concurrently optimized with the social subsystem (Emery & Trist, 1960). The sociotechnical approach gave birth to a more pragmatic trend in the research on groups in organizations. Sociotechnical researchers were more interested in interventions to improve work group effectiveness than in any other issue. However, it important also so notice that they were the first to include members' well being as a component of a group's effectiveness (Emery & Trist, 1960). In a description of four field experiments in Norwegian industry, Emery and Thorsrud (1976) give a striking account of the changes introduced by the socio-technical approach. One of the experiments involved a wire drawing department of a Norwegian metal working firm that the authors describe in the following way: "they changed from one man/one machine fragmented jobs, paid on time and motion studied piece rates, to a group systems of work. They started to take the initiative and to influence decisions, which were previously beyond their control" (pp. 22). The other reported benefits of these interventions included an increased productivity of 20 per cent, increased quality and decreased production costs, better communication and team work between operators, positive attitude towards the new work system, improved measurement and information systems and learning from using it, upgrading skills, and decreased turnover and absenteeism

(Emery & Thorsrud, 1976). The sociotechnical approach led the way to a new trend of research inspired by action-research methodologies (Kolodny & Kiggundu, 1980; Pasmore, Francis, Haldeman, & Shani, 1982), and the study of autonomous work groups implementation in organizations (Cordery, 1996).

The resurgence of interest in studying groups in the work place had to wait twenty years, until the mid 70's, when we assisted to the emergence of the first comprehensive model of work group effectiveness (Hackman & Morris, 1975; 1978). Coincidentally, or not, in the late 1970's companies started to pay more attention to groups as a way to organize work. Work teams were introduced in manufacturing companies in Europe and the United States. Assembly teams and employee involvement groups in General Motors, work teams in General Food and Saab paved the way to a blossom of group-based manufacturing plants all over the world, of which the most renowned is the Volvo plant at Kalmar (Sundstrom, McIntyre, Halfhill & Richards., 2000).

During the 1980's hundreds of companies began to adopt teams for other purposes. Production groups and project teams emerged, but special attention was given to a kind of problem-solving teams, known as quality circles, first developed in the United States by Lockheed's missile division. Quality circles were small groups of employees asked to suggest solutions to work organization problems. By that time, hundreds of companies made extensive use of teams. During the 1990's work teams became an established managerial practice, with teams pervading all areas of organization. A survey conducted in 1996 with Fortune 1000 companies' representatives revealed that 76% of employees were part of self-managing teams.

This represented a 30% increase when compared to a similar survey done in 1990 (Lawler, Morhman & Ledford, 1998).

An archival study of group research published in organizational psychology journals from 1975 to 1994 revealed that interest in work group research declined during the late 1970's, remained low during the 1980's and rose during the early 1990's (Sanna & Parks, 1997). Moreover, the majority of the studies was focused in group performance (64%), but less than a third were field studies (21%) or field experiments (7%). Another review of social psychology journals comprising approximately the same period, revealed a similar temporal pattern for group research (Moreland, Hogg & Hains, 1994). Although group performance accounted for the second highest percentage of studies (23%), the majority were laboratory experiments (76%), with a neglectable percentage of field studies (1%) or field experiments (3%). For half a century, researchers have been interested in determining the factors that contribute to team effectiveness. Although dozens of conceptualizations of team effectiveness emerged during the past twenty years (e.g., Ancona & Caldwell, 1992b; Campion, Medsker, & Higgs, 1993; Campion, Papper, & Medsker, 1996; Cohen, Ledford, & Spreitzer, 1996; Gersick, 1988; Gladstein, 1984; Hackman & Morris, 1975; Janz, Colquitt & Noe, 1997; Marks, Mathieu & Zaccaro, 2001; Sundstrom, DeMeuse, & Futrell, 1990; Tannenbaum, Beard, & Salas, 1992), they all seem to be bound by the same rational: a functional perspective of group performance.

Teams From a Functional Perspective

The functional perspective consists of a set of models who share a definition of work group as an open system that transforms inputs in outputs through interaction processes developed in the group (Guzzo & Shea, 1992). The functional perspective is, therefore, defined as a normative approach to describing and predicting group performance that focuses on the functions of input and processes. Three primary assumptions define the functional perspective: groups are goal oriented; group performance varies in quantity and quality and can be evaluated; and internal and external factors influence performance by means of interaction processes (Wittenbaum, Hollingshead, Paulus, Hirokawa, Ancona, Peterson, Jehn & Yoon, 2004, pp. 19). First, groups have one or more goals that characterize some aspiration or mission to accomplish. Although these goals may be member, group or task oriented, most research has been directed to task oriented goals. This kind of goals can have a more cognitive nature (solving problems, making decisions, generating ideas) or a more physical nature (assembling engines, erecting a wall). Second, group performance is evaluated against some normative criteria that indicates how the group should perform. One important tenet of functional perspective is that when groups fail to achieve the performance standards, interventions may be designed in order to help the group to raise up to the defined standard. Third, group performance is influenced by internal and external inputs. Factors like member composition, time pressure or resource

scarcity may facilitate or hinder group effectiveness. However, this relation is not straightforward. Inputs affect outcomes by way of the interaction processes (communication, support) that occur in the group. The interactions between inputs and between inputs and processes cause variation in group performance (Wittenbaum et al., 2004).

In light of the above, the following section will highlight a set of topics that traversed the research on work team performance over the last twenty years. I will draw upon four comprehensive team research reviews to present a summary of the research covering this period (Guzzo & Dickson, 1996; Salas, Stagl & Burke, 2004; Sundstrom, McIntyre, Halfhill & Richards, 2000; West, Borril & Unsworth, 1998).

Within the past twenty years there have been diverse attempts to classify teams according to the type of task they perform (Cohen & Bailey, 1997; Hackman, 1990; Sundstrom et al., 1990). Six types of organizational teams are commonly accepted (Sundstrom et al., 2000). Production groups are groups of front-line employees who repeatedly produce tangible output, such as automobile assembly groups. These groups can be semi-autonomous when they have a dedicated, full-time, higher ranking supervisor, or autonomous when they have more autonomy to make decisions traditionally made by supervisors. Autonomous work groups can vary in the degree of autonomy they have to schedule members' work, to do routine housekeeping, to maintain their own equipment, to work with external suppliers and customers, and even to participate in decisions about budgets, performance appraisals, training, personnel selection, or training. An example of research focused on this type of team is Little and Madigan (1997) automotive

parts manufacturing teams study. Service groups consist of employees who cooperate to conduct repeated transactions with customers, such as sales groups. These teams may have management responsibilities and may be self-managing. An example is Gladstein (1984) research with telecommunication sales teams. Management teams comprise an executive or senior manager and the managers or supervisors who report directly to him or her. These teams usually manage a work unit through joint planning, policymaking, budgeting, staffing, and logistics. Management teams can organize themselves as they want. An example is West and Anderson (1996) research with hospital management teams. Project groups carry out defined, specialized, time-limited projects and break up after finishing. They tend to be cross-functional, as their members tend to come from different departments or units. Examples of research including this type of teams are Katz's (1982) studies of R&D project groups. Action and performing groups often perform complex, time-limited tasks involving audiences, opponents, or challenging environments. Members are usually expert specialists who carry out complementary, interlinked roles. Example of research is Carter and West's (1998) television program production crews study. Finally, advisory groups work in parallel with production processes to solve problems and recommend solutions. An example of research focusing on this type of team is Adam's (1991) study about quality circles performance.

Most recently, Devine (2000) offered an integrative and more refined taxonomy of organizational teams, consisting of fourteen team types classified on seven underlying contextual dimensions (i.e., fundamental work cycle, physical

ability requirements, temporal duration, task structure, active resistance, hardware dependence, and health risk). The fourteen team types are divided into two clusters: intellectual work teams that include executive, command, negotiation, commission, design, and advisory teams; and physical work teams that include service, production, performance, medical, response, military, transportation, and sports teams. Devine (2000) argues that a work groups taxonomy is needed in order to advance our understanding of team effectiveness in different organizational contexts. This is particularly relevant as some findings suggested that team type influences the choice of team effectiveness criteria (Cohen & Bailey, 1997; Curral et al., 2001).

In summary, research about service teams accounted for one third of the studies conducted between 1980 and 1999, followed by production teams with 15 studies. Management and project teams represent the same number of studies (13) and accounted for almost 30 per cent of all studies. Most of the project teams studied were some sort of research groups. Following Devine's (2000) taxonomy, work team research in the past twenty years was more interested in physical (52 studies) than intellectual teams. Interestingly, 10 per cent of the studies reported by Sundstrom and colleagues (2000) included both types of teams.

A Small Number of Methodological Issues

Another theme that has been receiving increasing attention in the teams' literature is methodological issues and the awareness of their importance for successful team research and intervention (Salas et al., 2004). Two issues have been discussed more thoroughly: research strategies and effectiveness criteria. In this section I will present the issue of research strategies, whereas team effectiveness criteria will be discussed below when the input-process-output model is introduced. Sundstrom et al. (2000) identified three predominant research strategies in work teams research. Work redesign evaluations were a concern for the early days. Studies informed by the a sociotechnical paradigm wanted to know how effectively work units redesigned as autonomous groups performed compared to traditional work units (Cohen, Ledford, & Spreitzer, 1996; Cordery, Mueller & Smith, 1991 Wall & Clegg, 1981). A second group of studies, under the general designation of field studies, inquired about the correlates of group functioning – e.g., group communication - with team performance measures in existing work groups and no intervention. These studies focused on the group level of analysis (Gladstein, 1984; Katz, 1982). Recently, there has been a plea call for the use of multilevel analysis in the study of organizational teams as individuals, teams, and organizations are nested and intertwined within multilevel open systems (Salas et al., 2004, pp. 60). Until now very few studies have used multilevel designs (Hollenbeck, Ilgen, Sego & Hedlund, 1995; Neuman, Wagner & Christiansen,

1999; Neuman & Wright, 1999). A third set of studies asked about the impact of experimental interventions on work group effectiveness. These work group experiments were adequate to test specific hypotheses such as the impact of feedback, rewards, or training on team effectiveness (Eden, 1985; Pritchard, Jones, Roth, Steubing, & Ekeberg, 1988; Wageman, 1995).

An Input-Process-Output Framework for Team Research

Following a general input-processes-output pattern, I will present a brief review of the findings on work team effectiveness. On the inputs side, group's task, group composition, and organizational context have been the most well studied variables. The group processes that have been identified within the organizational psychology literature include communication, leadership, cohesion, group potency, and group norms for cooperation, decision-making and conflict management.

Effectiveness Criteria in Work Group Research

The 90 studies examined by Sundstrom et al. (2000) showed a variety of effectiveness criteria ranging from global concepts to individual members' behavior. About half of the studies used a global criterion such as performance, effectiveness, productivity, success, or other general criteria. The preferred

criterion was, however, performance that was used in twenty five per cent of the studies (Ancona & Caldwell, 1992a, 1992b; Janz, Colquitt & Noe, 1997; Pelled, Eisenhardt, & Xin, 1999; Uhl-Bien & Graen, 1998). Effectiveness appeared as the second most used criteria, either as single dimension criterion (Argote, 1982; Campion, Medsker & Higgs, 1993; Cohen, Chang, & Ledford, 1997), or defined as

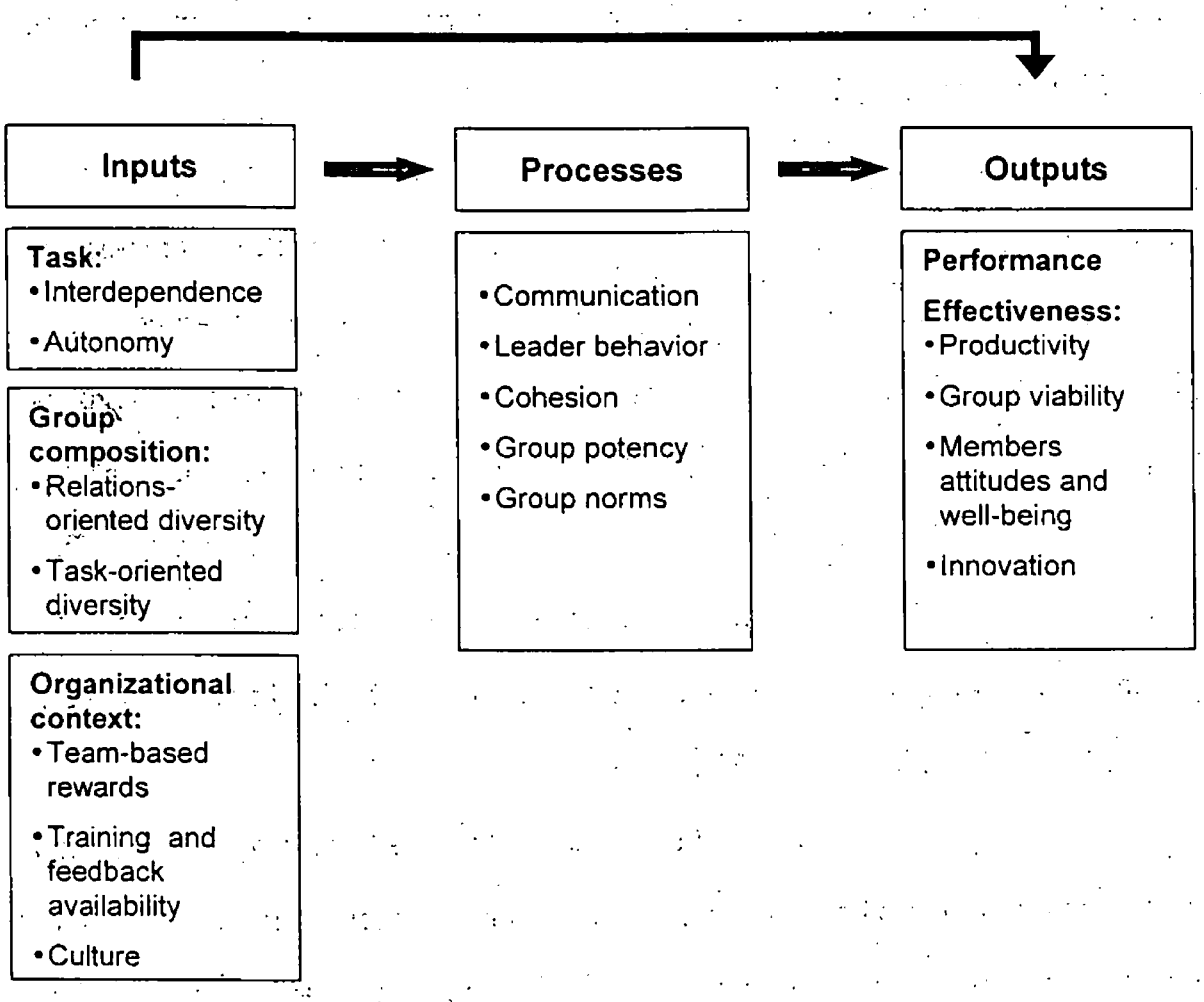


Figure 1. An input – process –output model of teamwork.

a multidimensional criterion that included performance (e.g. Gladstein, 1984; Uhl-Bien & Graen, 1998). The third most common criterion was productivity, defined as quantity or quality of output. It is a criteria most commonly used in studies involving production groups because it is the only kind of group where it is fairly easy to quantify team output (Banker, Field, Schroeder, & Sinha, 1996; Kolodny & Kiggundu, 1980; Pritchard et al., 1988). Other group-level criteria used in team research over the past twenty years included cohesion and social integration, coordination, communication, strategy development, and trust in management teams (Sundstrom et al., 2000).

Some studies assessed individual job attitudes and aggregated them at the group level. These included job satisfaction; satisfaction with team membership; organizational commitment; and work motivation. Perceived job characteristics, such as autonomy, feedback, work identity, and role clarity were also used as criteria (e.g., Ancona, 1990; Campion et al., 1993; Cordery et al., 1991; Wall & Clegg, 1981). Among individual behaviors most frequently used for team research were rates of turnover, absenteeism, accidents, and prosocial behavior (e.g., Goodman & Garber, 1988; George & Bettenhausen, 1990; Markham, Dansereau, & Alutto, 1982; O'Reilly et al., 1989).

West, Borril and Unsworth (1998) stressed the need to avoid the unmodified linear assumption proliferating in the team effectiveness literature that more performance means more effectiveness. They suggest that the concepts of performance, effectiveness, and productivity should be explicitly distinguished and operationalized as precisely as possible, and separately measured. West and

colleagues recommend we adopt the distinctions suggested by Brodbeck (1996) between performance - behaviors which are relevant for achieving goals - and effectiveness - degree to which performance outcomes approach goals - as well as the effectiveness dimensions he specifies: productive outputs (e.g. sales revenues); social criteria (e.g. group viability); individual outcomes (e.g. member satisfaction and well-being); and innovation (e.g. number of ideas implemented). In the same vein, Salas and colleagues call attention to the necessity to develop measures derived from clear, non-contaminated, constructs. They advocate that when constructing team measures one should take in to account aspects such as measurement purpose, targeted competencies, nature of stimuli, measurement timing, and cost concerns (Salas et al., 2004, pp. 59).

As noted before, the thinking about work group effectiveness in the last twenty-five years, has been dominated by an input-process-output framework, mainly because of its categorical simplicity and utility (West et al., 1998). Since the first research program to explicitly assume this model of input-process-output (Hackman & Morris, 1975), a few other research programs were informed by this same template (Campion, Papper & Medsker, 1996; Cohen, Ledford & Spreitzer, 1996; Gladstein, 1984; Sundstrom et al., 1990; Tannenbaum, Salas & Cannon-Bowers, 1996).

Another attempt at creating a lucid framework to understand team effectiveness was made by Lourenço (2002). Drawing upon Beaudin and Savoie four-dimension model of work team effectiveness (economical, social, political, and systemic), he developed a questionnaire to measure the concept of team

effectiveness and applied it to 118 members of 8 professional basketball teams. The results suggested that, even though the four dimensions of effectiveness proposed by Beaudin and Savoie might be an acceptable discrimination of the effectiveness construct, a two-facet model better describes the construct of team effectiveness, at least for this type of team. Consequently, Lourenço (2002) advocates that the concept of team effectiveness might be better operationalized around two dimensions: (1) organization and maintenance that includes measures of team adaptability and flexibility, team composition, cooperation and communication, cohesion, team member development and satisfaction; (2) production and reputation that includes team productivity, and the team reputation among its stakeholders. Another interesting finding reported by Lourenço (2002) is that the concept of effectiveness, perceived by team members, is different according to the development stage of the team. Mature teams put more weight on the organization and maintenance dimension than less developed teams.

The concepts of team effectiveness put forward by Brodbeck (1996) and Lourenço (2002) share in common the emphasis on the multidimensional nature of effectiveness. The multiple facets of teams' outcomes may help us understand the importance of team work for an organization that goes beyond the sheer productivity factor. In complex decision-making teams (e.g., top management teams, primary health care teams, project teams, and research teams) innovation, team viability or member well-being are far more interesting outcomes that productivity.

Inputs

Team inputs refer to the main task the team is supposed to achieve, the organizational context within which the team operates, and the skills, knowledge, experience, age, and values individuals bring to the team.

Group's *task characteristics* have been the subject of diverse classification schemes (see West et al., 1998). However, only a few dimensions have been studied in organizational settings. Interdependence and autonomy are up to date the most studied group's task characteristics. Janz and colleagues' (1997) study of information technology teams found that interdependence was positively related to objective measures of team performance and to members' satisfaction. However, Fry and Slocum (1984) found interdependence to be unrelated to police subunits' manager-rated effectiveness. Campion and colleagues (1993) examined three kinds of interdependence in clerical teams and found that task interdependence was related to productivity, goal interdependence was related to manager-rated performance, and outcome interdependence was related to members' satisfaction. They also found that some group autonomy characteristics were also significantly correlated with the three effectiveness measures. Wageman's (1995) study of service technician teams found that groups with high interdependence performed well when their reward system provided group incentives, and those groups with low interdependence and individual rewards also performed well. Another study involving production teams (Stewart & Barrick, 2000) found different effects of

interdependence on performance depending on the task type. For teams engaged in conceptual tasks, interdependence had a U-shaped relationship with team performance, whereas for behavioral tasks the same relationship assumed a reverse shape. These findings suggest that interdependence can be a facilitator or an inhibitor of team effectiveness, depending on the type of task the team as to perform. Finally, in a comparative study of self-management and traditionally managed teams, Cohen and colleagues (1996) found that a global measure of task design, including autonomy, variety, power, and identity, only predicted self-ratings of performance in self-managing teams, but predicted absenteeism and quality of work life in traditional teams. In a study involving service and military teams, Langfred (2000) reported a positive relationship between group autonomy and effectiveness, partially mediated by group cohesiveness.

Group composition is another group input factor that has received an increasing interest. Research on group composition in organizational contexts has been more focused in finding out the right combination of abilities, skills, personality traits, demographic characteristics, and expertise to different types of tasks. West et al. (1998) propose to group the most studied variables in two categories: relations-oriented, and task-oriented diversity.

Among the relations-oriented composition variables studied in relation to work group effectiveness, two consistent predictors of group performance are group members' average cognitive ability and group average scores on conscientiousness (Barrick, Stewart, Neubert, & Mount, 1998; Mohammed, Mathieu & Bartlett, 2002; Neuman et al., 1999; Neuman & Wright, 1999).

Combinations of team member's knowledge, skills and abilities have also been suggested to affect team effectiveness (Stevens & Campion, 1994), but so far this relationship has been observed only at the individual level and has received very little attention at the team level (West et al., 1998

Other relations-oriented variables include age, tenure and cultural diversity. Two studies (Jackson, Brett, Sessa, Cooper, Julin & Peyronnin, 1991; Wagner, Pfeffer & O'Reilly, 1984) found that heterogeneous groups regarding age had higher rates of turnover than homogeneous groups. Similarly, the averaged job tenure of group members has also been studied in top management teams. Eisenhardt and Schoonhoven (1990) found team tenure to be positively correlated with company sales growth, but other studies found top management team tenure to be unrelated to company financial performance (Smith, Smith, Olian, Smis, O'Bannon, & Scully, 1994), team decision quality (Amason, 1996), or innovation (West & Anderson, 1996). In the same vein, a studied conducted by Simsek, Veiga, Lubatkin, and Dino (2005) found tenure to be uncorrelated with top management teams' behavioral integration. Finally, a longitudinal study comparing culturally homogeneous and heterogeneous teams found that culture diversity seemed to be an advantage in generating creative alternative solutions and applying a range of perspectives in case analysis. However, during the early stages of task performance, culturally diverse teams performed less effectively than homogeneous teams because of coordination problems resulting from different backgrounds (Watson, Kumar & Michaelsen, 1993).

Composition variables based on task-oriented characteristics have also

been found to consistently relate with work group effectiveness. Gladstein's (1984) study of service teams found functional diversity - variety of job functions or specialties among group members - to be positively correlated with team member's self rated performance. A study of project teams also found a positive relationship of functional diversity with rated effectiveness (Ancona & Caldwell, 1992b). In top management teams, one study found functional heterogeneity to be inversely correlated with company performance (Haleblian & Finkelstein, 1993), but another found functional heterogeneity to be positively correlated with clarity of strategic planning (Bantel, 1993). A large-scale study with top management teams from 402 small to midsize privately owned firms found no correlation at all between functional diversity and top management team behavioral integration (Simsek, Veiga, Lubatkin & Dino, 2005). In turn, educational diversity was negatively correlated with collaborative behavior, information exchange, and joint decision making within the team. Additionally, the same study reported a strong negative correlation between diversity of goal preference concerning risk taking, firm expansion, importance of change, and goals in general and team members' behavioral integration (Simsek, Veiga, Lubatkin & Dino, 2005). Finally, a number of studies reported significant correlations of heterogeneity of skills and team effectiveness (Campion et al., 1993; Guzzo & Dickson, 1996; Jackson, 1996), but a negative correlation with affective outcomes (Milliken & Martin, 1996). Two studies reported that education diversity predicted strategic management initiatives (Wiersema & Bantel, 1992), and clearer strategies (Bantel, 1993). Diversity, although, seems to have a negative effect on satisfaction and commitment, and to

positively correlate with turnover and sick leave (Milliken & Martins, 1996). Two meta-analysis relating group diversity and performance do not show reliable direct effects, suggesting that researchers should look for moderators (Bowers, Pharmer & Salas, 2000; Webber & Donahue, 2001). More recently, researchers have been looking at moderators of the relationship between diversity and group processes and outcomes. In a study involving different types of teams, Schippers, Den Hartog, Koopman and Wienk (2003) reported interaction effects of an overall measure of diversity (age, gender, education, and team tenure) and outcome interdependence, and of diversity and group longevity on team process, satisfaction, and self-rated performance.

Organizational context factors that have been suggested as important in predicting team effectiveness include training, rewards, measurement, information systems, and training (West et al., 1998). Among the most frequently investigated organizational context variables are rewards, such as public recognition and money, which have been examined mainly in service teams. Findings are controversial. One study involving aircraft maintenance teams (Pritchard et al., 1988) found a small increase in a composite productivity index following introduction of incentives over the increases motivated by performance feedback and goal setting. In another study, Wageman (1995) found that service technician groups with low task interdependence performed best under conditions of individual-based rewards, but that groups with high interdependence performed best with group-based rewards. In contrast, other studies of service teams found no relationship of rewards with manager-rated effectiveness (Campion et al.,

1993), member-rated effectiveness, or objective measure of performance (Gladstein, 1984). The findings point to contingency variables in the role of reward systems for work teams, as Wageman's study shows.

Another contextual factor that has been studied is training. In a study with electronic systems repair teams, Hyatt and Ruddy (1997) found that availability of training was positively related to manager-rated effectiveness but not to customer satisfaction. Two other studies found some empirical support for the correlation of availability of training with members' ratings of effectiveness (Gladstein, 1984), and with manager-rated effectiveness and members' satisfaction (Campion et al., 1993) but not with objective measures of performance. In a study comprising production teams, Seers et al. (1995) found that a leader training intervention was associated with increased satisfaction and increased productivity over time. Finally, in a comparative study of self-managing and traditionally managed work teams, Cohen et al. (1996) found that a combination of several contextual factors - management recognition, feedback, and training – was positively related to quality of work life in both types of teams, and to manager's rating of performance in self-managed teams.

Organizational culture is another dimension that may have an effect at team level. West et al. (1998) suggest that the relation between group processes and outcomes will change depending upon the cultural context. They point out a few studies that show differences in the way teams work depending on the cultural context they are embedded in. For example, the social loafing effect found in western cultures does not exist, and sometimes is reversed, in China and Israel.

As a final point, an already cited large-scale study of top management teams (Simsek, Veiga, Lubatkin & Dino, 2005) found that previous firm performance was positively correlated with top management team behavioral integration. Moreover, firm size was negatively correlated with the integration of team members' behavior, while firm age had no correlation with the way managers cooperated, exchanged information, and made joint decisions within the teams.

Processes

Team processes represent the mechanisms that determine whether team members are able to successfully combine their capabilities and behavior into some kind of functional output. If the team wishes to be effective, the processes working within the team must be running smoothly. Bales (1953) suggests that group interaction processes can be organized into two types: expressive processes that account for social and emotional relationships among team members, such as affect, conflict, and support; and instrumental processes that are beneficial for the task performance, such as information exchange, problem-solving, and goal definition. A variety of team processes have been identified within the organizational psychology literature, including communication, leadership, group norms concerning the production, social norms, norms about resources allocation, cohesion, and group potency. I will next review the group processes that have been more central in work team research programs.

Communication research has examined information transmission within teams and across team boundaries, mainly in project teams. Communication in teams includes quality and rate of information exchange among team members, patterns of communication, and boundary spanning behaviors. Allen (1977) examined the information flow between technical development teams and found that communication with individuals external to the team was associated with successful project performance. In the same vein, Ancona and Caldwell (1992a) investigated the boundary spanning behaviors of product development teams and reported that behaviors involving political activities such as lobbying for resources, reporting progress to higher levels in the organization, and determining whether the company strategy may affect the project were the dominant communication pattern of successful product development teams. In another study, Katz and Tushman (1979) found that in high performing research groups, all members communicated intensively with each other. They also found different patterns of communication in different types of R&D teams. For example, development teams had much more boundary spanning behaviors than research teams. On the other hand, one of the few studies that not involved project teams reported that communication frequency was negatively related to performance (Smith et al., 1994).

Communication was also studied regarding its relationship with group member's well being. Yammarino and Naughton (1988) found that groups of law enforcement agents that spent more time communicating were more satisfied with their work. In a study involving hospital workers Rosse, Boss, Johnson and Grown (1991) also reported that communication quality was negatively correlated with

burnout. However, frequent communication is not always positive. Sonnentag (1994) reported that under a stressful situation even positive interactions within the group might put additional demands over team members and thus enhance burnout. As with other group processes, more studies of communication patterns in work groups are required.

There is substantial evidence of the influence *leadership* have on team performance. In a study involving military teams, Eden (1990) demonstrated that groups trained by leaders with high expectations performed better on physical and cognitive tests. Another study showed that leader contingent reward was positively related to group productivity and cohesion (Podsakoff & Tudor, 1985). Also, Cohen, Ledford and Spreitzer (1996) demonstrated that leader's self-management encouraging behaviors were correlated with manager ratings of performance in self-managing teams. The influence of leader's mood on group members' behavior was also studied. George and Bettenhausen (1990) observed that store managers' positive mood was negatively associated with members' turnover. On the other hand, Griffin, Patterson and West (2001) reported that manufacturing companies with higher use of teamwork also exhibited lower levels of supervisory support, which in turn contributed to decreased levels of job satisfaction, since supervisor support was positively related to job satisfaction. A promising classification of team leaders' behavior, distinguishing between managing, coaching, and leading behaviors, is proposed by West and colleagues (West, 1994; West & Markiewicz, 2004). As follows, team leader's management competencies include setting clear and shared objectives, clarifying the roles of team members, designing meaningful

tasks for team members, evaluating individual contributions, providing feedback on team performance, and reviewing team processes, strategies and goals. Likewise, team leader coaching competencies comprise active and open listening, recognizing and revealing feelings, giving feedback regarding individuals' behavior, and working with team members to establish specific, measurable and achievable goals. As a final point, team-leading competencies involve creating favorable performance conditions for the team, building and maintaining the team as a performing unit, and coaching and supporting the team.

Of the variables concerning intragroup relationships in this research literature, *cohesion* is among the most studied predictors of performance. A number of studies with different kinds of teams found cohesion to be correlated with performance (Gillespie & Birnbaum, 1980; Greene, 1989; Keller, 1986). On the other hand, a similar number of studies found no relationship between cohesion and performance, or with other outcome measures such as turnover (David, Pearce & Randolph, 1989; George & Bettenhausen, 1990; Labianca, Brass, & Gray, 1998; O'Reilly et al., 1989). Other studies found cohesion to be positively associated with other types of outcome, such as prosocial behavior (George & Bettenhausen, 1990) and behavior toward customers (Kidwell, Mossholder, & Bennett, 1997). A meta-analysis by Mullen and Copper (1994) found a consistent and significant relationship of cohesion and team performance in studies comprising a variety of groups. However, the direction of the effect was stronger from performance to cohesion than in the opposite direction, thus suggesting that a good performance can lead to increased cohesion which in turn

may lead to higher morale and satisfaction (West et al., 1998). The relationship between group cohesion and performance appears to be a non-linear one. A more recent meta-analysis showed that the relationship between cohesion and performance was moderated by interdependence. Tasks that required higher levels of coordination, communication, and joint performance monitoring had stronger correlation between cohesion and performance than tasks with lower levels of interdependence (Gully, Devine & Whitney, 1995).

Group potency was described by Guzzo, Yost, Campbell and Shea (1993) as the collective belief in a group that it can be effective (p.87). Guzzo and colleagues (1993) stated that potency refers to a shared belief about general effectiveness across multiple tasks encountered by groups in complex environments. Group potency differs from collective efficacy in a number of ways. First, potency is a shared belief in a group while group efficacy concerns individual's beliefs not necessarily shared by others (Guzzo et al., 1993). Thus, group potency is not simply the aggregation of individual-level beliefs about the group's capability to be effective. According to Guzzo and colleagues (1993), assessing a group's potency requires that: 1) the questions asked of members must be about the group; 2) measures must discriminate among groups; and 3) agreement among group members must be demonstrated. A second important difference between group potency and collective efficacy is that group potency refers to a more general capability belief across tasks, while collective efficacy is usually considered to be task-specific (Guzzo et al., 1993; Lindsey, Brass & Thomas, 1995).

Group potency and collective efficacy both appear to be grounded in the theory of self-efficacy (Lindsey et al., 1995), which holds that self-efficacy beliefs have an important role in the self-regulation of behavior (Bandura, 1991, 2001; Wood & Bandura, 1989). The self efficacy mechanism functions in a number of ways. First, self-efficacy influences an individual's choice of activities. Second, self-efficacy beliefs influence the level of effort that people will expend in an activity. Third, self-efficacy influences the attributions people make for failure and consequently their emotional reactions to failure. Finally, self-efficacy influences an individual's goal level of aspirations. Although group potency is rooted in theory of self-efficacy, it is more complex because it occurs within the group context. Thus, what was an external influence on self-efficacy becomes an integral component of shared efficacy beliefs in groups (Mischel & Northcraft, 1997). Group potency evolves from interactions among group members who collectively process information about the group's task, context, processes, and performance (Gibson, 1999, 2001). According to Gibson (1999), these collective processes do not occur during self-efficacy formation or when members form individual beliefs about their group. Thus, group-level capability beliefs are at least partially socially constructed and are shaped by social influence and social comparison processes that should lead to a consensual version of collective efficacy (Lindsey et al., 1995). Guzzo and colleagues (1993) stated that groups must have at least a minimal amount of potency before they can be effective, and suggested that excessive, unrealistic potency may have a detrimental effect on effectiveness. A number of studies have shown group potency to be positively related with effectiveness (Campion et al.,

1993, Gibson, 1999; Sosik, Avolio & Kahai, 1997). In a similar manner, a number of studies reported collective efficacy to be correlated with objective measures of performance (Campion et al., 1993, 1996; Hyatt & Ruddy, 1997), observer-ratings of team performance (Edmondson, 1999), and managers' ratings of effectiveness (Campion et al., 1993, 1996; Hyatt & Ruddy, 1997; Little and Madigan, 1997).

Group norms are guidelines for acceptable and unacceptable behavior that develop through interactions among group members and are informally agreed on by group members. Some are actively transmitted (e. g., explicit statements, rituals) whereas others are passively transmitted (e. g., nonverbal behaviors, imitation). Any punishments for not complying with norms come from social networks as opposed to formal systems established by the organization. Despite the fact that the concept of norms has been used to inform many theories of group behavior, relatively little empirical research has examined how norms develop and are transmitted (Cialdini & Trost, 1998). According to Hackman (1992), group norms are one of the most efficient and powerful ways for a group to influence member behavior. Bettenhausen and Murninghan (1991) stated that norms are among the least visible and most powerful forms of social control over human action. Shamir (1990) stated that an explanation of collectivist work motivation requires an understanding of the normative framework within which the relevant behaviors are to be carried out. Thibault and Kelly (1986) viewed norms as social inventions that accomplish more effectively what otherwise would require informal social influence and sustained that norms protect individual group members from

overthrow to some capricious exercise of power.

Scholars have defined group norms in a variety of different ways, but they seem to agree on certain key aspects: 1) norms specify expected behavior, 2) group members accept these norms, and 3) groups will enforce these norms (Goodman, Ravlin & Schminke, 1987). Norms are seen to permit a range of behaviors, which vary in degrees of conformity to norm. Non-conformity to norms is expected to lead to reduced attraction by the group toward non-conforming members and in some situations, to negative sanctions against the non-conforming members (Goodman et al., 1987; Nemeth & Staw, 1989).

Norms serve a variety of different functions, including regulating group member behavior (Bettenhausen & Murninghan, 1991; Hackman, 1992; Thibault & Kelly, 1986), reducing uncertainty and ambiguity (Feldman, 1984; Goodman et al., 1987; Thibault & Kelly, 1986), expressing central values of the group, facilitating group survival, helping the group avoid embarrassing interpersonal problems (Feldman, 1984), and allocating position, status, and resources within the group (Goodman et al., 1987).

Goodman and colleagues (1987) proposed a typology of norms for group and organizational settings. This typology consists of norms concerning production processes, informal social arrangements, and allocation of resources. Each of these three types of norms will relate to group effectiveness differently (Goodman et al., 1987). Production processes deal with group standards (e.g. outputs), instrumental task behaviors (i.e. how to perform the job), and indirect production (i.e. communication, helping behavior, coordination relating to the task). Norms

about group outputs and task behaviors should be more strongly predictive of group effectiveness than indirect production norms (Goodman et al., 1987). Informal social arrangements norms deal with group maintenance activities such as interpersonal relationships and social activities that keep the group together but that do not necessarily relate to the instrumental aspects of the group. Because informal social norms do not directly prescribe appropriate task-related behaviors, they would presumably only indirectly influence group effectiveness. The allocation of resources such as position and pay can be determined by using an allocation norm that is either equity-based, or needs based. Resource allocation norms will primarily influence member satisfaction, which in turn may enhance group effectiveness (Goodman et al., 1987). Unfortunately, there is not much research on the influence of group norms in team effectiveness. A few studies, however, appear to support the relevance of group developed norms to team performance. In a study involving 48 teams of undergraduate students working on a course assignment, Janicik and Bartel (2003) found that high levels of initial temporal planning contributed to the formation of time awareness norms, which in turn mediated a negative relationship between temporal planning and coordination difficulties, as well as a positive relationship between temporal planning and task performance. In another study, mood-regulation norms (norms that guide the breadth (type of moods), depth (number of nuances in behavioral expression), or intensity (how strongly it is expressed) of moods that members exhibit while performing their tasks) were generally associated with mood convergence in work groups, especially in high arousal mood conditions. Other studies have reported

associations between norms for innovation and innovative outcomes in teams (Carter & West, 1998; West & Anderson, 1996). These relationships will be further explored in the next chapter.

Summary of Current Research and Suggestions For the Future

Research on work team effectiveness has succeeded in identifying a number of factors that undoubtedly influence team performance. It also supported the functional assumption that is possible to develop team working in order to ensure high levels of effectiveness. Tannenbaum, Salas and Cannon-Bowers (1996) systematize a number of interventions to improve teams' effectiveness that illustrates the diversity and thoroughness of work team research in the last twenty-five years. However, despite the considerable number of theoretical propositions of team functioning, there have been only a few attempts to empirically test whole models (exception as are for example Campion et al., 1993; and Gladstein, 1984). The ongoing research on the lookout for the knowledge, skills, and attitudinal competencies underlying teamwork has served to provide guidelines for future research. For example, Salas, Cannon-Bowers and colleagues attempted to organize the identified multiple skill competencies that lie beneath teamwork around eight major dimensions: adaptability, shared situational awareness,

performance monitoring/back-up behavior, team leadership, interpersonal relations, coordination, communication, and decision-making (Salas et al., 2004, p.53). From a theoretical point of view, Wittenbaum et al. (2004) exhort researchers to move further from group outcomes related to task performance and effectiveness, into the exploration of other outcomes such as member satisfaction and learning, group solidarity and viability, and organizational level consequences. In a similar vein, more research is needed that adopts a contingency perspective on group functioning. The group organization and processes that are required to account for different types of task has received some although not enough attention (McGrath, 1984; Steiner, 1972). Other examples of teamwork contingency factors that deserve to be investigated are the external conditions on which teams operate, be it organizational or environmental. West (2002) gives some examples of research that link environmental demands with levels of participation in health care teams, and with technological innovation in manufacturing organizations. Another example of contingency-based research is proposed by Anderson, DeDreu and Njstad (2004) within what they called a distress-related innovation model. Drawing upon that model, I suggest we can look at distress as a contingency factor of group processes and performance. For example, it could be very useful to identify what type of group characteristics are more effective in dealing with turbulent environments. Similarly, one could set out to examine how distress at the individual level (negative mood states, role ambiguity) hinders group performance, or how distress at group level (work overload, task conflict) impacts team self-regulation.

Chapter Summary

This chapter examined the literature that relates to study of teams in organizational context. In the first section definitions of work team were discussed and comparisons between the concepts of team and group in organizational contex were made. In the next section a functionalist perspective was adopted to examine the most studied team inputs and processes and their relationship with diverse team outcomes. The major findings were discussed and some guidelines for future research proposed. In the next chapter the literature about innovation at the team-level is examined in detail.

CHAPTER 3

TEAM-LEVEL INNOVATION RESEARCH

Chapter Structure

Chapter 3 examines the literature that relates to the study of teamwork innovation. The first section covers definitions of innovation and describes innovation as a two-stage process made up of generation of ideas and implementation of ideas. In the following section an input-process-output framework is adopted to help organize the extant literature on team-level innovation in work contexts. The final section of the chapter proposes a process model of team innovation that introduces the concept of sharedness processes as group interaction processes that promote the exchange of ideas, information, knowledge, and representations among team members. Moreover, the model describes a process by which teams attempt to regulate their action vis a vis the accomplishment of the team goals. Finally, seven hypotheses are proposed that account for the relationship between team goals, sharedness process, reflexivity, and team innovative performance.

A Definition of Innovation

Today's highly competitive and rapidly changing business environment clearly favors those organizations that can implement deliberate changes in anticipation of opportunities and threats posed by the environment. Innovation is a critical aspect of this deliberate change (Anderson, 1992; West & Anderson, 1996) and is seen as crucial for an organization's ability to successfully compete and to survive (Angle & Van de Ven, 2000). As the environment changes, organizations must also change to adapt to the new conditions. Therefore, innovations are a means of introducing changes to the products, structure, or processes of an organization in order to facilitate the adaptation process (Damanpour, 1987). Innovation is a lever for producing change in organizations, either as a consequence of changes in its external or internal environment, or as an anticipating action to influence the environment (Damanpour, 1991). Innovation also occurs at the individual level, often initiated by a perceived need to change some aspect of work arrangements (Farr & Ford, 1990). It is, however, at the group level that innovation more often emerges in organizations, whether in top management teams, multiprofessional health care teams, or R&D teams.

Innovation can also be viewed as a product. In order to understand the factors, personal and organizational, that rests beneath the innovation process we must first define what an innovation is. Amabile (1988) argued that we should start by identifying a product or idea that can be considered creative and move from there to examine the personal qualities, the environmental factors, and the

though and social interaction processes corresponding to the production of those ideas or products. According to her, we could resort to the opinion of experts to identify a creative product or idea.

Innovative products have been broadly categorized as being technological, administrative, or ancillary (Damanpour, 1987; Damanpour & Evans, 1984; King, 1990). Technological innovations involve the use of a new tool, technique, equipment, or system. These technological innovations produce changes in how a product is made or in how a service is delivered. Administrative innovations pertain to the social domain of an organization, its structure and administrative processes. This type of innovations includes the structuring of tasks, personnel scheduling, and incentive systems. Ancillary innovations are organization-environment boundary innovations that involve joint efforts between organizational members and costumers or clients (Damanpour, 1987, p.677). An example of ancillary innovation would be a costumers focus group generating and proposing ideas for a new product or service. These categories of innovations, although developed for the organizational level of analysis, are also useful in describing types of innovation that can occur at the work group level.

Integrating Idea Generation and Idea Implementation

The terms creativity and innovation have been used interchangabely to refer to the introduction of new ideas by individuals or groups that may translate into new

products or organizational processes (Mumford & Gustafson, 1988; Woodman, Sawyer & Griffin, 1993). With the increase in amount and diversity of research in innovation and creativity in the organizational context, a distinction between the concepts of creativity and innovation, and a better operationalization of both constructs was needed. Amabile (1988) proposed that was imperative to distinguish between creativity and innovation for they were different processes that were impacted differently by organizational and individual factors. Assuming the perspective of creativity as a product of the mind, single and collective, Amabile (1988, p.126) defined creativity as "the production of novel and useful ideas by an individual or small group of indivduals working together". Therefore, the term creativity was reserved exclusively for the process of generating novel and useful ideas, leaving the term innovation to the successful implementation of creative ideas within the organization.

This distinction between idea generation and idea development and implementation contributed to the clarification of the innovation process and constituted a framework to organize the future research by stimulating researchers to examine what factors were focal relevant to each stage. In turn, a definition of innovation that encompassed both stages and accounted for the distinct courses of action that took place at different levels in the organization was required.

West and Farr (1990) faced the challenge and proposed what is now a generally accepted definition of organizational innovation as:

...the intentional introduction and application within a role, group or

organization of ideas, processes, products or procedures, new to the relevant unit of adoption, designed to significantly benefit the individual, the group, the organization or the wider society. (p.9)

The most salient attributes of this definition are the idea of cyclical process, the notion of intentional benefit, and the source of innovations. First, West and Farr emphasize the need to contextualize the novelty of ideas at the level of implementation. Idea generation is still paramount to the innovation process, as a source of plausible solutions to an identify problem, but the ideas that initiate the process can be already at work in another part of the organization or in the external environment. Second, they stress that novel ideas are good as only as they are useful, thus incorporating a dimension of intentional benefit to the process of innovation that distinguish it from inconsequential creativity or unplaned change. Third, in the definition given by West and Farr is implied that innovation in organizations is a cyclical process with clearly two stages: idea generation, and idea implementation. Although several researchers have proposed models of the innovation process that generally include recognition of a problem, initiation, implementation, and stabilization or routinization, although not necessarily in a linear order (Anderson & King, 1993; Schroeder, Van de Ven, Scudder & Polley, 1989; West, 1990) they can be organized around the core processes of creativity and innovation implementation.

Innovation is thus a process through which individuals and groups of individuals attempt to change some aspects of their work or their work products in order to gain some benefits for them or others inside and outside the

organization. Some of these benefits are higher productivity, better service quality, safer products, more environment friendly production procedures, better working conditions, and improved interpersonal processes.

West and Farr (1990) distinguished innovation from creativity by referring to creativity as the ideation component of innovation and to innovation as encompassing both the proposal and application of new ideas (p.10). Furthermore, they stated that innovation is a social process with the elements of the process being events that occur between people, whereas creativity is an individual cognitive process in which events occur within the person (p.11). Finally, Rosenfeld and Servo (1990) referred to creativity as the starting point for innovation and innovation as the hard work that follows idea conceptions and usually involves the labor of many people with varied, yet complementary, skills (p.25).

Group innovation thus involves both individual and group-level activities and integration processes. In general, ideation must begin with individuals, who then choose whether to offer their creative ideas to the group for further discussion and development (Drazin, Glynn & Kazanjian, 1999; Rosenfeld & Servo, 1990, West, 1990). Individuals can also help sustain the innovation process by offering ideas on how to develop and implement the ideas of other team members (Hackman & Morris, 1975; King & Anderson, 1990; Weldon, 2000, West, 1990). After an idea has been proposed to the group, it can be rejected or chosen to be further developed by the group. Presumably, the group will want to invest more time in discussing, developing, evaluating, and

implementing ideas that are perceived to lead to some outcome desired by group members (Drazin et al., 1999; Farr & Ford, 1990; Ford, 1996), for example, improved productivity or product quality, or better working conditions. The group interaction process may also involve negotiations among group members who have different ideas about how to proceed with solving their groups problems, or who have different or competing interests at stake (Anderson, 1992; Drazin et al., 1999; King & Anderson, 1990; Nystrom, 1979).

Ideas for innovation need not originate within a group. The group may borrow and adapt a useful idea from another group or organization. A certain group engages in the process of innovation simply by adopting and modifying a procedure to fit their own work, whether it is a police squad or an R&D team. An authority outside the group may mandate that the group adopt a new process or technology. In this case the idea is imposed upon the group and this has limited choice whether to implement or not the technology. In this case, the group may still take creative action in order to develop the best strategies to implement the idea (King & Anderson, 1990).

Problem-Solving and Creativity

Although the innovation process begins with the recognition of a problem, not all problem-solving efforts require creativity or group involvement in the development of solutions. Frequent or repetitive problems may be structured or programmed in such a way that problem-solvers will resort to rules, standard operating procedures, or an algorithm to find the best solution to a problem

(Amabile, 1988). Groups with relatively simple tasks do not generally need to discuss performance strategies; they may instead rely on standard operating procedures (Gladstein, 1984). Hackman and Morris (1975) noted that group would tend to adopt obvious or highly salient solutions rather than non-obvious solutions. The obvious solution will tend to acquire valence quickly, and perhaps gain adoption before the non-obvious solution is even considered (Hackman & Morris, 1975, p.52). Thus simple and repetitive tasks and problems will not likely require creativity or group problem solving, since the solutions are reached through the application of some pre-determined rules or procedures.

Other types of problems, especially those that are novel and unstructured, may likely require creativity and intuition of the problem-solvers (King & Anderson, 1990). In these types of problems the best solution may not be so clear-cut, especially when the consequences are difficult to predict and there is disagreement or conflict over the proposed solutions. When these types of problems are complex in nature and require information not possessed by a single decision-maker, a group problem-solving effort may be appropriate. The group may, however, still rely on the application of rules or tried-and-true solutions rather than through the development of creative alternatives to the problem (Hackman & Morris, 1975). Thus, decision-makers are sometimes faced with making a choice between habitual action (i.e., following standard operating procedures) and creative action (i.e., solving the problem in a novel and useful way).

When discussing innovation as an outcome of work group processes it is

useful to discuss the criteria for good innovation. According to West (1990), when assessing innovation we should consider quantity of as well as quality of innovations. Quantity of innovation is simply the number of innovations successfully implemented by the group. Quality of an innovation can be assessed in relation to its newness, to its significance, and to its effectiveness. Group factors may differentially influence quantity and quality such that some factors may influence quality but not quantity, while other factors may influence both.

A Framework for Team-Level Innovation

In spite of the greater attention given to the research of creativity and innovation in organizations, little theoretical and empirical work have been devoted to develop our understanding of the processes of innovation and creativity in work groups. Researchers have placed much more emphasis studying creativity and innovation at the individual levels than at the group level (Agrell & Gustafson, 1996; Anderson, 1992; Anderson & West, 1998; King, 1995; West, 1990; West & Anderson, 1996). A review of empirical investigation into innovation in the workplace at the individual, group, and organizational levels, published from 1997 to 2002 in the top-10 rated journals in management sciences, found 15 studies. Of these, only two studies were at the group level, and two more multi-level studies included a group-level analysis (Anderson et al., 2004).

Of the published empirical research addressing innovation and creativity

at the group level, very few studied groups of workers performing tasks on an ongoing basis. Most studies appear to have focused either on management teams, temporary project teams, or problem-solving groups in laboratory settings. Moreover, much of the research as addressed creativity in groups not innovation. Although creativity and innovation in ongoing task performing groups may involve the same fundamental processes as in the more commonly studied project teams and decision-making groups, the nature of the interactions and outcomes may be substantially different due to differences in group tasks. One possible reason for these supposed differences is that ongoing task-performing groups do not exist to create new ideas. Instead, their primary duties are to perform one or more tasks related to the production of goods or services (Heinen & Jacobson, 1976). However, research & development teams and other problem-solving groups are indeed expected to be innovative. Creativity and innovation are usually an integral part of their duties.

When ongoing task-performing groups make innovations to their work processes or procedures, they are changing the way they will do their work. These changes may increase the level of uncertainty the group experiences in its work, especially when the changes require new learning and the elimination of habitual group routines. These changes may be threatening to the group, and the group may therefore prefer continuity and stability to innovation and change (Ford, 1996; Gersick & Hackman, 1990). Problem-solving teams may produce innovations that change things outside their own group and organization, but their work activities may remain untouched. For example, a given management

team may implement innovations that change a production process in the factory, but that do not necessarily impact its own work. R&D teams may develop new products that do not change the way they do their work.

On the remaining of the chapter I will present an epigrammatic review of the research concerning team innovation. I will try as far as possible to give account of research done in organizational contexts. The review will be organized from an input-processes-output perspective.

INPUTS

On the input side, group task characteristics, and group knowledge diversity and skills are the two factors that contribute the most to team innovation.

Group Task Characteristics

The task a group performs moulds the structure and functioning of the group, by defining who should be the members of the group, what tasks should they perform individually and collectively, and how should they perform them. West and Farr (1990) discussed the importance of jobs that allow discretion, provide challenge, are unpredictable (rather than routine), and include financial and technical resources. Amabile (1988) discussed the importance of discretion in determining how to perform the task and having a sense of control over one's work and ideas. Oldham and Cummings (1996) discussed the value of having complex challenging jobs rather than simple or routine jobs. Task that are

complex tend to permit a much broader range of group behaviour for task completion and often require a greater degree of problem-solving than do more routine tasks (Jehn, 1995). According to Oldham and Cummings (1996) complex jobs may actually demand creative outcomes by encouraging employees to focus simultaneously on multiple dimensions of their work, whereas highly simple or routine jobs may inhibit such a focus (p.610). Several other researchers have shown that complex, challenging jobs tend to promote higher levels of intrinsic motivation than routine, simple jobs, and consequently more innovative behaviour (Campion, Medsker & Higgs, 1993; Deci, Connell & Ryan, 1989; Hackman & Oldham, 1980; Oldham & Cummings, 1996). Finally, jobs that are complex enough to permit discretion to the jobholder will usually require more consideration about how to perform the job and will promote intrinsic motivation, which will influence creativity and innovation (Shalley, Gilson & Blum, 2000).

Not much research has addressed the influence of task characteristics on group innovative performance. In a field study with 87 teams from four industrial sectors Curral, Forrester, Dawson and West (2001) examined the impact of team task type upon group processes, by comparing teams, which had high requirements to innovate with teams with low innovation requirements. The findings showed that teams with a high requirement to innovate had higher levels of participation and support for innovation. Ito and Peterson (1986) found that task difficulty predicted boundary-spanning activity by work unit members. In an attempt to relate task technology dimensions, group processes, and measures of team performance, Keller (1994) found that the fit between nonroutineness (task

uncertainty) and amount of information processing was the best predictor of project quality in 98 R&D project groups.

Research with other types of teams, who do not have innovation as their primary task, showed that interdependence related differently with performance depending on the type of task (Stewart & Barrick, 2000). In the same vein, experimental studies showed that groups differed on their decision processes depending on the type of task - intellective vs. judgmental - they had to perform (Laughlin, 1988; Laughlin & Ellis, 1986). These and other results relating task type, and group processes and outcomes suggest that task characteristics such as autonomy, completeness, varied demands, opportunities for social interaction, opportunities for learning, and development possibilities will predict team innovation and are, therefore, worthy to investigate (West, 2002).

Group Composition

Group compositions an important dimension of work groups that includes group factors such as size, and diversity of knowledge, skills, and demography.

Team size appears to have a complex relationship with innovative performance. Reviews by Agrell and Gustafson (1996), Anderson (1992), and Payne (1990) suggested that the relationship between group size and innovation is moderated by group cohesion. When groups are highly cohesive, size and innovation are more strongly related then when groups have low cohesion. Large groups have the advantage of having more members and therefore more possibilities for idea generation, but when the large group has little cohesiveness,

intra-group communication will be poor and creative ideas will not be proposed or discussed in an effective manner. Therefore, when cohesion is low, small groups are more effective than large groups (Payne, 1990). The relationship between team size and other group processes have also been observed. In a study with service teams, Curral et al. (2001) found that larger teams had poorer integrating group processes than smaller teams. However, team size was a negative predictor of group processes only in teams who had a high requirement to innovate, such as pharmaceutical R&D teams, and advertising teams. The relationship between team size and innovation is supported by other findings. In a study with top management teams in hospital, West and Anderson (1996) reported that team size had no significant effect on overall innovation, except for radicalness where larger teams introduced more radical innovations.

Diversity of knowledge and skills has a number of different facets that are related to creativity and innovation. Bantel and Jackson (1989) found that top management teams in banks were more innovative when they had diverse functional backgrounds. Ancona and Caldwell (1992a) found that product development teams with greater functional diversity received higher managerial innovation ratings than teams with less functional diversity. Tenure diversity was positively related to group processes, which were positively related to members' self-ratings of performance. In spite of this, the direct effect of diversity on team performance was negative. It seems that groups with more diversity of knowledge domains and skills tend to be highly creative (Dunbar, 1995). The positive impact of diversity on creative problem solving can be attributed to the

notion that heterogeneous groups will bring diverse perspectives to the problem. Having diverse perspectives will also facilitate the group's discussion and evaluation of alternatives, since it is expected to increase the group's ability to anticipate all possible costs, benefits, and side-effects (Jackson, 1996; Nystrom, 1979; Paulus, 2000). Group diversity may also have some negative influences on group creativity and innovation.

Diversity in work groups may increase interpersonal conflict and reduce intra-group communication because of perceived differences in values, attitudes, and perspectives about the work (Ancona & Caldwell, 1992b; Jackson, 1996; Jehn, Northcraft & Neale, 1999). Although low diversity can lead more to conformity than integration, high diversity may impede the development of shared mental model of the group and the task needed to coordinate efforts to innovation (West, 2002). When intra-group conflict does not get resolved in a positive way, group members may experience negative affective states regarding their group members with whom they differ (Jackson, 1996). This will likely lead to reduced cohesion in the group and, consequently, less effective communication (Nystrom, 1979). Diversity may also inhibit technical communication within the group, particularly when the group members have not learned each other's or the group's technical language. This situation, however, should not persist long in highly interdependent groups, since interdependence creates strong incentives for current members to help new members overcome language and skills deficiencies that would impede the group's performance (Zenger & Lawrence, 1989).

More recently, a trend emerged on diversity research that argues for the combination of various dimensions of diversity into a single global index as a way to deal with the differential effects various dimensions of diversity may have on different types of teams or situational conditions (Flynn, Chatman & Spataro, 2001; Lovelace, Shapiro, & Weingart, 2001; Schippers et al., 2003). That approach may become relevant in studying the relationship between diversity of knowledge and skills, and innovation at group level, since knowledge diversity in a team can be assessed through different measures (e.g., education, team tenure, teamwork experience). In a recent study with health care teams González-Romá, West and Borril (2002) found the same pattern of association between each of several measures of team composition and team innovation. Specifically, a U-shaped relationship.

PROCESSES

Group researchers generally view group interaction processes as mediating the influence of group inputs on group outputs (for a review see Gladstein, 1984; Guzzo & Shea, 1992; Hackman, 1987). This input-process-output framework appears to be the dominant way of thinking about groups in organizations. Group interaction processes include the exchange of information (Gladstein, 1984; Guzzo & Shea, 1992; West & Anderson, 1996), social influence (Guzzo & Shea, 1992), group leadership (Guzzo & Shea, 1992), the expression of approval or

disapproval of group members (Guzzo & Shea, 1992), participation in decision-making (West & Anderson, 1996), boundary management (Ancona & Caldwell, 1992; Gladstein, 1984), and support for group-related behaviour (Campion, Papper & Medsker, 1996; Gladstein, 1984; West & Anderson, 1996).

Group interaction processes are necessary for the group to transform individual inputs into group outputs such as innovation. Although a number of studies have addressed group influences on creativity, few have studied group-level innovation and those few have focused primarily on antecedent approaches to group innovation rather than on the group processes itself (see reviews by Agrell & Gustafson, 1996; Anderson, 1992). Among the studies addressing creativity and innovation in groups, scholars have especially emphasized the role of climate (Anderson & West, 1998; Amabile et al., 1996; Tierney, 1999; West & Anderson, 1996), group communication behaviours (Ancona & Caldwell, 1992; Firestein, 1990; Smith, 1993), group goals (Anderson & West, 1998; Burningham& West, 1995; West & Anderson, 1996), group cognitive style (Hammerschmidt, 1996; Tierney, 1997), problem-solving orientations (Tjosvold & McNeely, 1988; Scott & Bruce, 1994; West, 1990), quality of team-member relations (Scott & Bruce, 1994; Tierney, 1999), group support for innovation (Burningham& West, 1995; Curral et al., 2001; West & Anderson, 1996), and minority dissent and influence (De Dreu & West, 2001; Nemeth & Owens, 1996; Van Dyne & Saavedra, 1996). Drawing on the model of team innovation proposed by West (2002), I will review the integrating group processes that have been shown to have a consistent relationship with team innovative performance.

Team Goals

Innovation teams face the following dilemma: since group diversity promotes creativity but also can reduce cohesion and intra-group communication, how do we get diverse people in groups to openly discuss their ideas and consider differing, often opposing, perspectives? Tjosvold and colleagues stated that one way to resolve this problem is to ensure that group members have cooperative goals regarding their work, rather than independent or competing goals. In addition to cooperation, group members must feel their personal competence is confirmed rather than doubted and that they and other group members are open to mutual influence during the group process (Tjosvold & McNeely, 1988, ,Tjosvold, Wedley & Field, 1986).

The effects of goals on performance have been studied for a long time in the laboratory and in the field. One experimental study found that group goal setting led to higher performance than did individual goal setting (Matsui, Kakuyama & Onglato, 1997). Two complementary processes were offered to explain these results. Group goals were more difficult than their members individually set goals, and even higher than their sum. Findings suggest that participants in the group goal condition strove for higher goals than did participants in the individual goals condition, thus resulting in higher performance. Concurrently, goal acceptance means was significantly higher for the group goal condition than for the individual goal condition. The effects of goals on performance become increasingly complex as the task complexity

increases. Wood and Locke (1990) remark that more complex tasks - as the kind that are involved in innovation - depend less on general task planning and require more task specific plans for effective task performance.

Ensuring clarity of team objectives is likely to facilitate innovation by integrating knowledge diversity to develop new ideas. Moreover, commitment to those objectives is necessary in order to maintain member's perseverance in the face of resistance to change that is customary in innovation implementation processes (West, 2002). A few studies succeeded in demonstrating the impact that clear objectives have on innovative performance. Hirst and Mann (2004) found task communication to be positively associated with project performance of Australian R&D teams. Clarity of objectives, feedback, information transmission and understanding of costumer requirement taken together were a strong predictor of team members, and manager's ratings of performance. Clarity of objectives alone was significantly correlated with team performance across the first three time periods. In a large study of project teams, Pinto and Prescott (1987) discovered that a clear vision for the project was the only predictor of success at all stages of the innovation process. Team members who do not have clear objectives, or objectives at all, seem to have difficulties in coordinating their efforts and diverse knowledge, thus hindering the innovation process. In a study with engineering teams, Tamhain and Wilmon (1987) found that unclear objectives was the most significant barrier to technical success, while proper direction and leadership had the strongest positive relationship with success. A second study found similar factors to be determinants of innovative performance

in self-directed engineering teams (Thamhain, 1996). Research in other contexts has also emphasized the role that clarity of and commitment to shared objectives play in the innovation process. Studies with management teams (West & Anderson, 1996), health care teams (Borril et al., 2000; González-Romá et al., 2002) supported this association between objectives and innovation.

Participation

Participation in groups includes the frequency members interact; how they exchange information, and their influence in decision-making (West, 1990). These behaviours can contribute to high levels of creativity and idea implementation generation by bringing diverse perspectives to discussion, generating more feedback and therefore making a better evaluation of different solutions (Mumford & Gustafson, 1988). Of the many factors that influence R&D team innovation, those relating to information processing and communication have been identify as one of the most important (Tushman & Katz, 1980; Pelz & Andrews, 1976). For example, Keller (1994), li a longitudinal study with R&D project groups, reported that the amount of information processing in a group - measured by information communicated within the group, the R&D unit, and the company, and outside the company - predicted project quality at time one and one year later, and also predicted budget-schedule performance at time one. Also by participating in decision-making team members invest more in the implementation of the solutions (King, Anderson & West, 1992).

Another way participation may contribute to innovation is by social

comparison. Groups can use social persuasion to promote self-efficacy in members by providing realistic encouragement to attempt challenging or new tasks (Farr & Ford, 1990; Wood & Bandura, 1989). Groups can also enhance an individual self-efficacy for change by providing positive and realistic feedback; by clarifying tasks, and by helping develop group member's task and creativity-related abilities (Redmond, Mumford & Teach, 1993). In a similar mode, an individual can increase his self-efficacy by modeling the behaviour of group members who are particularly good at implementing change (Farr, 1990). Groups can influence the perceived payoff from change by providing verbal and material support for change efforts, and constructive feedback relating to the change effort (Farr & Ford, 1990; West & Farr, 1990). These types of support represent one form of payoff from group members, which may help offset or diminish the risk and cost of failure (Farr & Ford, 1990).

Groups can influence the individual's ability to generate new and useful ideas by offering relevant information and multiple perspectives for the individual to consider. This requires that the group members have the motivations and cognitive abilities to consider diverse information and perspectives (Paulus, 2000). Recent research advocates that groups can be, under certain circumstances, highly effective in generating ideas, with no need to have individuals producing ideas in isolation to be further discussed by the group (Paulus, Dugosh, Dzindolet, Coskun & Putnam, 2002).

The innovation process in groups necessarily involves the group evaluation and feedback of the creative ideas put forward by group members.

This evaluation and feedback regarding an individual's creative ideas can exert relatively powerful influences on whether an individual will offer the idea to others for consideration (Amabile, 1988; 1996). For example, when evaluation and feedback by the group threatens self-determination or the experience of competence, the individual's level of intrinsic motivation will be reduced, consequently inhibiting creativity (Amabile, 1996; Woodman et al., 1993). Thus, even though individuals may generate creative ideas, they may not be willing to propose their ideas to the group because they want to avoid threatening evaluations and feedback. Thus participation is only beneficial for innovation if the team as a safe and supportive climate (West, 2002).

Overall, participation seems to be a crucial integrating process for teams concerned with generating and implementing novel ideas. A few studies with teams from diverse work context testify the strong link between group participation and innovation (Burningham & West, 1995; Borril et al., 2000; Carter & West, 1998; Curral et al., 2001; De Dreu & West, 2001; West & Anderson, 1996; West, Patterson & Dawson, 1999).

Support for Innovation

According to Farr and Ford (1990), the perceived payoff from change can be influenced by people in the immediate work unit, including supervisors and group members. This influence is mostly done through the groups support for innovative actions taken by individuals. This support must be expressed not only by means of verbal encouragements, but also through the distribution of unit-

level resources and other valued outcomes, that may include time and physical resources, rewards, constructive feedback, and recognition (p.71). Hackman (1987) argued that group norms that support innovation can influence group members to actively look for opportunities and constraints in their work and can help members avoid enacting habitual patterns of behaviour. Breaking-out of habitual routines is essential for creativity and innovation to occur (Ford, 1996; Gersick & Hackman, 1990; Drazin, Glynn & Kazanjian, 1999), but habitual routines can be hard to brake, especially when the routine behaviours are under normative control (Gersick & Hackman, 1990). Thus, group norms that resist looking for opportunities and ways to change aspects of the group's work will inhibit creative and innovative action within the group.

Several researchers have specifically addressed linkages between group norms and group creativity and innovation. West and Farr (1990) noted the importance of group norms for innovation that reinforced risk-taking and attempts at innovation. Ford (1996) stated that groups could facilitate creative behaviour by developing group norms encouraging thinking and creative intentions. Amabile (1996) suggested that norms encouraging mutual openness to, and constructive challenging of, ideas would promote creativity in groups. West (1990) developed a theory of innovation in work groups that included norms of innovation or the expectation, approval and practical support of attempts to introduce new and improved ways of doing things in the work environment (p.315). West (1990) suggested that these norms of group support for innovation include: 1) verbal support within and outside group meetings; 2) group and

interpersonal cooperation in the development and application of new ideas; and 3) the provision of time and resources by the group members to develop and apply ideas. West (1990) argued that it is useful to differentiate between articulated (e.g. verbal) and enacted support because a group may express support for new ways of working, but do not give practical support to the implementation of those ideas. Thus, it is one thing to ask or expect group members to generate creative ideas, but quite another thing to actually spend group resources on supporting those ideas. This suggests that articulated support encourages group members to generate ideas and share them with the group, but that enacted support is necessary to make the ideas a reality. West and Anderson (1996) found group support for innovation to be an important group process predicting innovation in top management teams. This group support for innovation is particularly important in group settings, since an idea to change some aspects of the work may be met with resistance by group members who will be impacted by that change. A lack of group support for innovation is therefore likely to be a significant impediment to individual attempts to innovate in a group setting (Amabile, Conti, Coon, Lazenby & Herron, 1996; Burningham & West, 1995; Curral et al., 2001; West, 1990; West & Anderson, 1996).

Conflict Management

Group norms that encourage conflict avoidance within the group are also detrimental to innovative action (Ford, 1996), as are norms that inhibit dissent and independent though (Nemeth & Owens, 1996; Nemeth & Staw, 1989). Janis

(1982) work on groupthink showed that strong normative pressures toward conformity and consensus can influence members to avoid critical scrutiny of ideas and opinions championed by the group or a majority in the group. As a consequence, group members will tend to believe in the soundness of whatever proposal is promoted by the leader or by a majority of the group members (p.190). One negative result of this lack of critical scrutiny is poor decision quality (Tjosvold, Wedley & Field, 1986; Whyte, 1989).

Neck and Manz (1994) argued that teams also adopt though patterns, either negative or positive, that tend to guide their behaviour. Group though patterns that emphasize constructive ways of handling problems would tend to reduce the incidence of groupthink and would encourage consideration of divergent views, open expression of ideas, awareness of limitations, and discussion of collective doubts (Neck & Manz, 1994). Group norms that reinforce these constructive thought patterns should also promote creativity and innovation in the group, since group innovation relies on the open discussion and consideration of divergent views. Research has shown that group members who experience these conditions are more willing to openly express their views, question each other about their ideas, actively work toward mutual gains, and integrate their ideas to develop novel solutions (Tjosvold, 1998; Tjosvold & McNeely, 1988). This positive interaction within the group, described by Tjosvold, Wedley and Field (1986) as constructive controversy, allows the group to take advantage of its diversity while working on common problems. The open, constructive discussion and development of ideas within a group should help the

group avoid groupthink and other decision biases that occur in social situations due to excessive pressure towards conformity and the avoidance of conflict within the group. Because constructive controversy means the group is carefully considering a broader range of ideas and perspectives, the quality of then group's innovation should be better that when the group avoids controversy (Agrell & Gustafson, 1996; Tjosvold & McNeely, 1988; West, 1990).

Several studies have linked constructive controversy to innovation. Tjosvold and McNeely (1988) found that when organization members perceived that their goals were cooperative, rather than competitive or independent, they tended to express their views more openly, considered others opinions, and worked for mutual gain. These interaction behaviours were positively associated with self-reported creativity and quality of solutions developed by the organization members in the study. West (1990; 2002) considered a related construct called task orientation which was defined as a shared concern with excellence and quality of task performance in relation to shared vision or outcomes, characterized by evaluation, modifications, control systems and critical appraisals (West, 1990, p.38). Task orientation may be evidenced by constructive challenges to the group's goals, strategies, processes, and performance and by setting high standards of performance. Thus, task orientation includes the notion of constructive controversy as well as orientation toward excellence (West, 1990; West & Anderson, 1996). Field studies found task orientation to be positively associated with the administrative efficiency of innovations - an indicator of innovation quality - made by team managers in hospital settings (West &

Anderson, 1996), and with overall innovativeness of diverse work teams (Burnigham & West, 1995; Curral et al., 2001).

Minority Influence

Pressures to conform to majority views are another reason why individuals may be unwilling to offer their ideas to the group. According to Jehn (1995), group pressure toward agreement can stifle the creativity needed to perform nonroutine tasks effectively, because members will focus on building consensus instead of generating creative ideas. Nemeth and colleagues (Nemeth & Owens, 1996; Nemeth & Staw, 1989) stated that strong normative influence from majority coalitions in groups could promote conformity and reduce dissent within the group, in essence suppressing divergent ways of thinking about the group situation. This can result in group behavioural and decisional rigidity rather than on change (Nemeth & Staw, 1989). Individuals who hold divergent, minority opinions may choose to keep their ideas to themselves in order to avoid disapproval by the group, or because they do not trust their own intuition. On the other hand, people exposed to a minority that is consistent and confident in the presentation of arguments, tend to change their views (Nemeth & Owens, 1996; Nemeth & Staw, 1989). Minority dissent is expected to be important to creativity and innovation because it induces greater cognitive effort in seeking out other information and in considering divergent viewpoints (De Dreu & West, 2001; Nemeth & Owens, 1996; Schweiger, Sandberg & Rechner, 1989), both of which should positively relate to the quality of solutions and innovations (Farr, 1990;

Van Dyne & Saavedra, 1996; Nemeth & Owens, 1996). Thus, groups that attempt to prevent minority dissent deprive themselves from hearing about divergent, possibly better ways to solve problems or to be innovative.

The suppression of minority dissent in the workplace leads to reduced creativity and innovation (De Dreu & De Vries, 1993). Minority dissent, however, seems to depend upon other group processes, such as interaction frequency and information sharing, to influence the production of innovative outputs. In a study with service teams, De Dreu and West (2001) found that minority dissent predicted team innovation only in high participative teams.

Psychological Safety

A number of scholars have pointed to the importance of a safety climate in the group (Edmondson, 1999; George, 1990; Kahn, 1990; Nystrom, 1979; Smith, 1993; West, 1990, West & Anderson, 1996). Nystrom discussed psychological safety as an environmental condition favourable to creativity. In addition, Nystrom (1979) argued that a strong feeling of group cohesiveness could enhance a member's sense of psychological safety, perhaps because the group is fairly homogeneous in certain respects relevant to the problem (p.57).

Smith (1993) stated that when group members feel their group climate is unsafe, they would experience less psychological freedom to take risks and share their ideas. He posited that a group member's perceptions of safety could be damaged when a group member discounts her idea. Discounting occurs when the group, or an individual in the group, verbally or non-verbally punishes or

diminishes the verbal and non-verbal behaviour of a group member (Smith, 1993). An example of a discount would be to ridicule a person's idea or ignore a person's input to the group discussion of ideas. The receiver of the discount may interpret the same as a personal criticism and may therefore act defensively and retaliate, setting-up a cycle of discounting and retaliation. Discounting thereby influences the interactions within the group, changing the group's orientation from a collaborative problem-solving effort to one of interpersonal conflict (Smith, 1993).

George (1990) coined the term group affective tone to refer to homogeneous affective reactions within a group. She argues that if members of a team experience similar affective states, positive or negative, than it makes sense to talk about affect at the group level.

Kahn (1990) viewed psychological safety as a key psychological condition mediating the influence of interpersonal relations, group and inter-group dynamics, management style and process, and organizational norms on an individual's psychological engagement at work. Kahn (1990) defined the experience of psychological safety as feeling able to show and employ one's self without fear of negative consequences to self-image, status, or career (p.708). According to Kahn (1990), groups create contexts in which members feel more or less safe in taking the risk of expressing their views and take on the process of change. Since innovation in groups involves both self-expression and change, psychological safety should directly influence an individual's willingness to propose their creative ideas to group scrutiny.

Edmondson (1999) developed a similar construct called team psychological safety, which she defined as a shared belief that the team is safe for interpersonal risk taking (p.354). Team psychological safety should facilitate team learning because it alleviates excessive concerns about others reactions to actions that have the potential for embarrassment or threat, which learning behaviours often have (Edmondson, 1999). Two factors that influence team psychological safety are context support, and team leader coaching. Context support includes adequate resources, information and rewards, while team leader coaching refers to a style of team leadership that involves coaching and support of team members. Team learning involves asking questions about the situation, seeking feedback from team members, experimenting with changes, and evaluating the results (Edmondson, 1999). Since innovation in groups often involves trial-and-error learning and experimentation with alternative solutions, and requires the sharing of information within the group, team psychological safety should also be important for group innovation. In a qualitative study of hospitals implementing an innovative technology for cardiac surgery, Edmondson, Bohmer and Pisano (2001) reported that teams that successfully implemented the innovations created a climate of psychological safety, encouraged new behaviours and promoted reflective practices to improve processes. Moreover, in teams that lacked psychological safety, lower-status members refrained from making comments as they were afraid of what experienced might think of them.

West (1990) addressed the importance of participation safety in group innovation, described as a construct in which the contingencies are such that involvement in decision-making is motivated and reinforced while occurring in an environment which is perceived as interpersonally non-threatening (p.311). Participative safety may be promoted by encouraging group members to be actively involved in decision-making and by permitting risk-taking and tolerance for failure (West, 1990). Participative safety has been shown to have a positive impact on work group innovation (Bunce & West, 1995; Burningham & West, 1995; Curral, Forrester, Dawson & West, 2001) because it will reduce resistance to change and promote greater investment in decision outcomes, and will therefore facilitate the generation and offering of creative ideas by group members (Anderson & West, 1998; West, 1990, 2002).

Reflexivity

West and colleagues (West, 1996; West, Garrod, & Carletta, 1997) suggested that top management teams, primary health care teams, project teams, and research teams are examples of complex decision-making groups because they operate in uncertain, unpredictable environments, work with complex technology, have to perform complex task whose requirements change on a daily base. To deal with that uncertainty and complexity, complex decision-making teams need to develop a reflection-on-action process. West (1996) called reflexivity. He defined group reflexivity as "the extent to which group members overtly reflect upon the groups' objectives, strategies and processes, and adapt them to current

or anticipated endogenous or environmental circumstances" (pp. 559). Reflexive teams would be more adaptive to in the way they perform the task and therefore more effective when operating under more dynamic conditions.

Group reflexivity encompasses three kinds of collective action: reflection, planning, and action and adaptation. Reflection entails behaviours such as questioning, exploratory learning, evaluation, diversive exploration, making use of knowledge explicitly, learning at a meta level, and awareness of past and future events. Planning is characterized by inclusiveness of potential problems, detail, hierarchization of plans, and long as well as short range planning. During reflection, alternative courses of action can be envisaged, intentions formed, detailed plans elaborated; and decisions may be converted into action. Adaptation is reached through continuous cycles of adaptation, planning, and action (West, 1996; 2001). Reflexivity seems to be ideal mechanism for groups to self-regulate their action toward established goals. Reflexive groups might focus upon and attempt to change the appropriateness and clarity of goals; the effectiveness of group strategies or plans for achieving goals; the group's decision-making, communication, controversy, and self-appraisal processes; or the impact environmental factors, like technology, reward system, or intergroup relations have on the group. West (1996) proposes that in complex decision groups reflexivity will have a positive direct impact upon group task effectiveness and group social processes (social support, conflict management, support for member growth, and management of group climate). Reflexivity will also have an indirect effect on team members' mental health by means of task effectiveness.

Eight year after these propositions very few studies have addressed the impact of reflexivity upon team performance. West (2000) makes a synthesis of the research, manly conducted in the laboratory, that somehow support the relationship between reflexivity and effectiveness, but not a single study addressed the relationship between reflexivity and innovation in real groups. However, the existing research with teams has so far evidenced a promising role for reflexivity in explaining the effectiveness of complex making-making teams. In a study with television production teams, Carter and West (1998) found that reflexivity was a best predictor of team effectiveness, measured by audience appreciation and manager's ratings, than measures of team climate for innovation or team size. Another study found that reflexivity mediated the combined effect of diversity and goal interdependence on team members rating of satisfaction and team performance (Schippers, Den Hartog & Koopman, 2003). One study that involved students working in project groups also found a positive relationship between reflexivity and group performance (Gevers, Van Eerde & Rutte, 2003). Although no measures of innovation were used, reflexivity was found to contribute to project progress in the execution phase but not in the orientation phase.

Summary of Current Research and Suggestions for the Future

The research on group-level innovation over the past twenty years has highlighted the group characteristics and processes that invigorate the generation of novel ideas, and the adoption and implementation of solutions to organizational problems and challenges. Some of these factors are well grounded in research. Clarity and commitment to goals, high levels of information sharing and participation in decision-making, strong support for innovation, or constructive controversy are definitely common processes in high achievers. Others revealed to be too complex or ambiguous. It is not clear yet when is diversity an asset or a hindrance in teams' innovative performance. Other dimensions have been neglected and need more research. Different task types seem to require different group processes for effectiveness and innovation, thus a dexterous taxonomy is needed to help organize research. Also, minority dissent and affective climates in groups deserve more attention. Other dimensions are emerging as promising candidates to explain further why some teams are better than others at innovation, although much research is needed. Reflexivity as a group level self-regulation process is probably the most elegant and constructive concept in team performance theory to appear in the last fifteen years. Finally, the impact of external demands on group functioning have been, until recently (for a review see West, 2002), absent from team innovation studies, although recent research suggests that environmental demands interact with

team functioning to spur or disincentive innovation in health care teams (West, Utsch, Borril & Dawson, 2002).

So far, innovation research as established clear but simple relationships between constituent factors defined to be predictors of innovation and consensual criteria of innovative performance. Although this effort allowed researchers to set practical recommendations to improve team innovative potential in real organizational contexts, from a theoretical point of view we need to construct dynamic models that reciprocally link the processes of the group to its task and to its external environment (West, 2002). Very few attempts have been made to model innovative behaviours of work teams. Except for the more general models of organizational innovation that integrate group characteristics at the mezzo level of analysis (e.g., Amabile, 1988; Woodman, Sawyer & Griffin, 1993), and the attempts to model de development of innovation ideas (e.g., Schroeder, Van de Ven, Scudder & Polley, 1989; King, 1992), only three proposed models specifically addressed the integration of group factors that promote innovation as a group outcome. The first proposition was a simple but heuristic model that portrayed the differential effect of four group processes in the quantity and quality of innovation produced by groups (West, 1990). This model guided a considerable number of studies on team innovation. The second proposition was an attempt to comprehensively describe how variables at the individual and organizational levels interacted with group variables to impact the innovative outcomes of the group. This model considered the influence of beneficial and non-beneficial dimensions on three types of innovative outcome:

implement, abandon, or neglect innovation (Agrell & Gustafson, 1996). As far as I know, this model was never tested, maybe due to the extensive number of variables involved.

Recently, West (2002) proposed a more elaborated model of group innovation that also attempts to integrate variables from different levels. One major difference from the previous models is that it manages to integrate variables from the individual and organizational levels of observation into a strictly group level of analysis, either by aggregating individual characteristics like skills into a group variable like diversity, or by delimiting an organizational level variable such as external conditions to the dimensions that may have a direct impact at the team level (e.g. ratio of patients per doctor). The second difference is that the model specifies more complex relations between the clusters of variables, than simple correlations, thus contributing to the complexity requisite of group innovation theory (Nijstad & De Dreu, 2002). For example, it is propose that group knowledge diversity should have an inverted-U relationship with integrating group processes (West, 2002, p.364). This model has already received substantial empirical support (for a review see West, 2002).

For the future, we need to understand the more complex relations between the integrating group processes we already know. For example, do all processes have the same kind of influence on the outputs? Do high correlations between processes mean they influence each other or that they share a common influence from other variable? Also, we need more models that account for the differential patterns of relations between group characteristics, processes, and

outcomes for different task types and environmental conditions. Finally, we need more research.

What should change in our research about group level innovation? Anderson, De Dreu and Nijastd (2004) reviewed published research on innovation in the top-10 journals of organizational psychology over the last 5 years to provide a snapshot of the current state-of-the-science of innovation research, and to suggest some innovative pathways for future research.

Three issues are, in my view, paramount to the future of group innovation research. The first one concerns cross-national generalizability. One question that must be answered is whether the effects in innovation research found in North American samples could be replicated in European and Asian contexts. A few studies have hinted at the relative influence of cultural dimensions such as individualism vs. collectivism on the way innovation processes unfold. To further consolidate our understanding of innovation processes more research is needed across different cultural contexts.

The second theme focuses on the development of team processes and performance through time. Specifically, the dynamic inter-relations between team processes over time (Gersick, 1988; Marks, Mathieu & Zaccaro, 2001). Time is a central factor in team maturation, process, and effectiveness by the external contingencies it puts on collective task performance, as well as by the punctuation it puts on the group process itself (for a review see Salas et al., 2004). Future research should take into account the complex dynamic processes that take part in the effects inputs have upon processes and outputs; the long-run

dynamics of group development; and the changes in the group composition, task, goals, and context (McGrath & Argote, 2003).

Finally the third theme focuses on bringing more emphasis to team coordination and adaptation as the core of team effectiveness. One approach to understand what happens at the members' interaction level might be to focus on shared cognition. That is, how sharedness of mental models about task, technology, team interaction, and problems can facilitate team coordination, and therefore team effectiveness (Marks, Sabella, Burke & Zaccaro, 2002; Mathieu, Heffner, Goodwin, Salas & Cannon-Bowers, 2000; Mohammed & Dumville, 2001; Moreland, Argote & Krishnan, 1996). Sharedness of mental models would give team members a common framework, which facilitates the perception, interpretation, and response to the environment in a coordinated way that promotes effectiveness. A complementary approach would be to theorize and investigate metacognitive and self-regulatory processes at the team level. Such processes allow teams to become self-learning, and adaptive (Kozlowsky, in press). Some studies have already started to address this issue (for a review see Salas et al., 2004).

Outline of a Process Model of Team Innovation

The literature review demonstrated that research as been insofar more concerned with describing what group factors influence innovation and less with how group factors affect innovation. For instance, a handful of group inputs and processes are now consensually considered to be good predictors of team innovation, but very few is known about how these group processes interact to take advantage of team members expertise to produce a new product. Another example of unexplored territory is the process through which a team thrives in a context of uncertainty, that is characteristic of the innovation process, to successfully achieve a desired outcome. I will try to shed some light on the process by which team members put their individual resources to the benefit of the team, by focusing my analysis on the interrelations among group processes.

Researchers have suggested that in order to perform intellectual tasks, groups have to collectively process relevant and available information. This research has concentrated on the complex information processing underlying group performance of cognitive tasks, such as problem solving, judgement, and decision-making (Hirokawa, 1990; Larson & Christensen, 1993; Laughlin, VanderStoep & Hollingshead, 1991; Levine, Resnick & Higgins, 1993).

Information processing at the group-level can be defined as the degree to which information, ideas, or cognitive processes are shared, and are being shared, among the group members and how this sharing of information affects

both individual- and group-level outcomes. The shared information can concern the task, characteristics of the group, aspects of group members, the pattern of interaction within the group, or the context of the group (Hinsz, Tindale & Volrath, 1997).

Sharing some form of knowledge seems to be a necessary, although not sufficient, condition for a group to perform a task. Tindale and Kameda (2000) argue that things that are shared to a greater degree within groups have greater influence on the relevant group outcomes than those things that are less shared. Moreover, the degree of sharedness affects how groups reach consensus in terms of preference, how they use and share information, how group members define themselves, which members and arguments are most influential during discussion, and how members coordinate activities. What information is shared and how it is shared among group members seems to affect group effectiveness. Schneider (2000), suggested that when individuals come to share the meaning of a situation than we can talk of the psychological life of the situation. He goes further to propose that when there is sharedness of the psychological life of organizations, that psychological life is a property of the organization.

Stasser and Titus (1985) found that on decision-making tasks, groups discussion contained mainly information shared by all members, and that shared information was more likely to be used to make a decision than unshared information – known as the common knowledge effect - even when the shared information is incorrect or insufficient (Gigone & Hastie, 1996). Processing information at the group level implies the knowledge and cognitive processes that

group members have in common when they come into a group interaction (shared), as well as the information and ideas they exchange (being shared) during the process of task performance. It is the interaction process itself that constitutes the means by which ideas, resources, information, norms, or strategies are exchanged among group members. Thus, when groups have well developed interaction processes that facilitate sharedness, they are more likely to use the unique knowledge team members have to group advantage. For example, a few studies have shown that unshared information becomes more prevalent in group discussion over time (Larson, Foster-Fishman & Keys, 1994), and that assigning team members expert roles led to more discussion of unshared information (Stewart & Stasser, 1995). Another area where sharedness seems to be important for group performance is task representations, where different types of tasks require different decision processes. For instance, Laughlin (1980) demonstrated that majority rule models under predicted group performance in problem solving tasks when compared to 'truth wins' models. Tindale and Kameda (2000) suggest that whenever a shared task representation exists, alternatives consistent with it will be easier to defend – even in a minority position - and thus more likely to end up as the groups' collective choice. On the contrary, the absence of a shared task representation will lead the group to a majority rule decision process.

Hinsz and colleagues (1997) suggest that the share and sharing aspects of group information processing are separate but interdependent. Shared information refers more to the important contributions (resources, skills, ability,

and knowledge) group members bring with them to the group interaction and task, while the information being shared refers to the process involved in the way these various contributions are combined (aggregated, pooled, or transformed) to produce the group-level outcomes.

Team members sharing ideas, information and knowledge in order to produce a new product, process or procedure represent the core of the innovation process at group level. Hence understanding how a group processes information and how this process is affected by the group structure and dynamic is paramount to comprehend how innovation develops within groups. When reviewing the literature on group-level innovation, we can see that the contribution dimension of group information processing can be better approached from an inputs diversity perspective – the diversity of knowledge or experiences members bring to the group may constitute a facilitator or an hindrance of group innovation - while the combination of contributions feature is better understood from an integrating group processes perspective – diversity of knowledge is a facilitator only when the group can bring that diversity into discussion. It is the combination dimension of group information processing that is of major interest in this dissertation, and consequently the integrating group processes that enable it. Research have been thriving in identifying the factors of group dynamics that influence the innovative performance of work teams, but, so far, only a few researchers have made an effort to propose models of team innovation that account for the complex relations between group-level predictors (e.g., group characteristics and processes) and innovative outcomes (West, 2002).

Accordingly, Nijstad and De Dreu (2002) recognize that previous research has not been very effective in portraying this complexity, by focusing on the analysis of main effects in disregard of interaction and mediation effects. They urge us to give more attention to interaction effects in the future as a way of deepening our understanding of innovative groups.

The challenge I set myself in this dissertation is twofold. First, to understand whether there is a differential influence of sharedness processes – group processes that promote ideas, information, and knowledge sharing among team members - on idea generation and product or process implementation. West (2002) argues that creativity (idea generation) is likely to be most evident in the early stages of the innovation process, when teams are required to offer ideas in response to a perceived need for innovation, while innovation implementation starts only after the ideas have been thoroughly discussed and selected. Therefore, it is reasonable to assume that some group processes may have a differential impact on those two stages. Second, to understand the relation among group processes, namely between reflexivity and goals, and reflexivity and sharedness processes. Reflexivity is by definition the extent to which team members reflect upon group objectives and processes, and adapt them to changing circumstances (West, 1996). Therefore, its role seems to be more important as a self-regulation mechanism than as a direct predictor of team innovation.

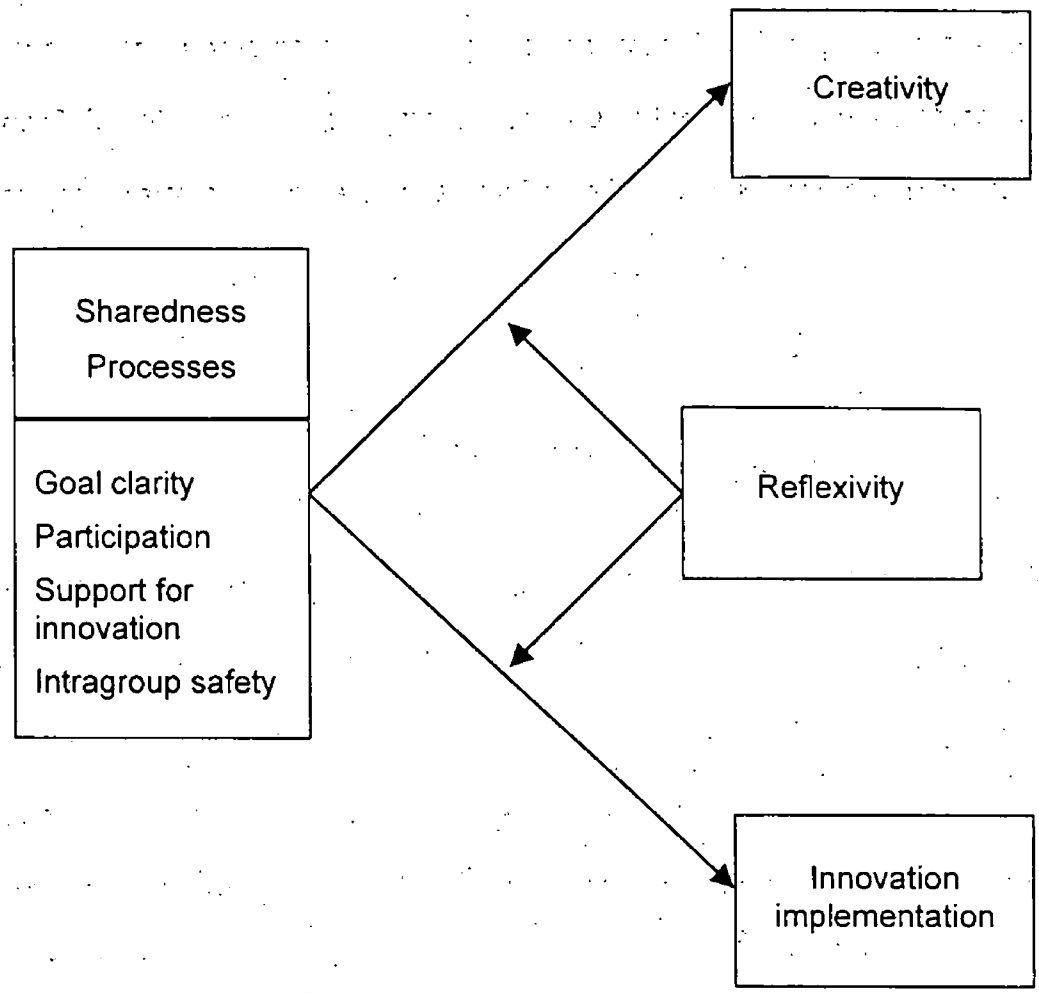


Figure 3.1. A proposed process model of team innovation

For the remainder of the chapter I will propose a information sharing model as a rationale for the comprehension of how group integrating processes facilitate the combination of information that group members possess to develop ideas and to successfully apply those ideas for new and improved products,

services, or ways of working (West, 2002). I found this model useful for two reasons: (a) it gives a distinct role to sharing in the process of group performance of complex cognitive tasks; and (b) it presupposes that the different group interaction processes have differential roles in the same performance process.

Sharedness Processes

I argue in this dissertation that group sharedness processes are necessary for group-level innovation because they allow teams to better take advantage of their members' knowledge and competences. By sharedness processes I mean those integrating group processes that facilitate the exchange of ideas, information and knowledge among group members in order to successfully accomplish the group's task. Goal clarity and commitment, participation, support for innovation, and developing intragroup safety are examples of such processes. These sharedness processes may have a direct effect on the performance of the team by stimulating its members to bring relevant information to the discussion, as well as an indirect effect through their interaction with other group processes.

One example of the way through which sharedness processes may influence team performance is evident in the concept of transactive memory (Wegner, 1997). Team members shared experience is associated with a team's performance through the development of a system that helps members get access to information possessed by each other. As people work together on

group tasks, they not only acquire more information about those tasks themselves, but also discover whatever relevant information other group members possess. When these two kinds of information are combined, a transactive memory system becomes available for use by the group. Such a system combines the knowledge possessed by particular group members with a shared awareness of who knows what (Moreland, Argote & Krishnan, 1996). So when group members need information they don't have they can turn to another group members for help. Transactive memory systems should be helpful, particularly in groups that perform complex knowledge intensive tasks such as the ones involved in innovation, by providing access to more information than any particular member could bring to the group. Therefore, the more time team members spend working together at similar or related tasks, the more likely it is the team develops a transactive memory system, which in turn will facilitate group performance (Moreland et al., 1996). Several studies, with problem-solving groups, suggest that groups learn to make better use of their members' knowledge over time (Watson, Kumar & Michaelsen, 1993; Watson, Michaelsen & Sharp, 1991). On the other side, these collective memory systems may be seriously interrupted when knowledgeable members leave the team. Studies with mine crews support the idea that turnover may disrupt these information sharing systems, thus affecting the team's performance and members well-being (Goodman & Garber, 1988; Goodman & Leyden, 1991).

At the team level, setting clear objectives has been considered an important determinant of the task performance of teams (O'Leary-Kelly,

Martocchio & Frink, 1994). Clear goals are likely to result in higher effectiveness because teams are provided with clear directions and therefore are better able to determine appropriate procedures, allocate tasks, and focus their effort on getting the job done. Setting clear goals is of particular importance for teams with innovative tasks, because goal setting works to reduce uncertainty about the qualities of the expected output. In the innovation context, several studies with project teams showed that clarity of objectives was among the major factors influencing innovative performance. Some of the studies demonstrated that clarity of objectives (Hirst & Mann, 2004; Marshall & Lowther, 1997; Pinto & Prescott, 1987) was one of the most important factor differentiating successful and unsuccessful teams in producing innovations. Conversely, Thamain and Wilemon (1987) found that the most significant barrier to innovation in engineering teams was unclear objectives.

Commitment to group objectives is also necessary, for it encourages team members to put their maximum effort to develop strategies to attain these goals (Locke, Shaw & Latham, 1981). In innovation teams, goal commitment is even more detrimental to success, because team members need to persist against error and failure in the discovery process, and against organizational resistance (West, 2002). At least one study with R&D teams found the importance of goals for team members to be a key factor for project success (Taylor, Snyder, Danke & Kuether, 1995). More recent studies included measures of both clarity and commitment to team goals in predicting innovative performance. For example, studies with different teams in a hospital context provided unambiguous support

for the association between goal clarity and commitment, and high levels of team innovation (Borril et al., 2000; West & Anderson, 1996).

For team members to contribute to the successful achievement of goals, they have to believe that the goals are realistically attainable. Through the sharedeness processes team members can cooperatively operationalize the team goals and thus gain confidence in the team ability to accomplish the established objectives. Furthermore, high levels of sharedness also imply that team members are on the same wavelength with each other and are more likely to trust other team members' assessments regarding the attainability and realism of their goals, thus enhancing the probability of successfully achieving set goals.

Participation encompasses two distinct but interrelated processes, which are open discussion and influence in decision-making. Open discussion refers to whether there is frequent, free and comprehensive discussion of ideas amongst team members, and whether individuals perceive they are welcomed to contribute information, knowledge and opinions to team discussions. The more information team members bring to the group, the more knowledge is available for the team to develop new ideas and to produce high quality solutions. Hence, the existence of processes that stimulate team members to share information are paramount to the development of ideas with greater likelihood of being implemented. In addition, the more frequent and openly team members interact, the more opportunities they have to integrate diverse perspectives, generate feedback and therefore making better decisions. Tjosvold (1985) argues that because people understand opposing ideas and information, they are able to see

the limitations in their views and incorporate other arguments. Ideally, team members combine the best ideas and most reliable information to make a high quality decision. Moreover, sharing information among individuals with different perspectives will foster the emergence of more and different solutions. Several studies with brainstorming groups suggest that open discussion can lead to high levels of creativity, given team members are provided with high comparison standards (social comparison processes may motivate individuals to perform at high or low levels depending on the comparison standard) and individual feedback (Paulus et al., 1996; 2002). In addition, functional interaction theory (Hirokawa, 1990) argues that, the more a decision-making task requires the exchange of information among its members and requires the members to collectively process information, the more important communication is for the group to succeed at the task.

Another facet of participation that may facilitate the sharing of information, ideas and opinions is the amount of influence team members have in decision-making. Influence in decision-making refers to whether the contribution of all members are discussed, respected and taken into account in the team decision process. The implementation component of the innovation process requires team members to evaluate the ideas generated and being generated by each other, as well as knowledge and new ideas on how to transform the original ideas in new products or processes. Thus, due to time, budget, and management pressure, idea implementation tends to impose higher demands upon team members in terms of investment, resistance to frustration and persistence. When team

members have some degree of influence in decision-making they are more motivated to invest in the outcomes of those decisions, taking their efforts farther and reducing their resistance to introduce changes. Influence in decision-making may be seen as the motivational force that stimulates group members to share their ideas and knowledge, as a way of ensuring the success of the innovations they are attempting to introduce. The positive relationship between participation and innovation as been empirically established in several studies (Burningham & West, 1995; De Dreu & West, 2001, Keller, 1994).

Support for innovation is another group process that facilitates the sharing of ideas and opinions. Within groups, individuals may perceive an immediate payoff from attempting to introduce some kind of innovation, from the support they get from other members. This support may include verbal encouragements and practical help from co-workers in developing new ideas. Hence, support for innovation may be operationalized as the expectation, approval, and practical support of attempts to introduce new and improved ways of doing things in the work environment (West, 2002). The expectations that individuals may hold about each other's role within the team can influence team members to look for opportunities and constrains in their work and environment and can also help team members to breakout of habitual routines, which is essential for creativity and innovation to occur (Drazin et al., 1999). Concurrently, the approval of one member suggestions and opinions by the other members is a strong stimulant for that member to continue proposing new ideas, as well as discussing the ideas introduced by other members. Thus, when creative thinking is expected and

approved within the team, members feel more encouraged to share their ideas with the other members, regardless of how different they are from others ideas. As with participation, verbal support for innovation can directly influence the team innovative outcomes by encouraging members to bring radical ideas into discussion, and also can influence team goals clarity and commitment by stimulating members to openly contribute to their definition (Pearce & Ensley, 2004).

The practical dimension of support for innovation seems to be of most importance for the implementation of ideas. Practical support includes interpersonal cooperation in the development and application of ideas, as well as the provision of time and other resources by group members (West, 1990). By providing help and resources to each other, members increase the likelihood of being successful in developing new products, or introducing new ways of doing the work. The argument behind this association is that two heads, and often two arms, are better than one. That is to say that the advantage of having members with diverse knowledge and competences can only be put to the team's service if individuals effectively cooperate with each other to solve the problems. This suggests that verbal support through expectations and approval encourages team members to generate ideas and share them within the group, while practical support is necessary to make those ideas work (Carter & West, 1998; West & Anderson, 1996). Finally, another consequence of the practical support for innovation in a team is that gives team member the opportunity to exchange information, knowledge, and ideas, thus contributing to an increased level of

sharedness within the team.

Intragroup safety refers to the sense of psychological safety group members feel in the presence of their fellow group members and specially during group interactions. It includes the concepts of safety climate, and group affective tone (West, 2002, pp. 374). Team psychological safety describes the extent team members perceive an interpersonal climate of trust and support, and therefore do not feel threaten when exposing their ideas or disagreeing with other team members opinions. West (1990) suggested that this safety climate might have a facilitating effect on the innovation process by allowing team members to take risks and come forward with more radical ideas and opinions. Edmondson and colleagues suggested that a safety climate is associated with innovation because it helps promote a learning environment where team members learn about the causes of their errors and devise innovations to prevent future errors (Edmondson, 1996); and also because a safety climate encourages new behaviours and promotes reflective practices (Edmondson et al., 2001).

The affective dimension of safety refers to consistent affective reactions within a group. George (1990) argues that if members of a team feel energetic and comfortable, then the team itself can be considered energetic and comfortable as well. She argues further that because similar people with similar affective reactions were expected to be found within work groups, it was hypothesized that they would behave in similar ways. Kelly and Barsade (in press) suggest that individual level affects combine to form the affective composition of the group. This group level affect develops as group members

share their affective experiences. Affective sharing, in turn, may occur through processes of emotional contagion, behavioral entrainment, affect modeling, or through a more conscious process of affective impressions management. More recently, George and Zhou (2001) tried to shed some light on the potential relationship between group affective mood and innovation. Hence, they suggested that positive moods tend to be associated with people being more confident in their efforts to date because their positive feelings serve as a cue or signal that everything is going well. On the contrary, negative moods signal that the status quo is problematic and that additional effort needs to be exerted to come up with new and useful ideas. Consequently, under these conditions, negative moods may be positively associated with creativity because individuals in negative moods are exerting more effort and trying harder to come up with truly new and useful ideas. Conversely, positive moods may be negatively associated with creativity because individuals in positive moods are confident in their ongoing efforts and do not feel the need to try harder.

Although the process by which positive and negative tone affects creative behaviors begins to be acknowledged, I would like to focus more on the contribute that a group affective tone might have on the sharing process. Two distinct processes may lead team members to share information, ideas, and knowledge. One process refers to the direct influence of mood on individual behavior. It seems that, during interactions, individuals with a positive mood are more willing to cooperate than individuals with a negative mood. Thompson, Nadler and Kim (1999) maintain that, when planning negotiation strategies,

positive-affect individuals predict using more cooperative strategies than do negative-affect individuals, while negative-affect individuals intend to be more competitive than positive-affect individuals. Additionally, positive-affect individuals when involved in a negotiation tend to overestimate the likelihood that the other negotiators will be cooperative, and rate themselves as more trusting, thus leading to a more cooperative orientation. The second process relates more directly to the unique contribution every member brings to the team. Apparently, a positive mood fosters individuals to exchange more information. Carnevale and Isen (1986) found that positive-affect individuals involved in a negotiation propose more alternatives, make more requests for their opponent's reaction to offers, and propose more trade-offs than individuals with a neutral mood. Additionally, individuals with a positive affect engage in more information exchange and show better recognition of integrative solutions than those in a negative mood.

When we think of the innovation process as a continuous negotiation of ideas, opinions and suggestions, it is easier to understand that the more members in a team are in a positive mood, generally described by feelings of enthusiasm, optimism, calm, and comfort, the more individuals are engaged in cooperation, in trading opinions, ideas and knowledge, and therefore the higher is the level of sharedness in the team (Kelly & Barsade, in press). In two laboratory studies, Barsade (2000) found that emotional contagion occurred between members of a group, and that this contagion influenced the group's processes, with contagion of positive emotions leading to improved cooperation,

decreased conflict and increased perception of task performance. The expected increase in group sharedness promoted by the positive affective tone of the group would lead also to an increase in the innovative performance of the team. Hence, the empirically supported association between positive affect and creative problem solving in individuals could find its expression at group-level through the described sharedness process.

Consistent with these findings, the following hypothesis are proposed:

H1a: Sharedness processes, namely group goals, participation, support for innovation, and intragroup safety, will be positively associated with team's creativity.

H1b: Sharedness processes, namely group goals, participation, support for innovation, and intragroup safety, will be positively associated with team's innovation implementation.

Team Reflexivity as a Team Regulatory Process

The extent to which group members collectively reflect upon the group's objectives, task strategies, and internal processes, and adapt to current and anticipated endogenous or environmental circumstances, is named group reflexivity (West, 1996). A reflexive group is one in which team members continually assess and negotiate their representations of team task and process.

Teams cope with the uncertainty of an innovation process by being able to change their path during the process. The adaptation to changing circumstance implies the team ability to promote changes in team objectives, strategies, and processes, by means of reflection, planning, and action. By constantly monitoring and evaluating the fit between actual and desired outcomes, goal attainability and their interaction processes, teams can anticipate and detect likely deviations from the desired path. Also, teams that can develop highly detail implementation plans that include potential problems and of short as well as long range focus are more likely to effectively implement innovations than teams with vague planning (Gollwitzer, 1996). Finally, monitoring and planning can only be effective in innovation implementation only if the team is capable of exhibiting actions aimed at changing the goals, the strategies, the processes and even the environment of the team (West, 2002). Hence, drawing on Carver and Scheier's concept of self-regulation (1998), reflexivity can be conceived as a team self-regulatory mechanism, in the sense that it monitors discrepancies between current performance and goal states and activates actions to reduce the discrepancy. A few studies have suggested the direct influence of reflexivity on team innovation (Carter & West, 1998; Gevers, Van Eerde & Rutte, 2001; Hirst & Mann, 2004; Schippers, Den Hartog & Koopman, 2003), but none has considered the self-regulatory role of reflexivity. For instance, Dunbar (1996) found that scientific breakthroughs tended to occur when groups reflected upon the potential causes of unexpected or inconsistent results, thus questioning theories, proposing alternative and novel hypothesis, and modify approaches to research problems.

Moreover, reflection tended to be more effective when done by teams, in comparison with individual reflection. Although these finding illustrate the role reflexivity may have in the regulation of team processes, no consistent model has framed team reflexivity as a regulatory mechanism.

Reflexivity can regulate team processes via two complementary pathways. One way would be the direct monitoring of the discrepancy between desired goals and actual performance and likely correction through changes of task strategies, implementation plans, and environment conditions. Other way, would encompass the direct effect of reflection on the group processes, which may lead to actively changing those processes, for example increasing participation opportunities, as well as the indirect effect that collective reflection might have on the sharing of task representations and the improvement of transactive memory systems. According to West (1996), reflexive teams have a more comprehensive and shared cognitive representation of their work that enables them to be more adaptive to and more effective in the execution of their tasks, especially when operating in uncertain and dynamic circumstances.

So far, no field research as addressed that hypothesis, but at least one laboratory study provides support to the idea that reflexivity is a team self-regulatory mechanism. In testing a multiple goal, multilevel model of feedback on the regulation of individual and team performance, DeShon, Kozlowski, Schmidt, Milner and Wiechmann (in press) found that some regulatory processes may indeed influence how teams set and change their goals, whether team members are more or less committed to the team goals, and team performance. For

example, they found that feedback was shown to be a potent lever that influenced the allocation of resources among multiple goals. Specifically, feedback affected team goal commitment such that teams receiving team-level feedback were more committed to the team goals than teams receiving only individual-level feedback. The regulatory influence of team feedback is even more evident in the finding that team embers who received no team-level feedback could not effectively calibrate team-level goals and, as a result, tended to set more unrealistic team-level goals. Moreover, their results suggested that feedback moderated the relationship between certain team characteristics (e.g., mastery orientation) and commitment to team goals, such that this relationship was stronger in teams receiving team feedback than teams receiving individual feedback. Finally, the influence of feedback as a regulator of team action is manifest in the finding that teams who received only team-level feedback were more likely to focus on team performance, which resulted in the highest team performance.

Another process similar to reflexivity that played a regulatory role at team level was team strategy and team-focused effort. DeShon et al., (in press) found that teams that used more team strategies, defined as the extent to which teams actively discussed and formed task-relevant strategies for accomplishing its' goals, had the highest levels of team-oriented performance. In a similar vein, teams that invested more effort into team-oriented tasks also had the highest levels of team performance.

These findings suggest that researching the role regulatory processes

may play in the dynamics of work teams and how they might affect performance is necessary. As DeShon and colleagues (in press) point out regulatory processes may be even more important in tasks that necessitate teams to devote effort to achieving individual responsibilities, but also requires team members to coordinate and work cooperatively to deal with problems that cannot be resolved without collective effort. These task characteristics are typical of innovation teams, where members are required to give a unique contribution, either by bring new knowledge or assuming individual responsibilities, as well as to coordinate efforts in order to share information, ideas, and task representations with other team members, thus engaging in a complex interplay between individual and team choices. Consistent with these ideas, the following hypothesis are proposed:

H2a: There is an interaction between team reflexivity and clarity of and commitment to team goals such that teams high on reflexivity that have high goal clarity and commitment will be more creative than teams with clear goals and low reflexivity.

H2b: There is an interaction between team reflexivity and clarity of and commitment to team goals such that teams high on reflexivity that have high goal clarity and commitment will be better at implementing innovation than teams with clear goals and low reflexivity.

H3a: There is an interaction between team reflexivity and participation such that teams high on reflexivity with high levels of participation will be more creative than teams with high participation and low reflexivity.

H3b: There is an interaction between team reflexivity and participation such that teams high on reflexivity with high levels of participation will be better at implementing innovation than teams with high participation and low reflexivity.

H4a: There is an interaction between team reflexivity and support for innovation such that teams high on reflexivity with high levels of support for innovation will be more creative than teams with high support for innovation and low reflexivity.

H4b: There is an interaction between team reflexivity and support for innovation such that teams high on reflexivity with high levels of support for innovation will be better at implementing innovation than teams with high support for innovation and low reflexivity.

H5a: There is an interaction between team reflexivity and intragroup safety such that teams high on reflexivity with high levels of intragroup safety will be more creative than teams with high intragroup safety and low reflexivity.

H5b: There is an interaction between team reflexivity and intragroup safety such that teams high on reflexivity with high levels of intragroup safety will be better at implementing innovation than teams with high intragroup safety and low reflexivity.

Chapter Summary

This chapter reviewed the literature that relates to the study of teamwork innovation. Based on an input-process-output research was presented that linked tem characteristics and processes to innovation outcomes in work contexts. Findings of previous studies were discussed contributing to the development of the present study. Next, a model of team innovation was outlined. Based on the previous literature review of team-level innovation research, it was proposed that sharedness processes, represented by clarity of and commitment to team goals, participation, support for innovation, and intragroup safety, are essential processes for teams to generate ideas and solutions, and to implement the resulting innovations. It was also propose that these processes are regulated by the team ability to reflect upon its goals, strategies, performance, and adapt them to changing circumstances. Several hypotheses were advanced to explain the mechanisms underlying the relationship between the referred processes and team performance. In the following chapters the measures used to operationalize the variables are specified, and the model is tested on a sample of research and development teams.

CHAPTER 4

METHOD

Chapter Outline

Chapter 4 comprises five sections, presenting a description of the sample, measures and design used to test the model of team innovation, as well as the psychometric properties of the measures used to operationalize and test the same model. Section 1 describes the procedures used to recruit the participating organizations and to select the study sample. The section also includes a description of the sample in terms of its size and demographics, as well as the types of R&D projects surveyed. Section 3 describes the measures comprised in the questionnaire and its reliability. The measures used to assess the model of team innovation were adapted from existing measures with a pre-defined structure. Each of the factors was made up of one or more scales, which contained sets of questionnaire items. Some of the factors, although independent, were adapted from the same inventory, which presumed them to be highly correlated. Therefore, confirmatory factor analyses were conducted to validate the structure of the four-factor measurement model. Section 4 tests the factor structure of the processes model, highlighting the convergent and discriminant validity of the scales. The last section describes the design, drawing attention to its cross-sectional

character and briefly outlining a few methodological concerns associated with composition models.

Recruitment

The research sample was drawn from two large R&D organizations based in Portugal: Instituto Nacional de Engenharia, Tecnologia e Inovação (INETI), and Instituto Gulbenkian de Ciência (IGC). These organizations were selected due to R&D being their main activity.

IGC was founded and it is supported by a private foundation to carry on biomedical research and education. The Institute's scientific interests are focused on the genetic basis of development and evolution of complex systems, and on the genetics of complex human diseases. INETI is a research, demonstration and technological development organization, integrated within the Ministry of the Economy, whose vocation is to strengthen the potential of innovation and quality in the business community and the national technological system, in order to foster knowledge towards sustainable economic growth.

IGC is a medium size institute organized in 36 groups encompassing a diversity of research areas from evolutionary genetics to neural development, from malaria to inflammation, or from virus pathology to plant development.

IGC operates as a "host institution", offering excellent facilities and services to foreign and Portuguese research groups or individual scientists, in particular to young post-doctoral fellows who are expected to develop their projects and form their groups in complete autonomy. The institute also offers post-graduate training in biomedicine.

INETI is a large institute organized in 14 units with areas of expertise ranging from biotechnology, and chemistry to energy, and aero-spatial activities. The institute main activities include technological R&D; direct support to the government in the areas of international representation, regulatory activity of metrology, standardization and certification, and policy-making; services and contracts to private and public organizations. Considerable differences were observed within and between the two institutes. Research groups in IGC are very similar in size, composition (age, sex and education), and organization, while in INETI the units were different in size, composition (age, sex, education, and proportion of technicians to scientists), and organization.

Selection Procedures

Research entry to these two organizations was obtained by approaches made to the Director, in the case of IGC, and to the Chairman of the Board, in the case of INETI. After obtaining the agreement of the top management, each unit manager was personally approached, by e-mail or telephone, and

acknowledged of the study purpose and methodology. To those who agreed to participate in the first place, an interview was conducted in order to get better understand the work organization and the main activities of the department. In INETI, where the departments included more then one team, a second interview was conducted with each team leader in order to explain the purpose of the study and get their agreement to participate. The next step was to schedule a meeting with team members. In most cases, I was invited to join one of the team's regular meetings in order to explain the study's goals and methodology, and to answer questions about member's identification and who would get access to the data. In a few cases, an extraordinary meeting was scheduled by team leaders to present the study to team members.

Team member selection/inclusion

The determination of team membership was not always straightforward. In a number of cases, individuals were formally part of certain team but had been working with another team for more than one year. In a few other cases, individuals were members of a certain team but had projects of their own which did not share with the team. To help determine team membership, team members were asked to list the last three projects they had worked or were still working on. Also, team leaders were asked to confirm whether each member was really involved in the team's projects and therefore should be

considered an active member of that team. Another criterion for inclusion was that team members had been working in the team for at least six months. That was considered by team leaders the minimum amount of time necessary for team member socialization.

The process of recruitment of teams into the study required a considerable amount of time and effort. In the first place, every unit in both organizations was invited to participate in the study. A number of units declined to participate immediately after the first approach, others withdraw after the interview, and a few other drop out after being given the questionnaires. Since participation was dependent solely on team members' will, the final sample depended more on the researcher persuasion skills than on anything else.

Sample Demographics

The final sample was comprised of 50 teams, with a total of 239 R&D employees (including 189 team members and 50 team leaders). In addition, 7 department managers from INETI were surveyed.

The following description of sample demographics starts with the organizational structure and moves to team composition. It concludes with a description of project attributes.

Organizational Structure

The two institutes were organized in different ways. INETI has R&D departments, which do basic and applied research, and act as service providers or knowledge resources for manufacturing companies. Each department was ran by a research manager, usually a senior scientist, and included several teams. Each team had a team leader. Research managers supervised from one to ten team leaders. The departments surveyed included biotechnology, energy engineering and environmental control, electronics, renewable energy, chemical industry technologies, laboratory of industrial microbiology, training management and engineering, and technical information for industry. The IGC is structured around research groups that constitute a single team each, managed by a senior scientist. Group managers reported to the Institute director who is also a senior scientist. The IGC's scientific interests are centered on the genetic basis of development and evolution of complex systems, privileging organism-centred approaches and using experimental models that include plants, yeast, flies, frogs and mice, while working on the genetics of complex human diseases as well. The teams surveyed for this study included extra cellular matrix, genetic epidemiology, hematopoiesis, inflammation, lymphocyte physiology, malaria cell-biology, mitoses, morphogenesis, neoangiogenesis, neural crest, organogenesis, plant development, population genetics, stress & cytoskeleton, stress & transcription, theoretical epidemiology, theoretical immunology, viral pathogenesis, yeast stress.

Table 4.1. R&D classification of project teams.

Type of R&D	% of Teams
1. Basic Research: R&D that creates broad-based new knowledge	36
2. Applied Research: R&D that creates new knowledge for application to a particular problem	16
3. Development: R&D that produces new products/processes on the basis of existing knowledge	6
4. Technical Services: R&D that improves or modifies existing products or processes	16
5. Combination of different types of R&D	26

Teams

The median team size was five people (standard deviation 2.42). The minimum team size was 3 people, while the maximum was 11 people. Teams were classified by team leaders and managers concerning their predominant type of R&D activity, based on the classification system proposed by Katz & Tushman (1979). Brief descriptors of each category and the percentage of teams in each are displayed in Table 4.1. The majority of teams that participated in the study were predominantly engaged in basic (36%) or applied research (38%). Most of the teams engaged in applied

research were also implicated in development (22%). A fifth (20%) of the sample included teams working in technical services, and small amount of teams (6%) were exclusively involved with the production of new processes.

Team Member Demographics

Education level. All the 239 respondents provided the following information about education levels. Six percent of staff had finished secondary school (12 years), and received complementary technical training. Sixty nine percent of staff held an undergraduate degree in Science (usually 5 years). Seven percent of staff held a masters degree. Eighteen percent of respondents held doctoral qualifications. In brief, a considerable proportion of the R&D employees had attained high levels of education. The vast majority of the sample had attended university, with a quarter of the sample holding a post-graduate degree. The percentage of employees who held doctoral qualifications is lower than those in other countries viz. Germany (36.0%) and the USA (38.7%) (Imano, 1995), and Australia (28%) (Hirst, 2001).

Training. Participants in the study covered a range of different disciplines. The following discipline distribution was found: 39% of the sample had a life sciences background, 31% of the sample had a chemistry background, 9% of

the sample had an engineering background, 6% of the sample had a physics background, 6% of the sample had a earth sciences background, 3% of the sample had a pharmaceutical sciences background, 1% of the sample were from mathematics, and 6% represented miscellaneous areas of technical expertise.

Gender. The sample had almost twice as women as men. Sixty six percent of the team members were women. Almost half of the teams have more than 75% of women in their composition. Twelve teams were composed exclusively of women, while only three teams were composed exclusively of men.

Tenure on the team. On average team members worked in their teams for more than five years. Seventeen percent of the participants worked in their teams for less than one year. Approximately thirty five percent of the participants worked in their teams for more than ten years. Nine members had worked in the same team for twenty years (4%).

Experience in R&D teams. On average, participants had over eight years of work experience in R&D teams. Forty percent of the participants had been working in R&D teams for more than eight years. Nineteen team members had more than twenty years of R&D teamwork experience (8%). Ten percent of the participants had worked in R&D teams for less than one year.

The Measurement Model

The team processes measures and the innovative performance measures are analyzed and discussed in greater detail in this section. All the analysis were based on a sample of 239 participants, which included professionals from research and development teams in a medium size private research institute (IGC), and research and development teams in a large public research institute (INETI).

Team Process Measures

Sharedness processes. The measures of sharedness included scales for assessing the group processes that facilitated the sharing of information, goals, and representations of the team, task or context: group goals, participation, support for innovation, and developing intragroup safety.

The group goals, participation, and support for innovation scales were developed by Anderson & West (1994) and have been described in detail, along with its validity and reliability (Anderson & West, 1998), and used in different cultural contexts (Agrell & Gustafson, 1994; Curral et al., 2001).

Group goals scale contains eleven items and assesses the extent to which objectives are clear to, attainable and shared by the team members' and their perceived goal value (i.e., commitment to objectives). Example items are: "To

what extent do you think your team's objectives are clearly understood by other members of the team?" and "To what extent do you think members of your team are committed to these objectives?" Participants had to give their responses on a five-point scale ranging from 1 = *not at all* to 5 = *completely* Cronbach's coefficient alpha for the eleven items was .91.

The p*articipation* scale contains twelve items and focuses on respondent's perceptions of the level of information sharing, interaction frequency, participation in decision-making, and influence in the team. Examples of items in this scale are: "We share information generally in the team rather than keeping it to ourselves" and "Members of the team meet frequently to talk both formally and informally." The 5-point response scale ranged from 1 = *strongly disagree* to 5 = *strongly agree*. Cronbach's coefficient alpha for the twelve items was .92.

Supports for innovation was measured with an eight-item scale that surveys the levels of enacted and articulated support provided by team members' ideas for new and improved ways of doing things. Examples of items include "Team members provide practical support for new ideas and their applications" and "People in the team co-operate in order to help develop and apply new ideas." Participants gave their responses on a 5-point scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. Cronbach's coefficient alpha for the eight items was .91.

Intragroup safety was measured with six items adapted from Warr's job-related affective well-being scale (1990). The six item used were intended to

tap the group affective tone, described as consistent positive or negative affective reactions within a group (George, 1990). The items were preceded by the question, "Thinking of the past few weeks, how much of the time has your job within the team made you feel each of the following?" Examples of items include: calm, contented, optimistic, and enthusiastic. Responses were: *never*, *occasionally*, *some of the time*, *much of the time*, *most of the time*, *all of the time*; and answers were scored from 1 to 6 respectively. In the original scale these six items loaded in two complementary axes: anxiety-contentment, and depression-enthusiasm. I decided to include the six items in a single factor that explained 48% of the variance (PCA). Cronbach's coefficient alpha for the twelve items was .89.

Team reflexivity. The scale measuring team reflexivity was developed by Swift & West (1998) and details about its reliability and validity can also be found in (Carter & West, 1998). This nine-item scale assesses the extent to which team members reflect upon team's objectives, strategies and processes, and adapt them accordingly. Example items include "The team often reviews its approach to getting the job done" and "We regularly discuss whether the team is working effectively together." Participants gave their responses on a 5-point scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. Cronbach's coefficient alpha for the nine items was .83.

Team Innovative Performance Measures

Assessing the innovativeness of a team is not an easy task. Some researchers plea for a the development of an objective criteria of performance, but others recognize that certain dimensions of performance are difficult to operationalize as they are strongly linked with the context. Nicholson (1990) advocates that we should focus on the social construction of innovation as a way to overturn the problem of construct indeterminacy. He suggests that an empirical approach to innovation should start with the analysis of the cultural context where the innovation process takes place, since it is culture that gives innovation its different meanings.

Amabile (1983) also advocates adopting definitions of creativity and innovation that rely on clearly subjective criteria that are validated by a context of shared interpretations. According to her, a satisfactory way to achieve consensual validation is by the use of domain-relevant experts. I would add that these domain-relevant experts should also have a strong knowledge of the cultural context where the innovation occurs. Department managers in INETI and team leaders in IGC were selected as domain-relevant experts, with the additional advantage of having also a deep knowledge of the cultural context – which includes organization, market, and scientific community - where their teams operate. Two questionnaires were distributed to the expert raters. One questionnaire with five items intended to assess the overall innovativeness of the team based on the dimensions proposed by West &

Anderson (1996). Therefore the experts had to rate the teams on the following criteria:

Novelty, defined as how new was the team's work within its scientific/technological domain. Responses ranged from 1 = *not at all novel* to 7 = *extremely novel.*

Magnitude, defined as how great would be the consequences of the team's work to knowledge development. Responses ranged from 1 = *of no consequences* to 7 = *of very great consequences.*

Overall innovation, defined as the level of innovativeness of the team. Responses ranged from 1 = *not at all innovative* to 7 = *extremely innovative.*

Benefit to the society, defined as the importance of the team's work to the wider society. Responses ranged from 1 = *not at all important* to 7 = *extremely important.*

In the case of IGC, and because they do mostly basic research, another dimension was added: Radicalness, defined as the extent to which a change to the status quo would likely be the result of the team's work. Responses ranged from 1 = *not at all radical* to 7 = *extremely radical.* Cronbach's alpha coefficient for the five items in the IGC questionnaire was .67. Inter-item correlation was .28 and the lowest item-total correlation value was .25 (benefit to the society).

In the case of INETI, and because they do mostly applied research and development, another dimension was added to the first four: Benefit to costumer, defined as the extent to which costumers are satisfied with the

solutions/products presented by the team. Responses ranged from 1 = *not at all satisfied* to 7 = *extremely satisfied*. Cronbach's alpha coefficient for the five items in the INETI questionnaire was .83. Inter-item correlation was .48 and the lowest item-total correlation value was .34 (benefit to costumers).

The second questionnaire handed over to the experts was intended to assess the overall level of creativity of the team based on two dimensions: (1) creativity of ideas generated by the team, and (2) creativity of solutions generated by the team. Responses ranged from 1 = *not at all creative* to 7 = *extremely creative*. The Cronbach's alpha coefficients for these two items were .88 for IGC, and .69 for INETI.

Confirmatory Factor Analysis of The Group Processes Scales

The team processes' measures are analyzed and discussed in greater detail in this section. Firstly, confirmatory factor analysis (using Structural Equation Modelling) performed to evaluate the measurement model's fit to the data set is described. Secondly, issues of level of analysis and aggregation of data are discussed.

A confirmatory factor analysis model, or confirmatory measurement model, specifies the posited relations of the observed variables to the

underlying constructs, with the constructs allowed to intercorrelate freely (Anderson & Gerbin, 1988). A two-step modelling approach that emphasizes the analysis of two conceptually distinct latent variable models is proposed by James, Mulaik, & Brett (1982). The first phase involves assessment of the measurement model. That is, whether the data support the theory underlying the model; in particular, the relations between measured or observed indicators (e.g. items on a questionnaire) and the latent variables. The second phase involves structural modelling, that is specifying and assessing the hypothesized directional relations among latent variables. The aim in this section is simply to evaluate the measurement characteristics of the model.

Confirmatory factor analysis was used to assess the discriminant and convergent validity of the measurement model. Convergent validity refers to the extent to which multiple items measure a single construct (Campbell & Fiske, 1959). Discriminant validity refers to the extent to which multiple items measure separate and distinguish constructs (Campbell & Fiske, 1959).

AMOS version 5.1 was used to analyse the data. The analysis reported was based on the examination of correlation matrices. The maximum likelihood (ML) method of estimation was the preferred approach. A range of indices will be presented. One of the mostly used fit measures is the minimum value of the discrepancy (chi-square). However, several scholars argue that hypothesis test is unsuitable to model selection because it tests the unrealistic hypothesis – in most empirical work - of perfect fit. In large samples, even very small departures from the null hypothesis have a very high probability of being detected (see Arbuckle & Wothke, 1999). Other

researchers advocate the use of fit measures based on a things-could-be-worse philosophy, thus encouraging us to compare our model with a worse model, usually the independence model (Bentler & Bonett, 1980).

A few indices will help us to put the fit of our models into perspective by putting the chosen model fit on the way between the terribly fitting independence model and the perfectly fitting saturated model (Arbuckle & Wothke, 1999). Hu and Bentler (1999) suggested that when maximum-likelihood estimation is used, the standardized root-mean-square residual (SRMSR) and at least one of several other indexes should be used to judge model fit. Following Hu and Bentler (1999), values are reported for the SRMSR, the root-mean-square error of approximation (RMSEA, Browne & Cudeck, 1993), the Tucker Lewis Index (also known as the non-normed fit index), and the comparative fit index (CFI). The cut-off values, indicating relatively good fit for sample sizes below 500, proposed by Hu and Bentler (1999) are at least .95 for CFI and TLI, .06 or less for RMSEA, and .09 or less for the SRMR. Those standards were adopted in this study.

Model Analysis

A two-stage analysis was conducted, consistent with procedures outlined by Bollen (1989). The first stage looked at the scales within each factor, analyzing each factor separately. For example, the group goals factor comprised the clarity, perceived value, sharedness, and attainability of

objectives scales. Thus the first set of analyses examined items comprising the scales and the correlations between scales specified for each factor. The second set of analyses considered the latent variable equation of the original model, treating the variables as though they were observed variables. These analyses examined the inter-relationship between scales comprising the five factors and the correlation between factors. If the first set of analyses verified that measurement parameters are identified and the second step made evident that the latent variable model parameters are also identified, then this is sufficient to identify the whole model (Bollen, 1989).

Second Order Confirmatory Factor Analyses

The first set of analyses was second order factor analyses. For each of the four proposed factors (group goals, participation, support for innovation, and positive affect) two alternative models were compared. One uncorrelated model where all items load on a single factor with no correlations between them (which is also referred to as a single factor model). One correlated model where the items load on different but correlated factors according to the measurement instrument prior structure (which is also referred to as a multi-factor model). Goodness-of-fit indices were computed for both models, the behaviour of the individual items and the inter-correlations between scales were reported.

Group Goals

The group goals factor comprises four facets: clarity, value, sharedness, and attainability, with the last three facets constituting the measure of goal commitment (Anderson & West, 1997). Goodness of fit indices indicated that the four-factor model had a poor fit to the data (see Table 4.2 following). Moreover, the correlations between the four factors were high (correlations ranged between .82 and .96) suggesting that a single factor solution could be more appropriate to describe the data. Therefore a single-factor model was tested. According to the criteria suggested by Hu and Bentler (1999) the single-factor model showed an acceptable fit (SRMR=.029; CFI=.97; TLI=.95).

TABLE 4.2

Goodness-of-Fit Indices for the group goals scale

Model	SRMR (≤ .09)	TLI (≥ .95)	CFI (≥ .95)	RMSEA (≤ .06)
Four factor model	.03	.90	.94	.12
Single factor model with 11 items	.03	.95	.97	.07
Single factor model with 9 items	.02	.97	.98	.07

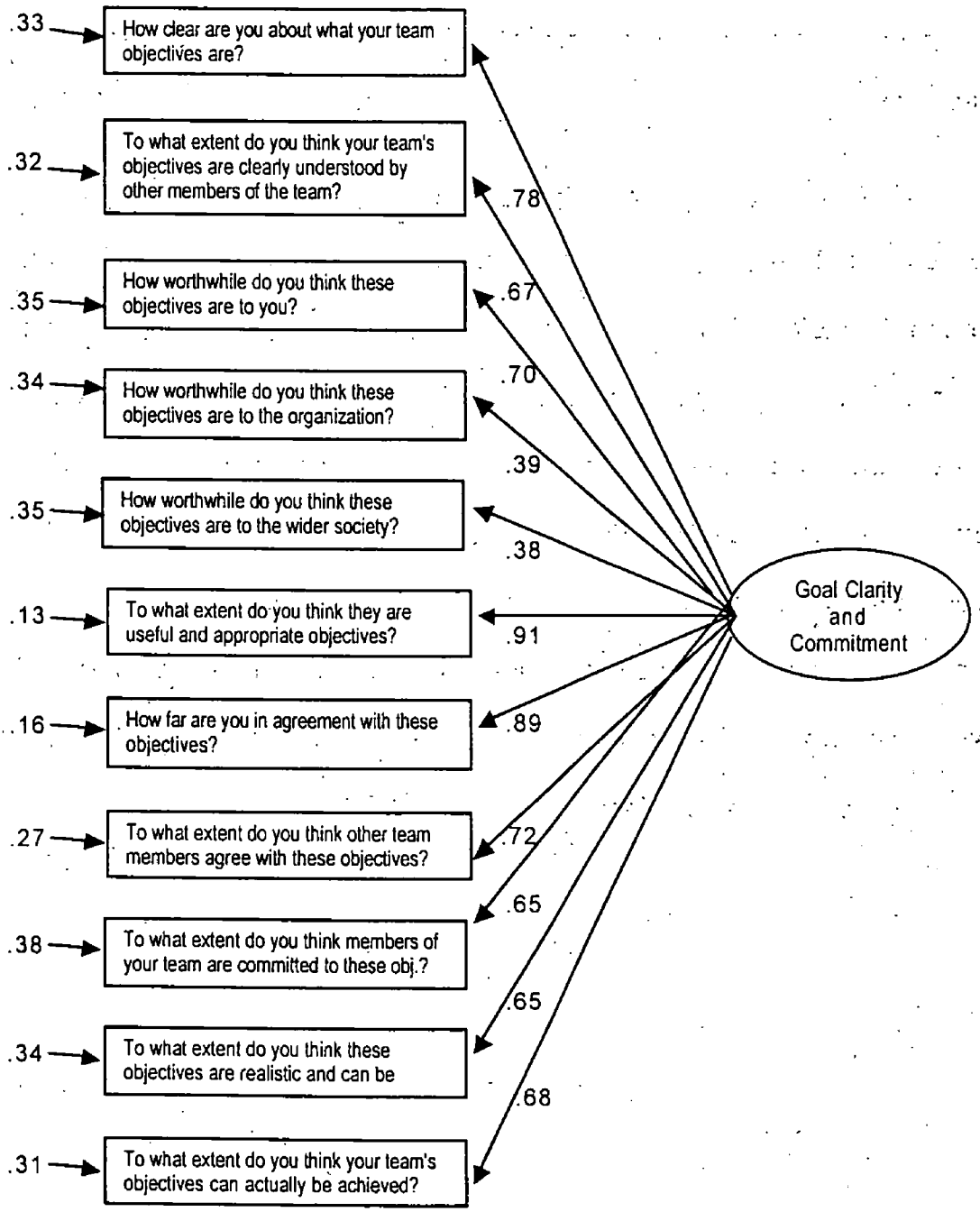
The mean parameter loadings for all items was .67 (ranging from .38-.91), which is slightly below the desired mean estimate (above .70, according to Arbuckle & Wothke, 1999).

However, two items had low parameter loadings (.38 and .39), which suggests that those items could be excluded from the goals scale. In order to test for this hypothesis, another model without those two items was ran (see Table 4.2).

Goodness-of-fit indexes are slightly better than the model including all the items, but they are both within an acceptable range of fit. The mean parameter loading of the second one-factor model is higher than the first one-factor model (.74, ranging between .65-.91). Given that the difference in fit between the two single-factor models is small, the reliability index is good for both models (Cronbach alpha above .90 in both cases), and the 11-item scale was shown to be a good measure in another study with Portuguese samples (Curral et al., 2001) I decided to retain all the eleven items. The group goals model, including parameter estimates, standardized residuals and scale correlations, is displayed in Figure 4.1.

FIGURE 4.1

Diagrammatic Representation of the Group Goal Factor: Parameter Loadings, Standardized Residuals and Construct Inter-Correlations.



In summary, the group goal single-factor model displays acceptable goodness-of-fit indices, adequate normalized residuals, desirable factor loadings and good scale reliabilities. The Cronbach alpha for the overall scale is .91, the mean inter-item correlation is .48 and the lowest value of the corrected item-total correlation is .44. There are no specific items, which seriously reduces the model fit to the data, although two items showed less than desired factor loadings. In the future it would be interesting to analyse if the lessen reliability of those two items was due to cultural differences either between countries or between types of teams. Overall, a single group goals measure including all items was adopted in these studies.

Participation

The second factor examined was participation, which comprises four scales including a total of twelve items, developed from Anderson & West (1997) Team Climate Inventory. Preliminary evaluation criteria of the four correlated factors model were all acceptable. The model did not contain negative error variances, correlations of one or greater, extremely high (.95 or greater) or extremely low parameter estimates. Following Hu and Bentler (1999), the four-factor model showed an acceptable fit (see Table 4.3) on at least one criterion (SRMR=.03; CFI=.96; TLI=.95). Although this model had a satisfactory overall fit, the correlations between the majority of the factors were high (ranged from .25 to .97), suggesting that a single-factor model could have a fit

at least as good as the four-factor model. The test of a single-factor participation model revealed that this model had a poor fit to the data (TLI=.90; CFI=.92; RMSEA=.10).

TABLE 4.3
Goodness-of-Fit Indices for the Participation Factor.

Model	SRMR (≤ .09)	TLI (≥ .95)	CFI (≥.95)	RMSEA (≤.06)
Four factor model	.03	.95	.96	.07
Single factor model	.04	.90	.92	.10

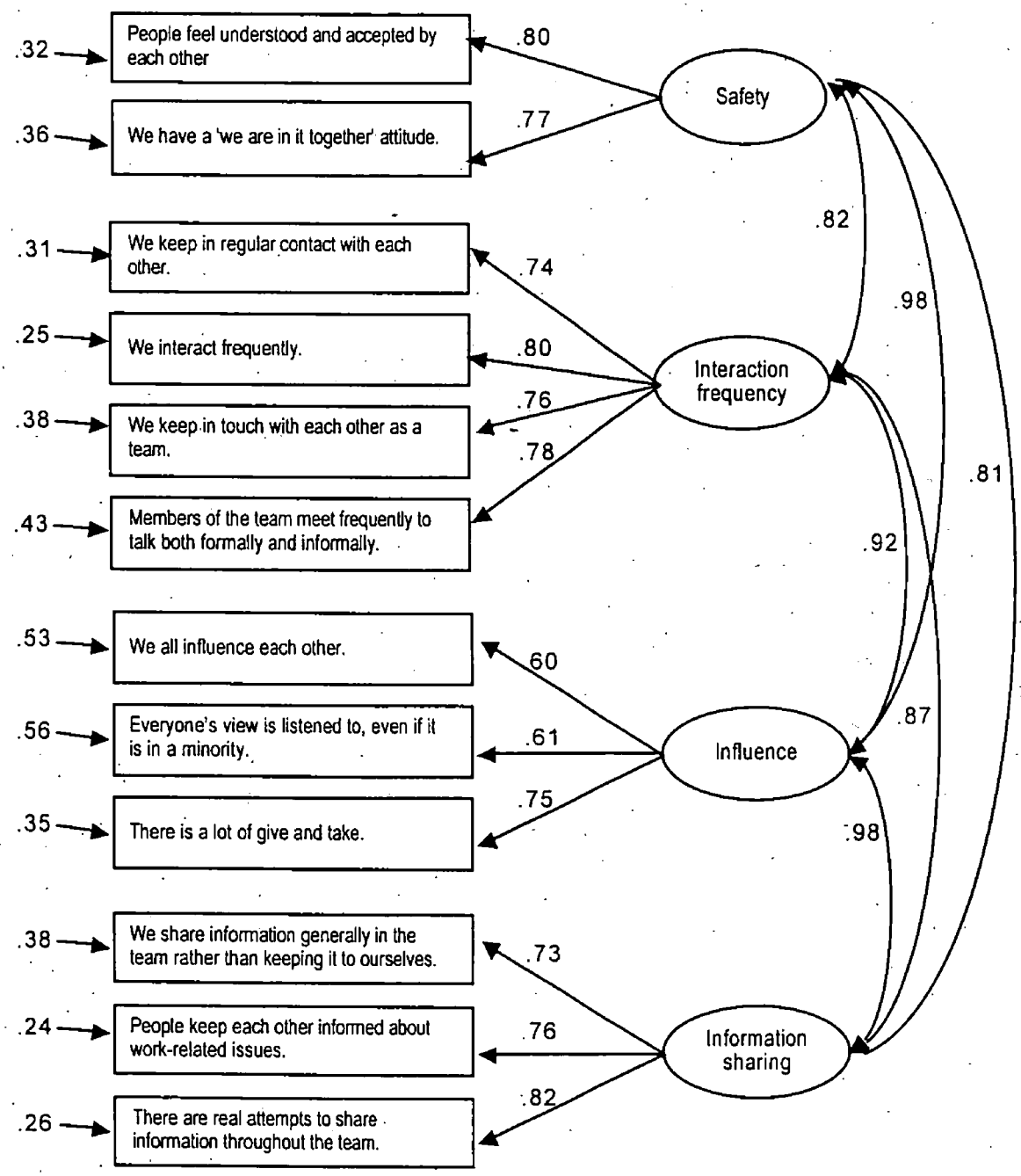
The four-factor model originally suggested by Anderson and West (1997) was retained as the model that better fitted the data. The mean parameter loading for all items was .74 (ranging from .60 to .82), which is above the desired estimate. The normalized residuals for all items were less than 2, the largest being -1.53, indicating that specification error is unlikely. The participation model, including parameter estimates, standardized residuals and scale correlations, is displayed in Figure 4.2.

In summary, the participation scale displays acceptable goodness-of-fit, normalized residuals, and adequate scale reliability. The Cronbach alpha

for the overall scale is .92; the mean inter-item correlation is .51 and the lowest value of the corrected item-total correlation is .58. There are no specific items, which seriously reduced the model's fit to the data. Hence a single participation measure including all items was adopted in these studies.

FIGURE 4.2

Diagrammatic Representation of the Participation Factor: Parameter Loadings, Standardized Residuals.



Support for Innovation

The support for innovation dimension comprises two facets: articulated support, and enacted support (Anderson & West, 1997). The goodness-of-fit indexes were within an acceptable range (see Table 4.4 following). According to the criteria suggested by Hu and Bentler (1999) the two-factor model showed an acceptable fit to the data (SRMR=.02; CFI=.96; TLI=.95). Moreover the model did not contain negative error variances, or extremely high (.95 or greater) or extremely low parameter estimates.

However, as a single measure of support for innovation was more desirable than two complementary measures, and since the two factors have

TABLE 4.4

Goodness-of-fit indices for the Support for Innovation factor.

Model	SRMR (≤ .09)	TLI (≥ .95)	CFI (≥ .95)	RMSEA (≤ .06)
Two factor model	.03	.95	.96	.09
Single factor model	.02	.96	.98	.08

a very high correlation (.99) a single-factor model with all the eight items was also tested.

The goodness-of-fit values showed a good fit of the single factor model to the data (SRMR=.02, CFI=.98, TLI=.98). The mean parameter loading for all items was .75 (ranging from .62-.83), which is slightly above the desired estimate.

The normalized residuals for all items were less than 2, the largest being 1.23, indicating that specification error is unlikely. The support for innovation model, including parameter estimates, standardized residuals and scale correlations, is displayed in Figure 4.3.

In summary, the support for innovation factor displays adequate goodness-of-fit indices and factor loadings, and desired scale reliabilities. The Cronbach alpha for the overall scale is .91, the mean inter-item correlation is .57 and the lowest value of the corrected item-total correlation is .60. There are no specific items that seriously reduced the model's fit to the data. Hence a single-factor support for innovation measure including all items was adopted in these studies.

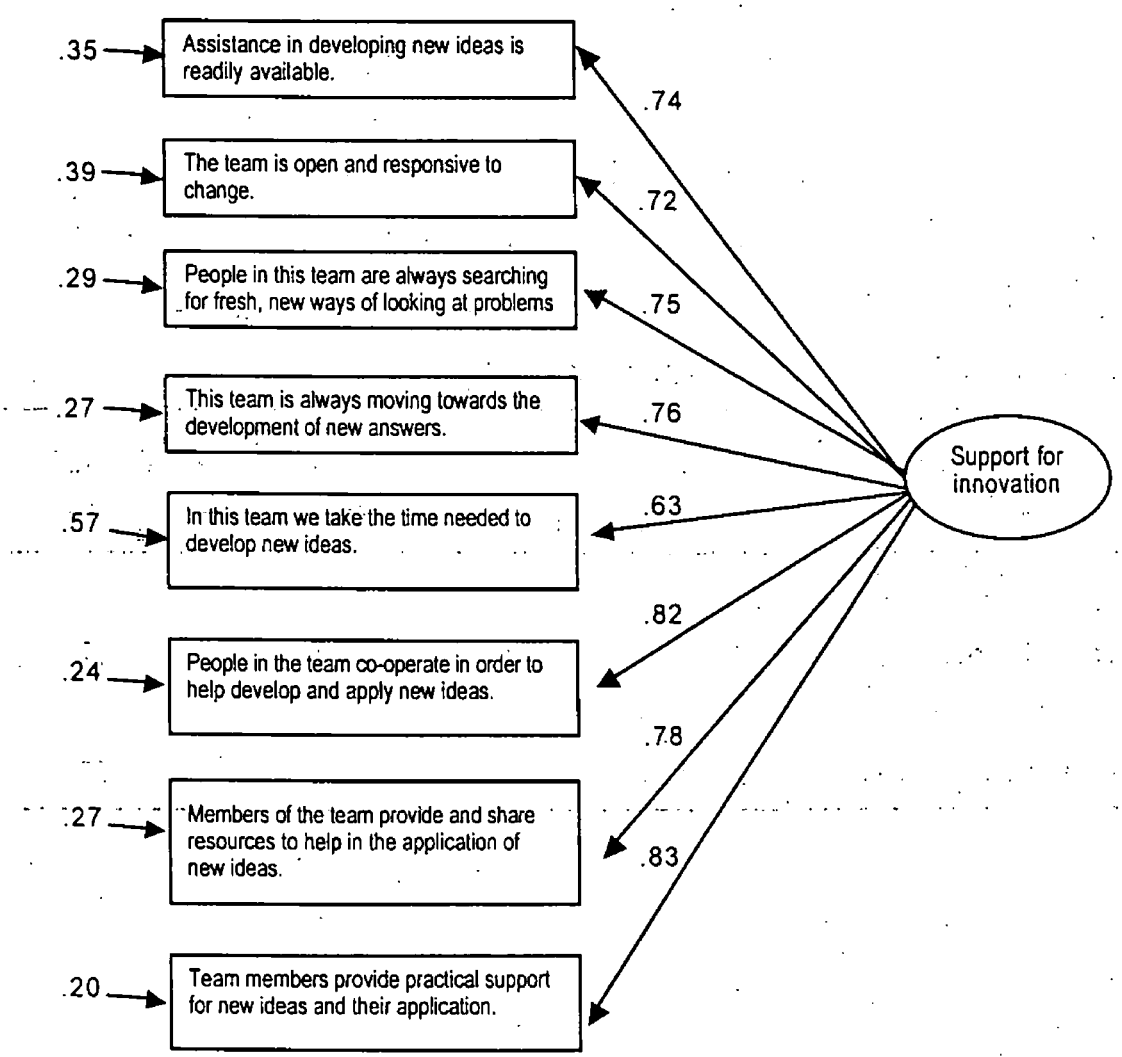
Intragroup Safety

Intragroup safety was assessed by a positive affect measure adapted from Warr's (1990) affective well-being instrument that includes two scales with positive adjectives and two scales with negative adjectives. Only the two

positive scales, in a total of six items, were retained in these studies.

In order to test the hypothesis that those six items would be measures of a latent variable designated as positive affect, a single-factor model was tested.

FIGURE 4.3.
Diagrammatic Representation of the Support for Innovation Factor: Parameter Loadings, Standardized Residuals.



Goodness-of-fit indices showed that a single-factor model had an unsatisfactory fit to the data (SRMR=.11; CFI=.98; TLI=.96), thus indicating that positive affect should be multidimensional (see Table 4.5 following). A two-factor structure corresponding to the two positive sub-scales proposed by Warr (1990) was tested. Preliminary evaluation criteria of the two correlated factors model were acceptable. The model did not contain negative error variances, correlations of one or greater, extremely high or extremely low parameter estimates. Following Hu and Bentler (1999), the two-factor model showed an acceptable fit on at least one criterion (SRMR=.04; CFI=.99; TLI=.98).

TABLE 4.5

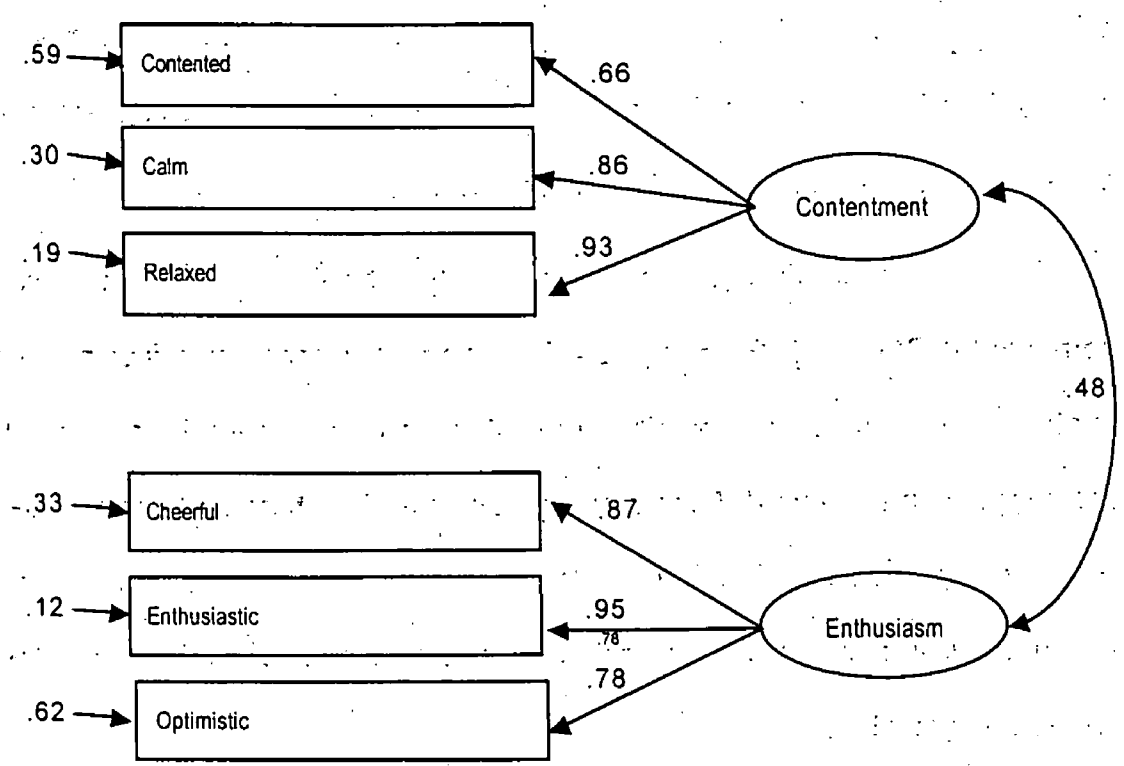
Goodness-of-Fit Indices for the Intragroup Safety Factor.

Model	SRMR (≤ .09)	TLI (≥ .95)	CFI (≥ .95)	RMSEA (≤ .06)
Two factor model	.04	.98	.99	.07
Single factor model	.11	.96	.98	.08

The two-factor model was retained as the model that better fitted the data. The mean parameter loading for all items was .84 (ranging from .66 to .95), which is above the desired estimate. The normalized residuals for all items were less than 2, the largest being -1.54, indicating that specification error is unlikely. The participation model, including parameter estimates, standardized residuals and scale correlations, is displayed in Figure 4.5.

FIGURE 4.4.

Diagrammatic Representation of the Intragroup Safety Factor: Parameter Loadings, Standardized Residuals and Construct Inter-Correlations.



In summary, the positive affect scale displays acceptable goodness-of-fit, normalized residuals, and adequate scale reliability. Since the two factors are significantly correlated (.48), and the overall scale has acceptable reliability values (Cronbach alpha=.89, mean inter-item correlation=.51, and the lowest value of the corrected item-total correlation is .61), a single positive affect measure including the six items was adopted in these studies.

Team Reflexivity

The nine items comprising the team reflexivity factor were developed by West (see Swift & West, 1999). The single factor model with the nine items revealed a poor fit to the data (see Table 4.6 following). Two items in particular (*team strategies are rarely changed*, and *the way decisions are made in this team is rarely altered*), with extremely low parameter loads (.29 and .19 respectively), appeared to be responsible for the model's lack of fit.

The model's fit improved significantly when the two items were correlated (SRMR=.03; CFI=.96; TLI=.95), suggesting that a two-factor model might be appropriate to describe the data. However, there is no specific meaning in this second factor, apart from the fact that both items were negatively formulated. Therefore, I decided to exclude these two items and test a single-factor model with seven items. Preliminary evaluation criteria were all acceptable.

According to the criteria suggested by Hu and Bentler (1999) the single-factor model showed an acceptable fit to the data (SRMR=.02; CFI=.99; TLI=.98). Moreover the model did not contain negative error variances, or extremely high (.95 or greater) or extremely low parameter estimates.

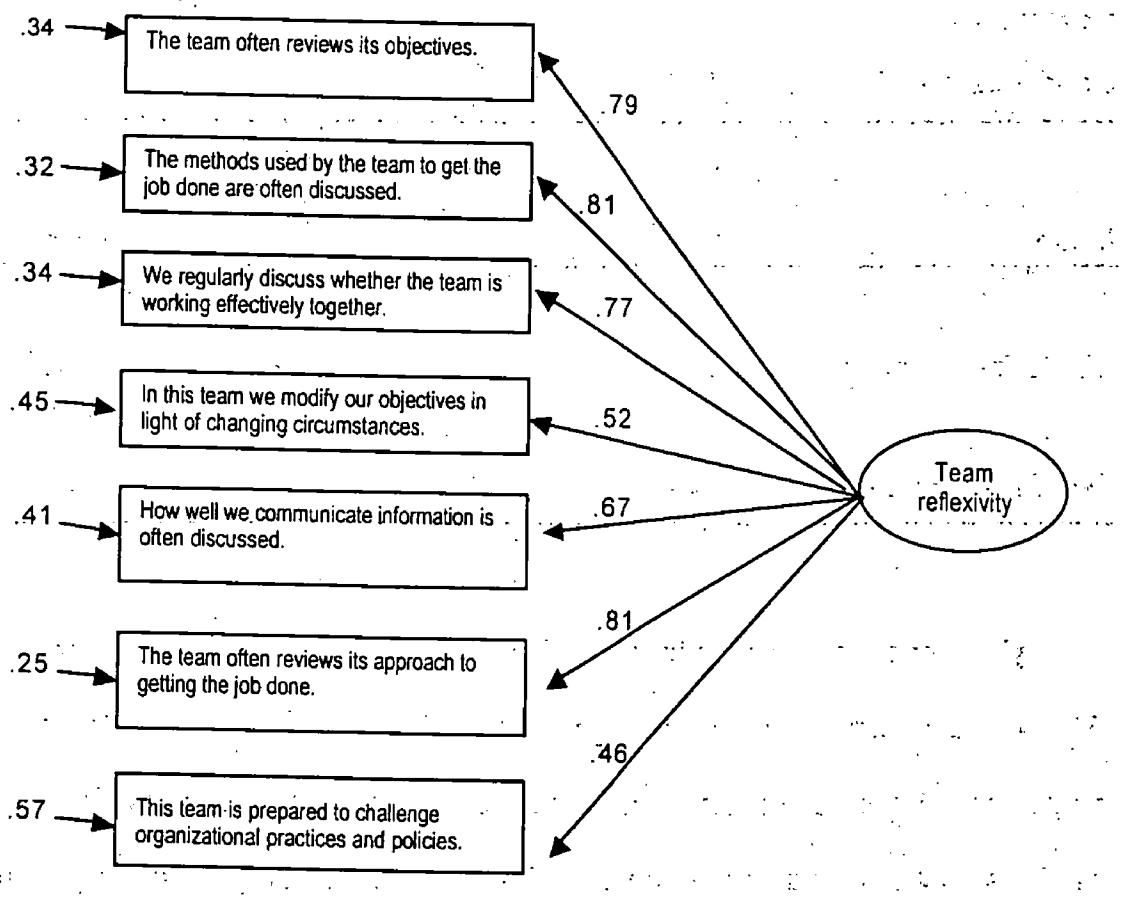
TABLE 4.6
Goodness-of-fit indices for the Team Reflexivity factor.

Model	SRMR (≤ .09)	TLI (≥ .95)	CFI (≥ .95)	RMSEA (≤ .06)
Single factor model	.02	.98	.99	.05
Two factor model	.03	.95	.96	.07

The mean parameter loading for all items was .70 (ranging from .46-.81). While overall mean parameter loadings were good to acceptable, the range was large indicating that some items displayed substantially lower loadings. Two items, as shown in Figure 4.5, displayed slightly lower parameter loadings. The normalized residuals for all items were less than two, the largest being -1.75. This was within the acceptable threshold, indicating that specification error is unlikely. The participation model, including parameter estimates, standardized residuals and scale correlations, is displayed in Figure 4.5.

FIGURE 4.5.

Diagrammatic Representation of the Team Reflexivity Factor: Parameter Loadings, Standardized Residuals and Construct Inter-Correlations.



Model Comparisons

Confirmatory factor analysis of the first order was utilised to examine a five-correlated-dimensions model in comparison to a one-dimensional model (see Table 4.7).

In the one-dimensional model all measured variables loaded on a single factor. As expected, the goodness-of-fit statistics showed a poor fit of the model (SRMR=.09; CFI=.68; TLI=.67; RMSEA=.10), indicating that it is not reasonable to conclude that all items are measures of the same group process construct.

The five-dimensions' model included the five hypothesized group processes: (1) goal clarity and commitment comprised one factor by itself, (2) participation included information sharing, safety, influence and interaction frequency scales, (3) support for innovation comprised a single factor, (4) intragroup safety included two positive affect (enthusiasm and contentment) scales, and (5) team reflexivity comprised one factor. The five dimensions were allowed to intercorrelate freely.

Following the criteria suggested by Hu and Bentler (1999), the five-correlated-dimensions model showed an acceptable fit on at least one combination of criteria (SRMR=.04; RMSEA=.05). The model did not contain negative error variances and parameter estimates are within acceptable range. However, the correlation between participation and support for innovation was particularly high (.95), suggesting it would be reasonable to

think of participation and support as a unique dimension. Thus a four-correlated-dimensions model was tested against the initial five-dimensions model.

TABLE 4.7

Goodness-of-fit indices for the Comparison Models.

Model	SRMR (≤ .09)	TLI (≥ .95)	CFI (≥ .95)	RMSEA (≤ .06)
Single factor model	.09	.67	.68	.10
Four factor model	.04	.94	.94	.05
Five factor model	.04	.94	.94	.05

Thus, the four-factor model comprised one dimension including participation and support for innovation, one dimension including goal clarity and commitment, one dimension including both scales of intragroup safety, and a fourth dimension comprising reflexivity. The comparative fit indices are provided in Table 4.7. Examination of goodness-of-fit indices demonstrates that the four-factor model had not a better fit to the data (SRMR=.04; RMSEA=.05) than the five-factor model. The last model was retained, as I was

interested in verifying the existence of differential associations between support for innovation and participation and team creativity and innovation.

The four group processes factors were positively correlated with values ranging from .45 to .95. The largest correlation was found between participation and support for innovation (r=.95), but the second largest correlation is substantially lower (r=.76). Use of Confirmatory Factor Analysis indicated all correlations, except for the correlation between participation and support for innovation, were +/- 2 standard errors below 1.00 (supporting the discriminant validity of the factors. When the inter-correlation between scales was constrained using the procedure outlined by Anderson & Gerbing (1988), a reduced chi-square in comparison to the previous model indicated that discriminant validity was achieved.

In summary, group processes model displays acceptable measurement properties. Scale reliabilities were in the desired range and above the acceptable criterion. Confirmatory factor analysis indicates that the second order factor structures had an acceptable fit to the data. The correlations between some scales were large indicating conceptual and measurement overlap, raising concerns regarding discriminant validity of the scales. Nevertheless, the scale correlations were within the desired range. As the model measures facets of the group interaction process, it is likely that some of the processes, while different, would be related. For instance, is hard to imagine that members of a team could provide effective support to each other in the development and application of ideas without frequent interactions and information sharing. However, interaction frequency (a

subscale of the participation factor) may be useful for other purposes rather than providing support. Where correlations between scales indicated a lack of discriminant validity, alternate models were examined. None of these models displayed significantly improved fit to the data.

The first order confirmatory factor analysis model displayed adequate goodness-of-fit indices and was superior to the alternate proposed model, leading to the conclusion that there were sufficient grounds to accept the model and to continue analysis by examining independent-dependent variable relationships. In this line of reasoning, there is a good basis for retaining the five factor group processes model, conducting analyses at the team level and examining the effects of each factor, separately and all together, on idea development and implementation.

Design of The Study

The major sources of data were written questionnaire responses (see appendix A). Team members were contacted personally and asked to fill the questionnaire. In the case of INETI, team members filled the questionnaires during the meeting and delivered it to me at the end. In IGC, most team members chose to answer the questionnaires after the meeting and to deliver them to me personally in the next meeting. Three months after receiving the questionnaires, unit managers were asked to provide innovation and creativity

ratings of each team belonging to their unit. In INETI, department managers usually did not belong to any team that constituted their departments. When managers were also team leaders (e.g., Industrial Chemistry Department), those teams were not included in the study. In IGC, because it has flatter structure without departments, the team leaders provided the ratings of team innovation. In this case, to reduce common method variance, team leaders responses where not included in the aggregate measures of team processes.

To recap, the group process measures used in this study included clarity and value of, and commitment to group goals; sharedness processes that included participation support for innovation, and intragroup safety; and team reflexivity. The group performance measures used were overall team innovation and overall creativity.

Some control variables were also used. Team composition variables have been demonstrated to be associated with team processes and performance. Examples of such association are team size (Curral et al., 2001; Levine & Moreland, 1990), tenure and functional diversity (Ancona & Caldwell, 1992), or global indexes of diversity including age, gender, education, and team tenure (Schippers, DenHartog, Koopman & Wienk, 2003). Thus, following the suggestion given by Pearce and Ensley (2004) the following control variables were included in the examination of each of our hypothesis: coefficient of variation of team tenure (standard deviation of team members tenure in each team), coefficient of variation in R&D experience (standard deviation of team members experience in R&D), team size, organization of

origin, gender heterogeneity of the teams, training heterogeneity of the teams, and the average tenure in the team. To calculate the heterogeneity measures I used Blau (1977) index of heterogeneity.

All this variables were collected from the same source, i.e., team members. When two or more variables collected from the same source are correlated, the interpretation of the correlation is called into question as it may be simply a consequence of common method variance (Campbell & Fiske, 1959; Podsakoff & Organ, 1986). The concern is that relationships observed between common source variables may be a result of the measurement method rather than of real relationships between constructs. In this study, this problem is relevant for the hypothesized relationship between team reflexivity and group goals, participation, support for innovation, and intragroup safety; i.e., the interaction effect between reflexivity and these four group processes variables. On the other hand, some studies suggest that common method variance is not always a biasing problem (Glick, Jenkins & Gupta, 1986; Spector, 1987), and that properly developed instruments are resistant to the method variance problem (Spector, 1987). I decided to adopt a more cautious approach to the common method variance problem and chose to diversify the sources from which data concerning group process was drawn. Thus data assessing the goals, participation patterns, level of support for innovation, and safety of the group was collected from the team members, excluding team leaders. Data assessing the reflexivity level of the team was collected from team leaders alone, therefore eliminating a possible common method bias.

Sampling Ratio

Composition models apply when there is an isomorphism between levels, which means, when constructs are analogous and there is functional equivalence across levels (Kozlowski & Klein, 2000). Thus, perceptions about group processes fall on this category. In the case of true isomorphism, perceptions of team processes measured at the individual level would be the same for all team members. However, true isomorphism is unlikely, and therefore some variation in the perceptions of team members about their team functioning is expected (Bliese, 2000). One common way to deal with this variation is to collect several individual measures and to aggregate them in a group's mean.

According to Dawson (2003) when dealing with composition models, we need to measure the mean of the individual responses as accurately as possible. That is to say, we want to ensure that the standard error of the mean (SE_M) is as small as possible. As a way of guaranteeing the maximum possible accuracy, Dawson (2003) proposes calculating the teams sampling ratio in order to inform the decision on which teams to include in a study. The sampling ratio (SR) is the ratio of standard error of the mean (SE_M) to group variance. A lower value of SR represents a more accurate situation. In this study the average sampling ratios for the 50 teams was 0.03 with a minimum of 0 and a maximum of 0.17. Providing that the respondents are an unbiased sample of all team members, which means, as long as we don't have any reasons to believe that the values of non-respondents differ from those of the

respondents, an SR of 0.32 gives, on average, a reliability of 0.90, for a normally distributed data (Dawson, 2003).

Aggregation of Data at Group Level

All variables were defined at the team level, but their measures are aggregates of individual responses. The exception is the performance measures. To aggregate individual data to the group level, the responses of individual team members were averaged for each variable defined as relevant for the study. To justify whether a measure can be aggregated, the following conditions should be met: (1) the construct must be conceptually meaningful at the group level (George & James, 1993; Kenny & La Voie, 1985; Klein, Dansereau & Hall, 1994); and (2) the measure must demonstrate a high degree of within-group agreement (George & James, 1993; James, Demaree & Wolf, 1984; Kozlowski & Hattrup, 1992).

The first condition is primarily related to the validity of the construct – does this construct exist at the group level? Members of organizational groups work within a shared context and to some extent collectively interpret and attach meaning to the context. This social interaction among the group members helps to "facilitate common interpretations and systems of shared meaning" (Kozlowski & Hattrup, 1992, p.162). It is therefore reasonable to expect the group to develop shared cognitions about their leader, about their tasks, and about the group itself.

The constructs that make up the theoretical framework of this dissertation reflect aspects of the group dynamics and can appropriately be considered group-level constructs. The extent to which the group members agree with each other about these aspects of their group indicates the extent to which they share similar cognitions about those aspects. In a study on the antecedents of within-group agreement, Klein, Conn, Smith and Sorra (2001) found that group member social interaction and work interdependence were significantly positively related to within-group agreement regarding perceptions of work environment. They also found that within-group agreement is sensitive to the questionnaire referent. The use of a group rather than individual referent ("We" instead of "I") increased within-group agreement in response to descriptive items but decreased within-group agreement in response to evaluative items. In this study all the descriptive items used a group referent. Only the more evaluative scale of affective well-being contained wording directed to the individual feelings.

The second condition – whether there is agreement among group members' perceptions' – is determined statistically. Justification for aggregation is provided by the demonstration of agreement within settings rather than difference across groups (George, 1990). According to Schneider and Bowen (1985, p.452) "the appropriate test for within-settings agreement would be a measure of homogeneity rather than an index like analysis of variance (ANOVA) or the intra-class correlation coefficient (ICC) that depend upon between setting differences for significance."

For this study, the measure of within group interrater agreement developed by James, Demaree and Wolf (1984, 1993) was used. Their statistical method calculates a coefficient of agreement, rwg(j), for each group-level measure. This coefficient can range from 0 to 1 and values above 0.70 are considered to demonstrate sufficient within group interrater agreement (George, 1990).

When aggregate variables are used, it is also recommended that some type of analysis of variance procedures be used to demonstrate that groups differ on the aggregate variables. Determination of between-group variance is of particular importance when hypothesized correlations involving aggregates are nonsignificant. In such case, nonsignificant results could be due to a lack of a meaningful relationship between the variables of concern or to a lack of between-group variance on the aggregate variables. When there are no between-group differences on an aggregate variable, correlations between this and other variables will be zero. Conversely, obtaining significant correlations for hypothesized relationships involving aggregate variables indicates that an adequate between-group variance exists (George & Bettenhausen, 1990). A one-way ANOVA was conducted for each aggregate variable. An F ratio from an ANOVA greater than 1.00 is considered to be sufficient evidence for differences across groups (Hays, 1981).

Table 4.8. Justification for using aggregate variables.

	Mean Rwg	Rwg Min - max	F ratio from ANOVA
Group goals	.95	.86 – 1.00	3.73**
Intragroup safety	.97	.90 - .99	1.62*
Participation	.92	.68 - .99	3.15**
Support for innovation	.96	.83 – 1.00	2.19**

** $p < .001$ * $p < .01$

Table 4.8 shows the James, Demaree, and Wolf's (1984) index of within-group interrater reliability, and the F ratio from ANOVA. Overall, the estimates of within-group interrater reliability for group goals, intragroup safety, participation, support for innovation, and interdependence showed a high level of agreement within groups. Of the 250 estimates of within-group interrater reliability calculated, only 5 were below the recommended level of .70.

Having provided theoretical reasons for the group-level constructs and having demonstrated sufficiently high within-group interrater agreement on the variables of interest, it was appropriate to aggregate the individual-level data into group-level measures.

Chapter Summary

Chapter 4 discussed the psychometric properties of the measures used to operationalize and test the model of team innovation. Section 1 described the procedures used to recruit the participating organizations and select the study sample. The following section described the sample, in terms of its size and demographics, as well as the types of R&D projects surveyed. Section 3 presented the measures comprised in the questionnaire and their reliability. Section 4 tested the factor structure of the processes model, highlighting the convergent and discriminant validity of the scales. The analysis indicated that the five group process dimensions showed sufficient discriminant validity to allows us to consider them as independent variables in the innovation model. Section 5 described the design of the study, drawing attention to its cross-sectional design. Results are presented and discussed in the following chapters.

CHAPTER 5

RESULTS

Chapter Outline

Chapter 5 presents the results of statistical analyses used to test the model earlier proposed in Chapter 3. Regression analyses were conducted to determine whether the sharedness processes were significantly associated with team innovative performance, and to establish which processes were the most significant predictors of creativity and innovation implementation. Moderated regression analyses were conducted to test the hypotheses that team reflexivity would moderate the effect of other group processes on team creativity and innovation implementation.

Descriptive Analysis

The means and standard deviations of the group processes measures are shown in Table 5.1, as well as the correlations between the five group processes, and between group processes and team creativity and innovation implementation.

The majority of the teams exhibited above average scores of goal clarity and commitment, participation, support for innovation, intragroup safety, and

team reflexivity. Correlations between group processes measures showed that, as expected, all team processes were highly intercorrelated. The highest inter-correlation of group processes was between participation and support for innovation (r=. 90), and the lowest between team reflexivity and intragroup safety (r=. 32).

The particularly high correlation between participation and support for innovation might suggest that those would be measures of the same construct and thus would not be reasonable to analyze them separately. However, the difference in correlation size between participation and support for innovation and other group processes (e.g. team reflexivity) and outcomes (e.g. innovation implementation) brings some support to the idea that participation and support may have a differentiated influence on the innovation process. Additional support to the difference between participation and support for innovation was given by the confirmatory factor analysis. The four-factor model (goals, participation, support, and safety) was better than a three-factor model where participation and support for innovation appeared collapsed in a single factor. Finally, all group processes are significantly correlated with team creativity (ranging from .36 to .48) and innovation implementation (ranging from .38 to .60), thus suggesting that further analysis are appropriate.

Table 5.1
Means, Standard Deviations and Correlations Among all Variables

	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Organization																
2. Team size	5.60	2.42	.11													
3. Team tenure	64.46	52.11	-.62**	-.01												
4. R&D experience	93.59	51.44	-.53**	-.20	.82**											
5. Team tenure diversity	45.72	36.15	-.73**	.02	.76**	.67**										
6. R&D experience diversity	71.77	33.26	-.28	-.10	.21	.26	.36*									
7. Training diversity	.72	.27	-.19	.22	.21	-.10	.17	-.08								
8. Sex diversity	.50	.28	.31*	.13	-.15	-.07	-.19	-.04	.13							
9. Group goals	3.88	.45	.41**	-.03	-.56**	-.38**	-.33*	-.03	-.39**	.11						
10. Intragroup safety	4.18	.48	.19	-.14	-.37**	-.21	-.21	-.08	-.18	.04	.60**					
11. Participation	3.95	.45	.38**	-.06	-.48**	-.34*	-.22	.08	-.23	.24	.64**	.50**				
12. Support for innovation	3.89	.42	.38**	-.11	-.51**	-.38**	-.30*	.04	-.25	.16	.64**	.54**	.9-**			
13. Team reflexivity	3.66	.43	.46**	.06	-.43**	-.34*	-.25	-.12	-.10	.49**	.52**	.32*	.49**	.34*		
14. Creativity	5.53	.63	.16	-.03	-.43**	-.22	-.25	-.14	-.18	.15	.41**	.36**	.45**	.48**	.43**	
15. Innovation implementation	5.57	.68	.29*	.00	-.34*	-.19	-.23	.09	-.38**	.15	.57**	.40**	.49**	.38**	.60**	.55**

*p <.05; **p <.01

Test of Hypotheses

In order to test the hypothesis that predicted a positive association between the sharedness processes and the team innovative performance, two regression analyses were conducted. The four sharedness processes, group goals, participation, support for innovation, and intragroup safety, were entered as independent variables into two separate models predicting team creativity and innovation implementation, after controlling for the eight composition variables defined earlier. The results of the analysis are shown in Table 5.2.

In Hypothesis 1a it was predicted that all four sharedness processes would be positively associated with team's creativity. After controlling for our eight control variables (R^2 *change* = 0.28, p= 0.07), I found that sharedness processes - group goals, participation, support for innovation, and intragroup safety – did not account for a significant portion of the variance in team's creativity beyond what was accounted for by the control variables (R^2 *change* = 0.112, p< 0.16). These results do not provide support for Hypothesis 1a. However, when we looking at Table 5.2 we can see that sharedness has relatively high correlations with team reflexivity (group goals, r = 0.52, p< 0.01; participation, r = 0.49, p< 0.01; support for innovation, r = 0.34, p< 0.05; and intragroup safety, r = 0.32, p< 0.05), suggesting the operation of a suppression effect. Suppression means that the relationship between two or more independent variables is hiding or suppressing their real relationships with the dependent variable, which would be larger or possibly of opposite sign were they not correlated. Hence, the inclusion of the suppressor in the regression

equation removes (suppresses) the unwanted variance in the specified independent variable, in effect, and enhances the relationship between that independent variable and the dependent variable (Cohen & Cohen, 1983, p.95).

Considering a plausible suppression effect of reflexivity on the relationship between sharedness processes and creativity, a second regression equation was specified including the four sharedness processes together with team reflexivity on the second step. Results indicate that the five group processes accounted for a significant portion of the variance in team's creativity beyond that accounted for by the control variables (R^2 *change* = 0.211, $p < 0.05$).

To better understand the relationship between each sharedness process and team's creativity, I calculated the relative importance of predictors following Johnson's' procedure (Johnson & LeBreton, 2004). One of the main objectives of this analysis was to understand the unique contribution of each group process to the team innovative outcome. In other words, the examination of the relative contribution of predictors (LeBreton, Ployhart & Ladd, 2004). Identifying the proportionate contribution of each predictor is of both theoretical and practical importance. Theoretically, information about relative importance facilitates the development of parsimonious models of organizational behavior. Researchers are able to identify a succinct set of predictors, all of which contribute to a better understanding of criterion behavior. Practically, by identifying a set of important predictors, organizational decision makers may improve their decisions in terms of both validity and utility (LeBreton, Ployhart & Ladd, 2004, p.257). For example, relative importance analysis might be

particularly useful in understanding how does collinearity among team climate dimensions affect the relative importance of these dimensions for predicting innovation. Group processes are highly intercorrelated by nature, thus concealing the unique contribution of each single process to the outcomes of work teams. To further understand the association between group sharedness processes and innovative performance a relative importance index that would account for the effect that each group process has on team innovative performance, considering the influence each group process has on the other processes was needed. Johnson and LeBreton (2004, pp. 238) define relative importance as the proportionate contribution each predictor makes to R^2, considering both the unique contribution of each predictor by itself and its incremental contribution when combined with the other predictors. The authors calculate the relative weights of predictors (epsilon) by transforming the original predictors (X_j) to their maximally related orthogonal counterparts (Z_k), which are then used to predict the criterion (Y). To compute the relative weight for X_j, multiply the proportion of variance in each Z_k accounted for by X_j by the proportion of variance in Y accounted for by each Z_k and sum the products. This method not only yields importance weights that represent the proportionate contribution each predictor makes to $R2$, as well as considers a predictor's direct effect and its effect when combined with other predictors (Johnson & LeBreton, 2004).

Results presented in Table 5.2. suggest that, after controlling for the indirect effect of reflexivity, support for innovation (29% of total R^2) and intragroup safety (29% of total R^2) appeared as the most important predictors of

creativity, whereas participation (17% of total R^2) ,goal clarity and commitment (13% of total R^2) are responsible for a more modest contribution. Finally, team reflexivity makes also a small direct contribution to the total variance in team's creative outcomes (12% of total R^2).

Table 5.2. Regression analyses and relative importance of creativity predictors.

	Model 1			Model 2		
	Raw relative weights	Relative weights as % R^2	ΔR^2	Raw relative weights	Relative weights as % R^2	ΔR^2
Step 1:			0.280			0.280
Control variables						
Step 2:			0.112			0.211*
Group processes						
Group goals	0.057	22.3%		0.042	12.6%	
Participation	0.068	26.3%		0.057	17.2%	
Support for innovation	0.087	33.8%		0.097	29.1%	
Intragroup safety	0.045	17.5%		0.096	28.9%	
Team reflexivity				0.041	12.3%	

*$p < .05$; **$p < .01$.

In Hypothesis 1b it was predicted that all four sharedness processes would be positively associated with team's innovation implementation. After controlling for our eight control variables (R^2 *change* = 0.26, p= 0.11), I found the sharedness processes - group goals, participation, support for innovation, and intragroup safety - to account for a significant portion of the variance in innovation implementation over and above that accounted for by the control variables (R^2 *change* = 0.21, p< 0.01). Thus, I found support for Hypothesis 1b. However, when the relative importance of each sharedness process in predicting innovation implementation is estimated, results indicate that group goals is the strongest predictor (43% of total R^2), followed by participation. Noticeably, support for innovation and intragroup safety make a similar but more modest contribution (14% of total R^2) to the predictive power of sharedness processes concerning the implementation of ideas.

Similarly to what was observed for creativity, a suppression effect may have influenced the relative importance of innovation implementation predictors, due to the relatively high correlations between the four sharedness processes and team reflexivity. Therefore, I decided to run a second regression analysis including reflexivity in the second step as a way to control for its probable effects on the relationship between sharedness processes and the implementation of innovation. Results presented in Table 5.2. show that sharedness processes together with reflexivity account for a larger portion of the variance in innovation implementation than the four sharedness processes alone (R^2 *change* = 0.32, p< 0.01). The estimation of the relative importance of predictors after controlling for the indirect effect of reflexivity, replicates the

Table 5.3. Regression analyses and relative importance of innovation implementation predictors.

	Model 1			Model 2		
	Raw relative weights	Relative weights as % R^2	ΔR^2	Raw relative weights	Relative weights as % R^2	ΔR^2
Step 1:			0.256			0.256
Control variables						
Step 2:			0.215**			0.318**
Group processes						
Group goals	0.174	42.7%		0.123	26.3%	
Participation	0.118	29.0%		0.074	15.7%	
Support for innovation	0.057	13.9%		0.038	8.2%	
Intragroup safety	0.059	14.4%		0.048	10.2%	
Team reflexivity				0.186	39.6%	

*$p < .05$; **$p < .01$.

pattern of importance found in the previous analysis, with group goals (26% of total R^2), and participation (16% of total R^2), being the most important predictors, of all four sharedness processes, of innovation implementation. Beyond all predictions, team reflexivity is the group process that accounts for the larger portion of variance in innovation implementation (12% of total R^2), thus becoming the strongest single predictor of success in implementing innovation at the team level.

Reflexivity as a Moderator

In order to test Hypothesis 2 through 5, I used a hierarchical multiple analysis to examine how team reflexivity affects (i.e., regulates) the direction and/or strength of the relation between sharedness processes and team creativity and innovation implementation (Baron & Kenny, 1986). The moderating effect of team reflexivity was examined separately for each of the four sharedness processes and for each of the two outcome measures (creativity and innovation implementation). Hence, eight regression equations were computed including the main effects of reflexivity and one sharedness process, along with the eight team composition variables defined earlier as the control variables, in the first step, and the two-way interaction between reflexivity and each sharedness process in the second step. When using hierarchical multiple regression to test interaction effects there is a possibility that high multicollinearity between the product term and the independent variables that make the product term will result in incorrect estimation of the values and the signs of the regression coefficients (Cohen & Cohen, 1983).

Because it was likely that each product term would be highly correlated with team reflexivity and the respective group process, the two independent variables were centered before computing the product term for each regression. Centering – subtracting the sample mean from each observed value - is a means to minimize multicollinearity and thereby some of the coefficient estimation problems associated with it (Cohen & Cohen, 1983). An overview of the analysis is given in Tables 6.6 through 6.9.

Table 6.6. Hierarchical multiple regression analysis for the effect of group goals and team reflexivity, and their interaction term, on creativity and innovation implementation (N=50)

	Innovation		Creativity	
	Additive model	Interaction model	Additive model	Interaction model
Step 1				
Organization	.08	.12	.30	.35
Team size	.12	.09	.09	.04
Team tenure	.07	-.01	-.70*	-.80**
R&D tenure	.08	.14	.44	.52†
Team tenure diversity	-.23	-.31	-.09	-.20
R&D tenure diversity	.12	.14	-.13	-.12
Training diversity	-.20	-.16	.03	.09
Sex diversity	-.05	-.07	.02	-.01
Group goals	.33*	.33*	.19	.19
Team reflexivity	.41**	.38*	.22	.17
Step 2				
Team reflexivity x Group goals		-.26*		-.35**
Adj. R^2	.35	.41	.18	.30
R^2 change	.48**	.06*	.35*	.11**
F	3.61**	4.06**	2.07*	2.86**

† $p < .10$; *$p < .05$; **$p < .01$.

Hypothesis 2a predicts that team reflexivity moderates the relationship between group goals and creativity. Results shown in Table 6.6 indicate that there is partial support for Hypothesis 2a. The interaction term between team reflexivity and group goals explained a significant portion of the variance in team creativity beyond that accounted for by their additive combination (R^2 *change* = 0.11, $p < 0.01$). This interaction effect suggests that teams high on reflexivity are equally creative no matter whether they have high or low group goals, whereas teams low on reflexivity are more creative when their group goals are high (β=-.35, $p < .01$).

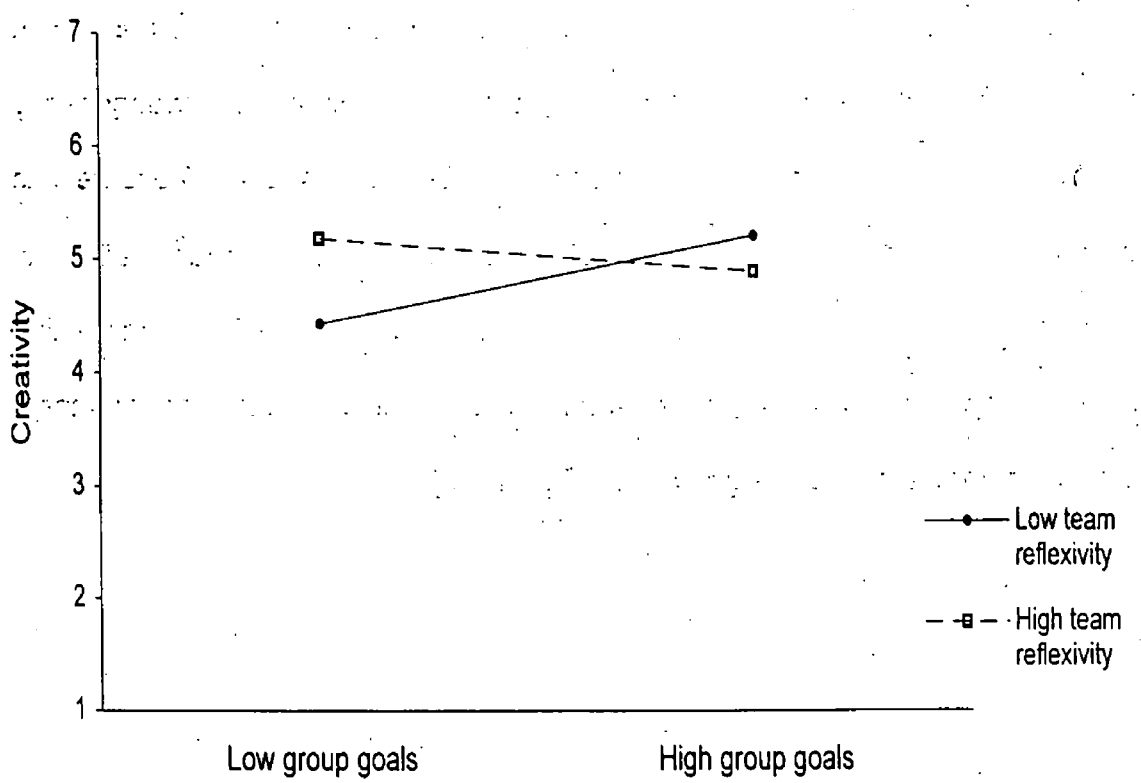


Figure 6.1. Creativity as a function of group goals and reflexivity

Opposite to what was predicted, teams low on reflexivity are as creative as teams high on reflexivity providing they also have high goal clarity and commitment. These results indicate that reflexivity becomes more important in the absence of clear group goals (see Figure 6.1).

Hypothesis 2b predicted a moderating effect of team reflexivity on the relationship between group goals and innovation implementation. Providing partial support for this Hypothesis, the interaction term between team reflexivity and group goals explained a significant portion of the variance in innovation implementation beyond that accounted for by their additive combination (R^2 *change* = 0.06, $p < 0.05$). A significant interaction for group goals shows that teams low on reflexivity are better at implementing innovation when their goals are clear and their members are committed to the group goals, whereas teams high on reflexivity are equally good at implementing innovations independently of their level of goal clarity and commitment (β=-.26, $p < .05$). These results indicate that, similarly to what was observed for creativity, team reflexivity interacts with group goals to predict innovation implementation in the sense that reflexivity becomes more important when goals are unclear and team members are less committed to these goals (see Figure 6.2).

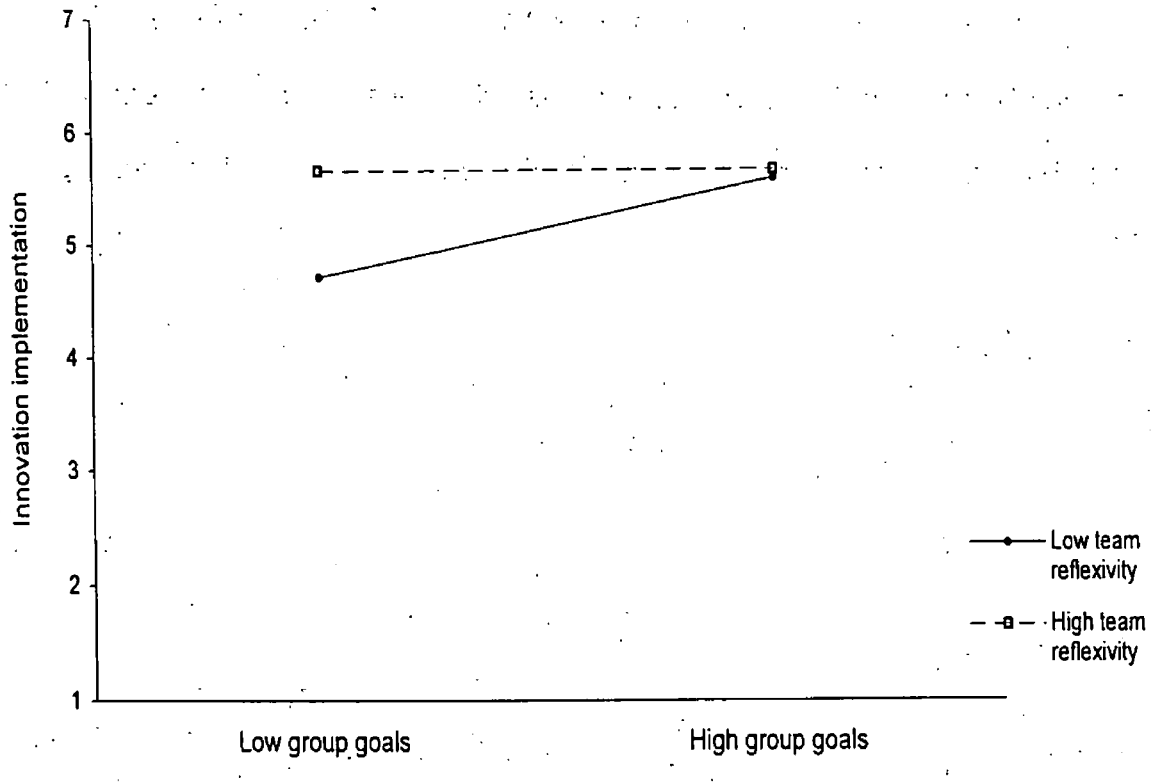


Figure 6.2. Innovation implementation as a function of group goals and reflexivity

Hypothesis 3a predicts that team reflexivity moderates the relationship between participation and creativity. Results shown in Table 6.7 indicate that the interaction term between team reflexivity and participation explained a significant portion of the variance in creativity beyond that accounted for by their additive combination (R^2 *change* = 0.05, p= 0.09), hence giving partial support to Hypothesis 3a. The slope and direction of this interaction parallels that shown for group goals (β=-.25, *p*= .09). Teams high on reflexivity are equally creative no matter whether they have high or low levels of participation, whereas teams

low on reflexivity are more creative when their participation levels are high. In line with Hypothesis 2a, teams low on reflexivity are as creative as teams high on reflexivity providing they also have high levels of participation (see Figure 6.3).

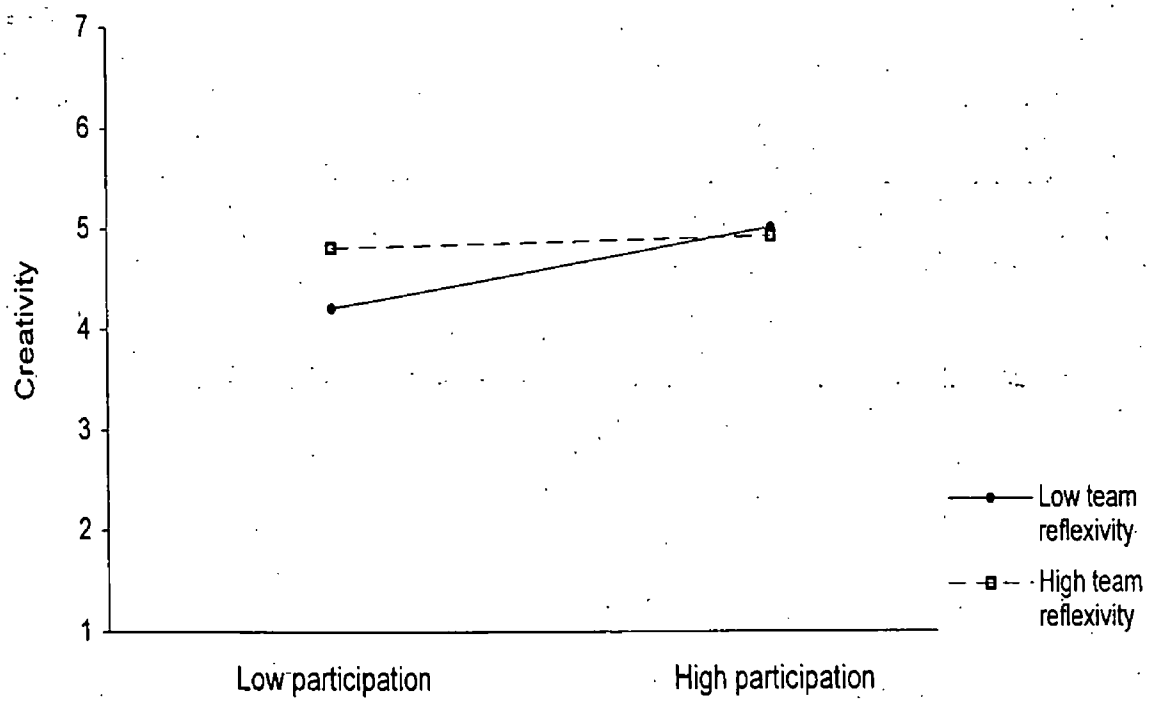


Figure 6.3. Creativity as a function of participation and reflexivity

Here the significance level is slightly above 0.05 but we should remember that because of reduced sample size there is substantially more power to detect significant effects at the individual level than the team level of analysis (DeShon et al., 2004).

Table 6.7. Hierarchical multiple regression analysis for the effect of participation and team reflexivity, and their interaction term, on creativity and innovation implementation (N=50)

	Innovation		Creativity	
	Additive model	Interaction model	Additive model	Interaction model
Step 1				
Organization	.12	.17	.38†	.42*
Team size	.16	.08	.13	.07
Team tenure	.05	-.03	-.62*	-.69*
R&D tenure	.12	.26	.49†	.61*
Team tenure diversity	-.31	-.43†	-.22	-.33
R&D tenure diversity	.10	.04	-.16	-.21
Training diversity	-.24	-.17	.03	.09
Sex diversity	-.11	-.17	-.04	-.10
Participation	.31*	.31*	.36*	.36*
Team reflexivity	.47**	.44**	.22	.21
Step 2				
Team reflexivity x Participation		-.31*		-.25†
Adj. R^2	.34	.41	.25	.29
R^2 change	.48**	.07*	.40*	.05†
F	3.56**	4.14**	2.66*	3.83**

† $p < .10$; *$p < .05$; **$p < .01$.

A significant interaction for participation shows that teams low on reflexivity are better at implementing innovation when their levels of participation are high, whereas teams high on reflexivity are equally good at implementing innovations independently of having low or high levels of participation (β=-.31, p < .05). These results indicate that, similarly to what was reported for creativity, team reflexivity interacts with participation to predict innovation implementation in the sense that reflexivity becomes more important when participation levels are low (see Figure 6.4).

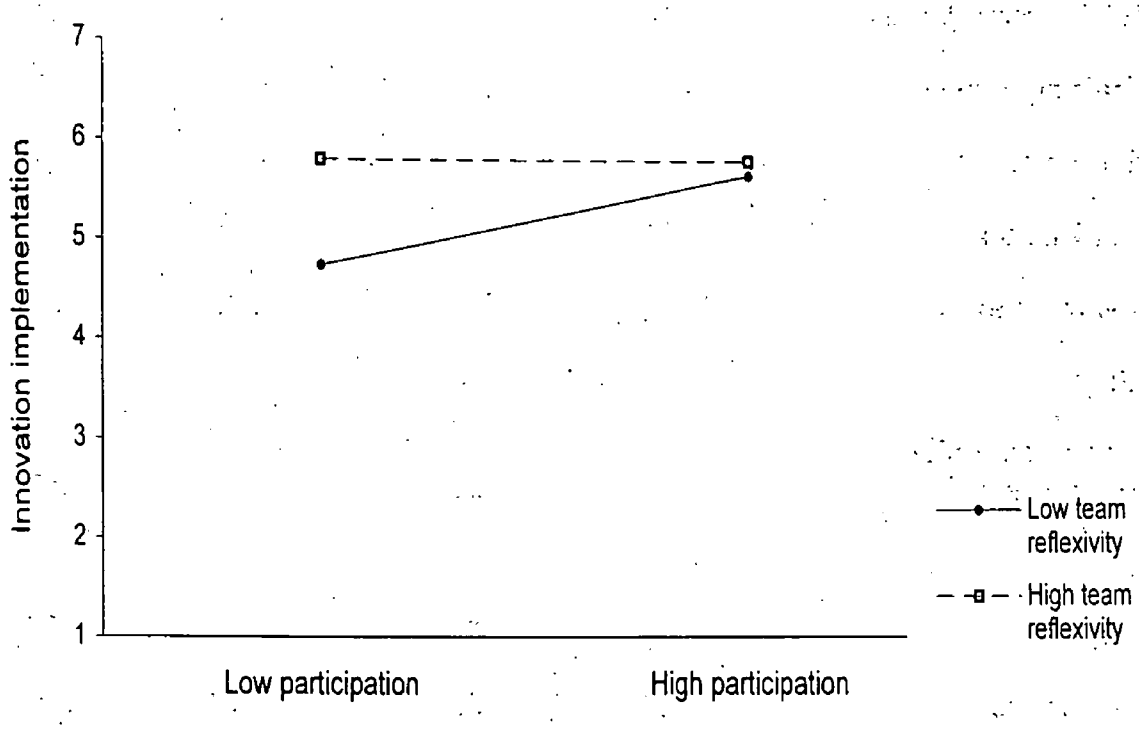


Figure 6.4. Innovation implementation as a function of participation and reflexivity

Hypothesis 4a predicts that team reflexivity moderates the relationship between support for innovation and creativity. The results presented in Table 6.8 indicate that team reflexivity do not interact with support for innovation in predicting team creative outcomes. There are, as expected, main effects of support for innovation but not of team reflexivity. Thus Hypothesis 4a receives no support from these results.

Hypothesis 4b predicts a moderating effect of team reflexivity on the relationship between support for innovation and innovation implementation. The results presented in Table 6.8 lend partial support to this Hypothesis by showing that the interaction term between team reflexivity and support for innovation explained a significant portion of the variance in innovation implementation beyond that accounted for by their additive combination (R^2 *change* = 0.04, p= 0.09).

The found interaction effect suggests that teams low on reflexivity are better at implementing innovation when their levels of support for innovation are high, whereas teams high on reflexivity are equally good at implementing innovations even if they have lower levels of participation (β=-.25, $p < .09$). Again the significance level for the interaction effect between reflexivity and support is slightly above 0.05, but similar to Hypothesis 3a I decided to accept it due to the relatively small sample size.

Table 6.8. Hierarchical multiple regression analysis for the effect of support for innovation and team reflexivity, and their interaction term, on creativity and innovation implementation (N=50)

	Innovation		Creativity	
	Additive model	Interaction model	Addicitve model	Interaction model
Step 1				
Organization	.09	.13	.38	.42*
Team size	.16	.10	.16	.12
Team tenure	.02	-.07	-.58*	-.65*
R&D tenure	.12	.23	.52†	.61*
Team tenure diversity	-.25	-.32	-.22	-.28
R&D tenure diversity	.11	.10	-.17	-.17
Training diversity	-.24	-.21	.06	.08
Sex diversity	-.09	-.09	-.05	-.05
Support for innovation	.23	.30†	.43**	.49**
Team reflexivity	.52**	.42*	.29	.21
Step 2				
Team reflexivity x Support for innovation		-.25†		-.20
Adj. R^2	.33	.35	.31	.33
R^2 change	.46**	.04†	.45**	.02
F	3.25**	3.37**	3.15**	3.07**

† $p < .10$; *$p < .05$; **$p < .01$.

These results indicate that, similarly to what was found for the other group processes mentioned above, team reflexivity interacts with support for innovation to predict innovation implementation in the sense that reflexivity becomes more important when there is low support in the team (see Figure 6.5).

Hypothesis 5a predicts that team reflexivity moderates the relationship between intragroup safety and creativity. The results presented in Table 6.9 indicate that team reflexivity does not interact with intragroup safety in predicting team creative outcomes. Contrary to expectations, there are no main effects of intragroup safety or team reflexivity on creativity. Thus Hypothesis 5a receives no support from these results.

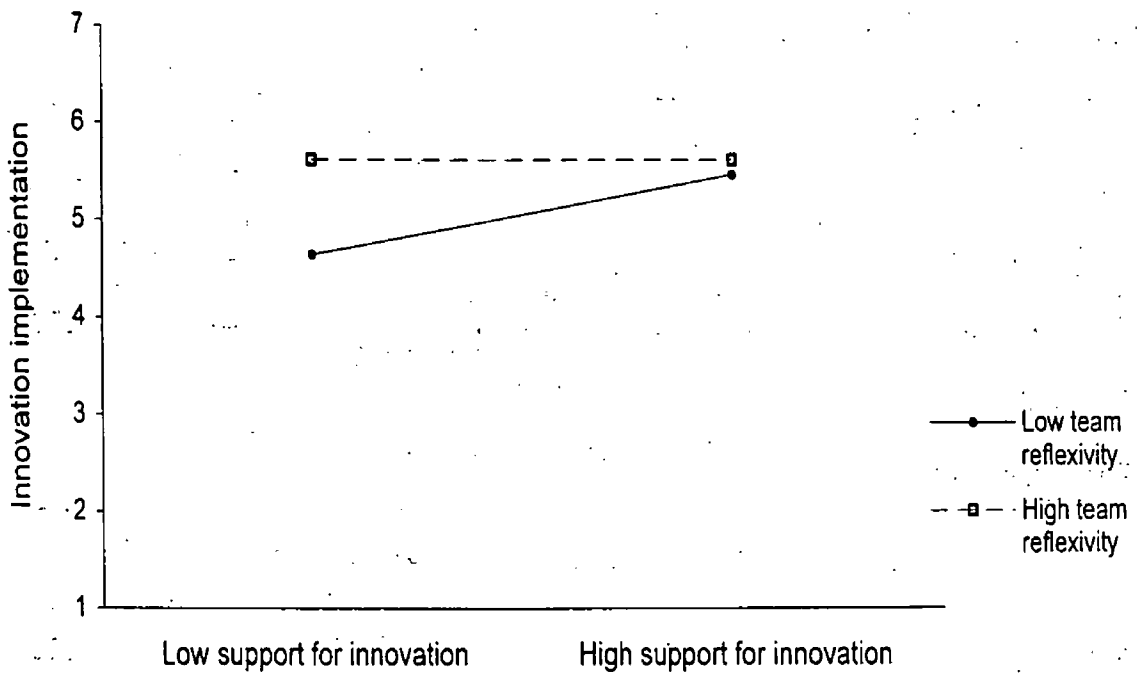


Figure 6.5. Innovation implementation as a function of support for innovation and reflexivity

Table 6.9. Hierarchical multiple regression analysis for the effect of intragroup safety and team reflexivity, and their interaction term, on creativity and innovation implementation (N=50)

	Innovation		Creativity	
	Additive model	Interaction model	Additive model	Interaction model
Step 1				
Organization	.03	.02	.27	.27
Team size	.16	.09	.11	.05
Team tenure	.04	-.01	-.70*	-.72*
R&D tenure	.03	.07	.41	.45
Team tenure diversity	-.19	-.26	-.07	-.13
R&D tenure diversity	.15	.16	-.12	-.11
Training diversity	-.28†	-.22	-.01	.04
Sex diversity	-.05	-.09	.02	-.02
Intragroup safety	.23†	.19	.16	.13
Team reflexivity	.46**	.48**	.24	.26
Step 2				
Team reflexivity x Intragroup safety		-.26*		-.22
Adj. R^2	.33	.39	.18	.22
R^2 change	.47**	.06*	.35*	.04
F	3.41**	3.80**	2.10*	2.23*

*$p < .05$; **$p < .01$.

Hypothesis 5b predicts a moderating effect of team reflexivity on the relationship between intragroup safety and innovation implementation. The results shown in Table 6.9 lend partial support to this Hypothesis by showing that the interaction term between team reflexivity and intragroup safety explained a significant portion of the variance in innovation implementation beyond that accounted for by their additive combination (R^2 *change* = 0.06, p< .05).

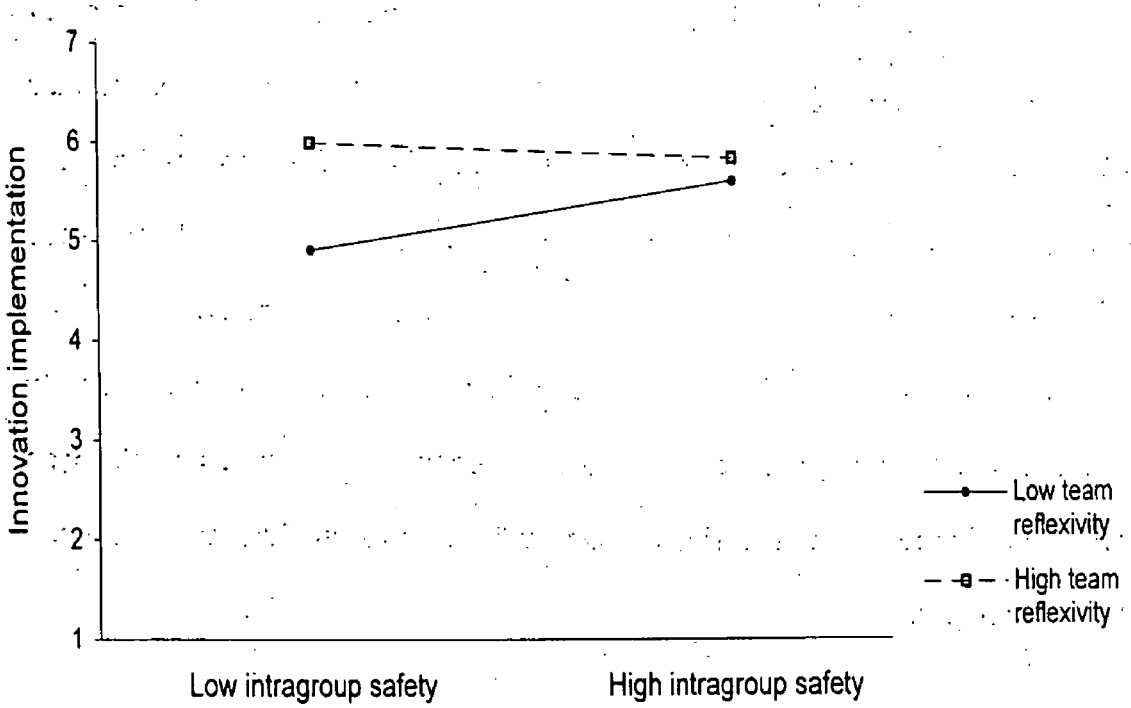


Figure 6.6. Innovation implementation as a function of intragroup safety and reflexivity

The significant interaction for intragroup safety shows that teams low on reflexivity are better at implementing innovation when their levels of intragroup safety are high, whereas teams high on reflexivity are equally good at implementing innovations even if they have lower levels of intragroup safety (β=-.26, p< .05). These results indicate that team reflexivity interacts with intragroup safety to predict innovation implementation in the sense that reflexivity plays a significant role when safety levels are low (see Figure 6.6).

Chapter Summary

Chapter 5 presented the results of the analyses conducted to test the hypotheses outlined in Chapter 3. The results indicated that all sharedness processes – goal clarity and commitment, open and frequent participation, expressed and enacted support for innovation, and intragroup safety expressed by a positive group affective tone – were significant predictors of team innovative performance. The results also showed that reflexivity moderated the relationship between almost all sharedness processes and team's creativity and innovation implementation. The results outlined here are further discussed in the next chapter.

CHAPTER 6

DISCUSSION

Chapter Outline

In the current chapter the major findings are discussed. First, I clarify which processes exert more influence in the idea generation phase and which are more preponderant during the idea implementation phase. Second, I argue for the regulatory function of team reflexivity on team dynamics. Finally, previous findings are integrated in the explanations provided throughout the discussion of findings.

A considerable number of studies has examined the direct effects of group processes on group innovative outcome but none, to the author's knowledge, has analyzed how the interaction among group processes facilitates or hinders the team innovation process. In the current study, I first assessed the unique contribution of each sharedness process to the team innovation process. Specifically, which processes exert more influence during the idea generation phase and which are more preponderant during the idea implementation phase. Second, I attempted to demonstrate that team reflexivity might have a regulatory function on team dynamics.

I drew on the information processors literature to define sharedness as those processes in the group dynamics that facilitate the exchange of ideas,

information and knowledge among group members in order to successfully accomplish the group's task. Goal clarity and commitment, participation, support for innovation, and developing intragroup safety are examples of such processes that have been shown to be associated with team innovation (West, 2002). Moreover, I attempted to demonstrate that these sharedness processes have a differential influence on two stages of the innovation process: idea generation and innovation implementation.

The first Hypothesis, relating sharedness processes with team innovation process, was supported. The four sharedness processes model explained a significant amount of the variance in both creativity and innovation implementation. The findings suggest that clarity of and commitment to team goals; interaction frequency, participation in decision-making and influence in the team; members' support for new and improved ways of doing things; and the group affective tone improve the team's awareness, understanding of task and sharedness of information and knowledge, thus contributing to increase the team innovative outcome. The importance of this kind of group processes as correlates of innovation performance is consistent with previous research in different contexts ranging from R&D teams (Hirst & Mann, 2004; Marshall & Lowther, 1997; Taylor, Snyder, Danke & Kuether, 1995) to hospital teams (Borril et al., 2000; West & Anderson, 1996).

As expected, different sharedness processes emerged as the strongest predictors of creativity and innovation implementation. Results indicated that

intragroup safety and support for innovation were responsible, in equal parts, for the largest portion of variance in creativity explained by the sharedness processes. Thus, a positive affective tone in the team, associated with high levels of articulated and enacted support among team members may create the proper environment for introducing and discussing novel ideas. These findings are consistent with previous research showing that the more members in a team are in a positive mood, generally described by feelings of enthusiasm, optimism, calm, and comfort, the more individuals are engaged in cooperation, in trading opinions, ideas and knowledge, and therefore the higher is the level of sharedness in the team (Kelly & Barsade, 2001), and show better recognition of integrative solutions than those in a negative mood (Carnevale and Isen, 1986). From a strict individual perspective, mood can influence people's cognition, particularly regarding social information. That influence may be exerted through several ways. For example, the person's current emotional state helps to focus on any information that is consistent with state. Also, the greater the consistency between the information and the emotional state, the better able an individual is to assess complex and ambiguous aspects of that information (Forgas, 1994). Thus, an emotional state influences memory and information processing, as well as information based judgments. During the process of innovation, idea generation depends more of individual skills and ability than any other stage, even if idea development is to be done by a group. Thus, a positive affective tone or mood within a group may facilitate the task of generating novel ideas and negotiating those ideas with other team members. The influence of positive moods in cooperative behavior during

teams' negotiation is also well documented (Baron, 1990; Forgas, 1998). Another explanation for the relationship between positive mood and creativity may be found in the suggestion of George and Brief (1992) whether positive mood will lead to more extra-role behaviors because there is greater goodwill within the group due to positive thoughts about the group. Contributing ideas to the team is a voluntary action and therefore can be perceived by team members more as an extra-role behavior than a core activity of the team's task.

These findings also suggest that verbal support through expectations and approval encourages team members to generate ideas and share them within the group. The approval of one member suggestions and opinions by the other members is a strong stimulant for that member to continue proposing new ideas, as well as discussing the ideas introduced by other members. Results from other studies bear witness to the association between support and group effectiveness (Campion et al., 1993, 1996), and more specific support for innovation and innovation (Anderson & West, 1998; Burningham & West, 1995), as well as the relation between interpersonal support within the group and greater willingness of group members to engage in change efforts (Tierney, 1999) and to engage in innovative efforts (Scott & Bruce, 1994). In a study with hospital teams, West and Anderson (1996) found support for innovation to be the best predictor of implemented changes novelty.

Participation emerged as the third most important predictor of creativity. Interaction frequency, influence in decision-making, and the exchange of

information among team members seem to be necessary for idea generation but only to a certain degree. During idea generation, the exchange of knowledge or information is not as important as the willingness to put forward novel and radical ideas and to question the ideas advanced by other colleagues. Apparently, the mere presence of norms for participation may not stimulate team members to put their ideas forward unless an affective climate of positive value exists as well as a behavioral indicator – usually verbal – that his or her ideas are welcome.

Of all sharedness processes, group goals and participation emerged as the most important predictors of innovation implementation. Clarity of and commitment to team goals is by far the strongest predictor of product or process implementation. Clear goals provide team members with clear directions, which in turn facilitate the choice of appropriate procedures and promote a stronger focus and effort on the tasks. Setting clear goals is of particular importance for teams with innovative tasks, as goal setting reduces uncertainty about the qualities of the expected output. Making good decisions about allocating limited resources is critically dependent upon knowing where the team stands with respect to the desired goal states. For example, Hoegl and Parboteeah (2003) found that goal setting was more strongly correlated to effectiveness (output quality) than efficiency (adherence to budget and schedule) in software development teams.

The importance of clarity of objectives is consistent with previous research in innovation teams. Thamhain (1996) found that communication of project objectives was an important determinant of performance in engineering teams, and

Pearce and Ensley (2004) found that shared vision was reciprocally and longitudinally related with teams dynamics and innovation effectiveness in product and process innovation teams. The reciprocal influence between vision and team dynamics is congruent with the high correlations observed between group goals and the other group processes and gives support to the idea espoused in this dissertation that there are certain interaction processes in a group that promote the sharing of information and knowledge among group members, but also facilitate the development of shared team goals. Reciprocally, clear goals may help team members focus their exchanges around the issues that are more relevant to the goals of the team. These processes I called sharedness processes.

A concurrent explanation for the association between group goals and innovation implementation may also found support in the Pearce and Ensley (2004) study. Such explanation posits that clarity of and commitment to goals depends not only on the interactions within the group but also on the success of the team. As a team becomes more effective at implementing new solutions, the reason for the team's existence and its path to the future becomes clearer. Similarly, as the effectiveness of the team increases, its members became more committed to team's goals.

Participation also emerged as an important predictor of innovation implementation. As expected, the implementation stage of the innovation process is dependent on different behaviors than those involved in idea generation. It is the negotiation, cooperation, resources gathering, power struggles inside and outside the team that allow team members to transform ideas into products, processes or

procedures novel and useful to the team or the organization. Therefore, group processes that allow team members to frequently engage in free and comprehensive discussion of ideas have more influence in the development of ideas. Latham, Winters and Locke (1994) suggested that participative decision-making in autonomous work teams will have a positive effect on performance because subordinates with task-relevant knowledge are allowed to share it and implement it. High quality solutions require extensive and diverse knowledge that may only be brought up through idea and information sharing among team members. Therefore, the existence of processes that stimulate team members to share information is paramount to the development of ideas with greater likelihood of being implemented. This idea has received empirical support from previous research. In a study with cross-functional teams, from high-technology firms responsible for developing new products, Lovelace, Shapiro and Weingart (2001) found that collaborative communication moderated the relationship between intrateam task disagreement and team innovativeness, such that the negative effect of task disagreement on team's innovativeness will be less frequent in teams that communicate in a collaborative manner. Such relationship finds support in the idea that through sharedness processes team members can dilute their differences by increasing the level of sharedness in task representation. Also, open and frequent interaction among team members stimulates the integration of different perspectives, the generation of feedback and eventually will lead to better decisions (Tjosvold, 1985).

Due to time, budget, and management pressure, transformation of ideas into products or processes tends to impose higher demands upon team members in terms of investment, resistance to frustration and persistence. When team members have some degree of influence in decision-making they are more motivated to invest in the outcomes of those decisions, taking their efforts farther and reducing their resistance to introduce changes. Influence in decision-making may be seen as the motivational force that stimulates group members to share their ideas and knowledge, as a way of ensuring the success of the innovations they are attempting to introduce. Previous research has empirically supported this positive relationship between participation and innovation in contexts as different as oil companies (Burningham & West, 1995), and research and development project groups (Keller, 1994). In yet another context, De Dreu and West (2001) argued that creativity induced by minority dissent would lead to innovation only when team members participated in decision making.

The second goal of this research was to examine the influence of team reflexivity in the innovation process. In particular, how team reflexivity interacts with the sharedness processes to promote the generation and implementation of ideas within the team. The results indicate that team reflexivity plays an essential role in team innovation process. For example, team reflexivity was found to be a strong predictor of idea implementation, but not of idea generation. This is not surprising since creativity and implementation demand different individual skills and different group processes. West (2002b) argues that generating ideas in a group depends more on individual creativity and is relatively easy, while implementing new

products, processes, or procedures is more of a group task and is more difficult because of resistance to change, and cultural and structural barriers. In the same vein, Amabile (1988) proposes, in her model of creativity and innovation in organizations, that generating ideas (creativity) and implementing them (innovation) are processes that occur at different levels and require different skills and resources. Therefore, creativity is primarily an individual process that depends on worker's intrinsic motivation to do the task, creativity-relevant skills, and domain-relevant skills (Amabile, 1988). Innovation, is first and foremost a group and organizational process that depends on the availability of resources in task domain – people with relevant knowledge, material and financial resources, information and training – and skills in innovation management – goal-setting, rewarding of innovative behaviors, participation in decision-making, flat structures, and intergroup cooperation.

Suggesting new ideas, despite how inappropriate they might be, has no consequences to the organization. However, attempting to implement them usually has high costs to the organization concerning time, resources, and people, and may have negative consequences regarding costumer commitment and overall performance if such attempts to introduce innovations fail. Therefore, the constant reflection upon the team's objectives, strategies and processes, detailed implementation planning, and consideration of alternative courses of action are paramount to idea implementation (West 2002). The results of this study suggest that members of teams with higher reflexivity are interacting frequently to monitor their progress on achieving the goals. Thus, higher team reflexivity not only

ensures that teams are aware of their progress but also aids them in planning project milestones and deadlines. The differential influence of team reflexivity on creativity and implementation may start to shed some light on the group processes that are called upon in the two stages of the innovation process (King, 1990; West, 2002).

Additionally, team reflexivity was shown to moderate the relationship between sharedness processes and innovative performance of R&D teams. Hypothesis concerning the interaction effect between team reflexivity and each of the four sharedness processes were supported but only partially, as the interaction between reflexivity and the other group processes did not turn out to be exactly as I was expecting. The original hypothesis predicted that teams high on reflexivity and high on sharedness processes would be more innovative than teams with high sharedness processes and low reflexivity. The rationale for this hypothesis is that team reflexivity works as a group regulatory process that focus the team sharedness processes on the task of generating ideas and developing them into new products, processes or procedures. Either by changing the strategies to approach problems, or redefining goals, making them more clear to team members, and changing the processes by which team members share ideas, information and knowledge, I was expecting a synergetic effect to emerge that would greatly boost team performance. Such effect was not evidenced by the results since teams with high sharedness processes and low reflexivity were as innovative as teams with high sharedness processes and high reflexivity. However, teams with low sharedness processes benefited greatly from high team reflexivity,

in such a way that teams low on sharedness but high on reflexivity were as innovative as teams high on reflexivity and high on sharedness processes. In this case, can we speak of team reflexivity as a regulatory mechanism of group dynamics? To answer this question I will begin by defining team regulation and proceed to analyze the interaction effect between reflexivity and sharedness processes separately for idea generation and idea implementation.

Reflexivity as a Team Regulatory Process

A self-regulation process may be defined as the "modulation of thought, affect, behavior, or attention via deliberate or automated use of specific mechanisms and supportive metaskills" (Karoly, 1993, p. 25). According to Kanfer and Ackerman (1989), self-regulatory processes at the individual level are part of the motivational processes individuals use for cognitive resources allocation. When confronting tasks, individuals must decide whether to allocate attentional resources to goal attainment and how much resources should be dedicated to task accomplishment. This self-regulatory process includes three types of behavior: self-monitoring, self-evaluation, and self-reaction. Self-monitoring involves attention to goal-related behaviors and strategic allocation decisions to make goal completion possible. Self-evaluation entails the comparison of current performance to the desired level of performance, and the assessment of the magnitude of goal-

performance discrepancy. Self-reaction includes both affective reactions to feedback and self-efficacy judgments. The setting of goals automatically initiates self-regulatory activities whereby people monitor and evaluate their performance (Kanfer & Ackerman, 1989).

Regulation at the team level was conceptualized as an isomorphic process to the individual level self-regulation process, characterized by construct parallelism and functional equivalence of the relations linking parallel constructs (DeShon, Kozlowski, Schmidt, Milner & Wiechmann, 2004). Therefore, situational factors such as performance feedback and team characteristics such as performance orientation and mastery orientation have both direct and interactive effects on the formation of intentions and actions that are part of the team-regulatory processes. Examples of common intentions are team goals, team members' commitment to the goals, and team efficacy. These intentions affect performance by means of regulatory actions such as increasing team-focused effort and developing the strategies needed to achieve the goals. This is a dynamic process where a team develop intentions, act on those intentions through team focused actions, collect formal and informal feedback on the effectiveness of those actions, and adapt either the intentions (team goals) or the actions (e.g. changing strategies) in response to the goal-relevant feedback (DeShon et al., 2004, p. 10).

With this definition of team regulation in mind let us take a look at the results for the interaction hypothesis. First, there is a significantly different pattern of effect between team reflexivity and creativity, and team reflexivity and innovation implementation. Not surprisingly, reflexivity plays both a direct and interactive

effect on the implementation of ideas, but has no direct effect and plays a partial interactive effect on the generation of ideas. Reflexivity appears to be more a hindrance than an advantage to the process of generating ideas. Creativity is best predicted by support for innovation and intragroup safety, thus suggesting that in R&D teams ideas are generated on a free willing base and without much constraint. Team members give their ideas when they feel appropriate without concerning with their consequences and without fear of peer reproof. Usually, high goal clarity and goal commitment will motivate team members to contribute novel ideas and will channel those ideas toward the team's objectives. In this scenario, reflexivity may be a hindrance to creativity either by excessive monitoring and planning that may reduce the radicalness of ideas, or by consuming time and cognitive resources that would be best allocated to generate ideas. Conversely, when goals are unclear team members may be a little lost on what is expected from them and attempt to generate ideas through a process of trial and error. In the absence of feedback, either from within or outside the team, this trial and error process will continue indefinitely without much success. In this scenario reflexivity can make a difference by regulating the team members process of generating ideas. This can be achieved by clarifying goals, setting new strategies, and adjusting team members' effort.

The same logic applies for participation in the team, or more precisely, for the lack of participation in the team. Again, in R&D teams where researchers do not interact frequently and do not engage in openly discussion of issues, reflexivity may facilitate team members' interactions in such a way that their creative

performance comes close to the level of highly participative teams. On the contrary, when teams are highly participative, engaging in reflexivity does not bring out any advantage to the team. Previous research has shown that reflexivity by itself does not promote creativity. For example, Carter and West (1998) found reflexivity to be positively related to clarity of team goals, participation in decision-making, team affective tone, and even team effectiveness (audience ratings) but not to team creativity in television production teams.

Reflexivity as a team regulatory mechanism is supported by the results of this study. Teams low on participation or low on goal clarity and commitment and low on reflexivity have the worst creative performance. However, when those teams engage in a reflexive process they can be as creative as teams high on participation and group goals. The hypothesized interactions between team reflexivity and support for innovation, and reflexivity and intragroup safety follow the same trend of the other two but were not statistically significant. One possible explanation may be found on the distinction that Kanfer and Ackerman (1996) make between motivational control and emotional control. Motivational control is a self-regulatory process more concerned with maintaining task focus despite boredom or satisfaction with performance, whereas emotional control is more concerned with preventing intrusion of negative emotions on task performance. The homology with team level regulation may lead us to think of team reflexivity as a motivational regulation process, thus having a limited power in the regulation of team's emotions or affective tone expressed in the support for innovation and intragroup safety processes.

Team reflexivity evidenced a direct as well as an interactive effect on the process of idea implementation. Reflexivity interacted with clarity of and commitment to team's goals, participation in decision-making, support for innovation, and intragroup safety to predict development of ideas into new products, processes or procedures, although not always in the hypothesized direction. Contrary to expectations, team reflexivity did not act as a steering wheel for teams with high levels of goal clarity and commitment, participation, support and safety, leading them to a higher performance. However, team reflexivity acted as a team regulation mechanism by pulling teams up when goals are not clear, participation and support for innovation levels are low, and the mood is not good. The team-regulatory capacity of reflexivity is called to intervene along the implementation process whenever there is a discrepancy between team current performance and goal states, thus reducing the discrepancies.

The results of this study support that idea given that teams less successful in implementing ideas are the ones who could not develop a reflexive process to counter the innumerous discrepancies that may have surfaced during the idea development process caused by either lack of goal clarity and commitment, participation, support for innovation, and intragroup safety or all the sharedness processes taken together. One can speculate that by being reflexive, teams can clarify goals, define strategies and delineate implementation intentions, which by them prompt action. In a set of experimental studies, Brandstätter, Lengfelder and Gollwitzer (2001) demonstrated that forming implementation intentions instigates immediate efficient action initiation. Forming implementation intentions is a

conscious mental act with automatic consequences, since individuals attempt to decide in advance on how one wants to respond if a certain anticipated critical situation is encountered. According to Gollwitzer and colleagues, implementation intentions represent a self-regulatory tool that can willfully be used whenever the initiation of goal-directed behavior is at stake. The strategic character of implementation intentions is characterized by three features: (1) implementation-intention effect seems to be more pronounced the more difficulties in initiating goal-directed behavior are encountered; (2) implementation intentions were most effective in completing difficult instead of easy goals; and (3) their effect on action lasts only as long as the individual still holds the respective implementation intention. Taken together, these findings imply that the less routine the implementation of a specific goal is per se, the more effective the forming of implementation intentions can be for goal achievement (Brandstätter, Lengfelder & Gollwitzer, 2001).

The regulation effect reflexivity has on team functioning is fundamental during the process of developing ideas. The success of an R&D team is less dependent on the idea generation part than on implementation part of the process. No matter how good or how bad the ideas are the consequences are not as dramatic as the failure in translating those ideas into novel products. Developing ideas consumes more resources; time included, and therefore is less compliant with wandering around without clear directions. Reflexivity does not replace group integration processes or even had to them – teams with high levels of group

integration processes are very good at implementing innovations even when they are low on reflexivity – but it may help members of teams with low levels of integration focus their efforts in accomplishing the task at hand. In contrast with what was verified concerning creativity, several studies with real teams have found a direct positive relationship between team reflexivity and team performance (Schippers, Den Hartog, Koopman & Wienk, 2003; Tjosvold, Hui & Yu, 2003), and between team reflexivity and innovation (Borril, West, Shapiro & Rees, 2000; Carter & West, 1998). In a study with research teams Dunbar (1996) found that scientific breakthroughs tended to occur when groups reflected on potential causes for negative or inconsistent findings. A few additional studies have addressed the interaction effects of reflexivity with some group processes and composition attributes. For example, DeDreu (2002) reported that minority dissent was associated either with more innovations and higher team effectiveness only when there were high levels of team reflexivity. West, Utsch, Borril & Dawson (2002) found that teams with high levels of knowledge diversity were able to be more innovative, provided they engaged in task reflexivity.

Chapter Summary

Chapter 6 discussed the findings of the data analysis performed in the previous chapter. All hypotheses received full or partial support. Results sustained the idea that the four sharedness processes play a differential role along the innovation process. While the generation of creative and useful ideas is more dependent on

high levels of support between team members and a positive affective tone in the team, the development of ideas into novel products, processes, and procedures is more dependent on high levels of goal clarity and commitment, and participation in decision making. Finally, results also bared witness to the idea that a team's ability to reflect upon goals, strategies, and processes and to adapt them to changes in their environment is fundamental to the innovation process. Reflexivity plays a regulatory role that enables teams to correct the surfacing discrepancies between their functioning and goal states along the implementation process.

CHAPTER 7

OVERVIEW AND CONCLUSIONS

Aims of Thesis and Summary of Findings

This thesis formulated and tested a model of team innovation. I based the theoretical framework and hypotheses on two well-established theoretical perspectives: a functionalist approach to team performance, and a group information processing perspective. The functionalist approach informed my quest for the factors that distinguished successful from unsuccessful teams in producing innovation. It helped me to focus on the functions of inputs and processes as predictors of team innovative performance. The perspective of teams as information processors helped me to clarify the specific functions of certain group processes in promoting sharedness of information, idea and task definition among members of a team. The group processes operationalized as sharedness processes were clarity of and commitment to team goals, participation in decision-making, support for innovation, and intragroup safety. The information processing perspective was also relevant to hypothesize differential effects of group processes upon the idea generation and idea implementation phases of the innovation process. This distinction between idea generation and idea implementation was anchored in previous research on the process of innovation. Finally, both perspectives lay ground to the

conceptualization of reflexivity as a team-regulatory mechanism. Testing a model of regulation of team sharedness processes as predictor of innovation involved two stages. The first stage established whether the team innovation model adequately measured the proposed constructs. Confirmatory factor analysis demonstrated that the five-factor team innovation model displayed acceptable measurement properties. In the second stage of hypothesis testing I examined the relationship between sharedness processes and idea generation and idea implementation, based on ratings provided by team managers and leaders. The team-regulatory effect of reflexivity was also examined. The results provided support for the general model of sharedness processes and regulation. In general, team sharedness processes explained an important proportion of the variance in team's innovative performance. Furthermore, the four sharedness processes studied have dissimilar impact throughout the innovation process. Support for innovation, and intragroup safety, followed by participation, emerged as the strongest predictors of success during the idea generation stage while goal clarity and commitment, and participation in decision-making, followed by safety, emerged as the strongest predictors of success during the implementation stage. The hypothesized effect of reflexivity as an innovation booster did not find support on the results, given that high levels of reflexivity did not add to the positive effect of sharedness processes on creativity and innovation. Nevertheless, team reflexivity appeared as a group-level regulatory mechanism, preventing teams with low levels of sharedness processes of becoming unsuccessful either in generating and implementing ideas. Another relevant finding in this study was that almost all team

composition characteristics used as control variables (coefficient of variation of team tenure, and R&D experience, team size, sexual heterogeneity of the teams, training heterogeneity of the teams, and the average tenure in the team) had no direct effect on the innovation process beyond that of group processes. The exception was average team tenure, which was negatively associated with idea generation; even when group processes and their interaction were controlled for.

In summary, the results provided support for the team innovation model and suggest that the five factors play distinct functions throughout the process of developing novel products, processes or procedures which are designed to benefit the team, the organization or the wider society as is the case of the R&D teams who accepted to be part of this study. Enacted and articulated support provided by team members for new and improved ways of doing things and a positive group affective tone were the most important predictors of the idea generation stage. Also, diversity of team attributes did not predict creativity, but teams where people worked together for longer were less creative than younger teams. Conversely, clear team goals and high commitment of team members to those goals, and high levels of information sharing, interaction frequency, participation in decision-making, and influence in the team were the most important predictors of idea application. The team ability to reflect upon team's objectives, strategies and processes, and adapt them to environmental changes or performance discrepancies was also an important predictor of idea implementation. However, the most interesting feature of reflexivity was its

capacity to regulate team processes, enabling teams with poor sharedness processes to become successful innovators in the long run.

Strengths and Limitations

This study builds on a number of strengths. First it made an effort to shed some light on the group integration processes that are called upon in different stages of the innovation process. West argues that innovation is a two-component process, encompassing both creativity – the generation and development of ideas – and innovation implementation – the introduction of new and improved products, services, and ways of doing things – in a non-linear progression (West, 2002, p. 357). He also argues that factors influencing both creativity and innovation implementation are not identical, urging us to clarify such differential impact. Paulus (2002) questions to what extent team members' skills and knowledge and team processes enable teams to overcome the problems they encounter in idea generation and implementation. Nijstad and De Dreu (2002) challenged researchers to study more real groups and examine interaction effects in more detail. Therefore, this dissertation attempts to respond to those challenges in several ways: by studying real R&D teams whose main tasks are to create new knowledge, broad-based and applied to particular problems, to produce new products or processes or to improve existing ones which are the heart of the innovation process; by identifying two separate stages in the innovation process and described which group processes are more relevant for

each stage; and finally, by examining the interaction effects of reflexivity and the other group processes on each stage.

Second, from a theoretical point of view, this dissertation integrated contributions from a perspective of groups as information processors (Hinsz et al., 1997) into a traditional functionalist framework. By conceptualizing well studied group interaction processes as sharedness processes I intended to describe with greater accuracy how group processes enable teams to achieve complex tasks as those involved in the creation of something new and useful. Complex tasks require team members to transfer cognitive resources from the individual to the group. That can be successfully achieved only by means of interaction processes that enable and encourage such transfer. That is why group processes like participation, goal clarity and commitment, support, and intragroup safety are necessary for team members to share their specific knowledge and put it to the service of the team.

Third, the introduction of team-regulation construct helped clarify team performance as a dynamic adaptive process. The idea of regulatory mechanisms in teams has been rarely the object of study. The exception is DeSchon and colleagues (2004) that conceptualized and test a regulatory process at team level that is isomorphic and functionally equivalent to regulatory process at individual level. The test of team reflexivity as a regulator of team performance, although suggested by West (1996) was never done before. Finally, this study discussed the idea that different group processes have different functions depending on the type of task teams have to accomplish in a given moment. It is argued that some processes are necessary to facilitate idea

and information exchange within the group while others are more relevant for goal achievement and implementation. The findings of this study seem to support the idea proposed by Gollwitzer and colleagues (Beckman & Gollwitzer, 1987; Gollwitzer, 1990) that different mindsets are called upon in different stages of a goal implementation process. When people decide whether to adopt a specific goal the best results are achieved when individuals adopt a deliberative mindset, and once that decision has been made an implemental mindset would be better. A deliberative mindset is characterized by careful examination of competing goals, objective weighing of pros and cons of each. It is assumed to foster accurate and open-minded appraisal of evidence and thorough judgment processes. An implemental mindset is oriented toward moving quickly and expeditiously to a positive outcome. It is assumed to have a determined, closed-minded, self-serving focus, biased toward thinking about success. In an isomorphic model of team innovation process mindsets would be equivalent to shared teamwork schemas, that is shared representations of team tasks and processes (Rentsch & Hall, 1994). During the idea generation stage where evaluation of alternative idea and choice of ideas for further implementation would require a collective deliberative mindset. In turn, the stage of idea implementation where focus on outcome is paramount would be better served by an implemental mindset.

The results of this study reflect the greater importance of effective sharedness processes as well as regulatory processes in settings of high complexity, such as R&D teams. As tasks become increasingly complex, so does the need to transfer cognitive resources from the person to the group. If

we look at the nature of R&D activity, there seems to be a greater emphasis on knowledge acquisition and retrieval than in many other areas of team working. In effective teams members act as collective sources of ideas, enhancing the shared-knowledge base of the team and providing opportunity for the voicing and testing of different opinions. The study analyses suggested that reflexivity by itself is not a guarantee of project success. However the absence of reflexivity, particularly when performing complex tasks, may severely impede project performance.

At the methodological level of concern this istudy used real teams that tended to perceive of themselves as a team, perceived that others in the organization recognized them as a group, and worked together on an ongoing basis to produce new knowledge and products. In addition, the teams had a high level of within interrater agreement for the variables in the study, indicating that teams had engaged in "collective interpretation" (Kozlowski & Hattrup, 1992, p.162) of these relevant contextual, team-related, and job-related features of their situation and had arrived at a consensus about those features.

Furthermore, the variable measures appeared to have acceptable discriminant validity and high reliability. I used existing, previously validated measures with Portuguese samples (goal clarity and commitment, participation, support, and safety), and with other samples (reflexivity) and developed two new measures (creativity, and innovation implementation) after existing published measures. Finally, the measures of creativity and innovation implementation were collected either from team managers or leaders that were

not included in the team for purposes of analysis in order to eliminate concerns of common-method bias.

Despite the methodological strengths described above, this study is not without its limitation. One limitation of this study was the impossibility to use hard-data measures of innovative performance. More objective measures of team's performance (e.g. articles published, patents, costumer evaluation of new products) were not available for two main reasons: (a) outcomes produced after the measurement of team processes were available long after the deadline of this research, (b) frequently information about a new product could not be disclosed without costumers consent, which revealed almost impossible to get. Nevertheless, I would like to stress that it is important to collect other innovative performance measures to concurrently validate the self-reported and supervisor reported measures of innovation often used in studies of team innovation. For example, the number of projects that teams were engaged in the year after team processes were measured divided by the number of team members, was positively correlated ($r = .37$, $p = .06$) with the innovation implementation as assessed by managers. Also creativity measure was positively correlated ($r = .73$, $p = .02$) with number of produced articles, divided by number of team members, for the same year. The downside is that archival data was available only for 25 teams in the first case and 10 teams in the second.

A second limitation is concerned with sample size. There was considerable variation in the teams examined according to the type of R&D tasks the teams were involved in (see Table 5.1 in Chapter 5), hierarchical structure of the team, and other non-controlled variables that could not have

been included in the analysis due to the sample size. For example, it would have been interesting to compare teams whose major concern was to produce new knowledge with teams who were created to develop new products or improve existing ones. Another problem of small sample size has to do with the power of statistical tests. Statistical power "refers to the probability of rejecting the null hypothesis when it is false." (Cohen & Cohen, 1983, p.59). In other words, tests with low statistical power have a lower probability of rejecting false null hypothesis than do tests with high statistical power. In practical terms, this means that true effects having relatively small sizes will have a low probability of being statistically significant. In the case of this study, it is possible that some effects that were not significant, or were significant only at higher confidence level, could have been with a larger sample.

A third limitation of this study is related with the operationalization of the sharedness construct. I argued in Chapter 3 that goal clarity and commitment, participation, support for innovation, and group safety could be conceived as sharedness processes for the reason that they promote the exchange of ideas, information, knowledge, and task and environment representations among team members. I also argued that sharing of ideas, information, knowledge, and representations would be predictors of the innovation process. Although these processes revealed to be good predictors of idea generation and idea implementation, I did not examine whether they really promoted sharedness among team members. That is, a measure of the amount of information, knowledge or ideas shared between members of the team would be appropriate in order to argue that these interaction processes led to sharing and therefore

could be considered sharedness processes. One way out of that limitation could be to find a measure of how much information and knowledge each member received from other members in the team. As a matter of fact, team members were asked to express in a scale ranging from "To a very little extent" to "To a very great extent" how much new knowledge have they learnt from working in their team concerning team management (mentoring, giving individual feedback, facilitating discussion, conflict management, managing change, and boundary spanning), and technical/scientific knowledge. Scientific learning correlated positively and significantly with the four sharedness processes, while team management correlated with team goals, participation, and support but not with safety. Furthermore, scientific learning correlated positively and significantly with idea generation and idea implementation. However, scientific learning did not mediated the relationship between sharedness processes and innovative outcomes, thus suggesting that learning is another outcome of the process of sharing.

A final limitation is the cross-sectional design of the study. Although previous research lends support for the ways in which relationships among variables were conceptualized, such design does not allow expressing those relationships in terms of causality. Moreover, a longitudinal design would have been necessary to account for the dynamic nature of the reflexivity concept. That is, I speculated that reflexivity would compensate for performance discrepancies in teams because it would improve sharedness processes, although that explanation is still to be supported by a longitudinal study. I concur with Anderson, DeDreu and Njstad (2004) on their assertion that in order to

have both internal and external validity in innovation research it is necessary to use a multiple research design and a combination of different operationalizations of our dependent and independent variables.

Practical Implications

The results of this study provide some useful insights to promote team-based innovation. First, group interaction processes that enhance sharing of ideas, knowledge, information, and perceptions are paramount to successfully create and implement ideas. Thus, this study provides empirical justification for the development and use of training programs designed to improve the level of sharedness. West (2002) argued that for teams to be innovative their members had to have relevant skills to work effectively in teams. Examples of such integration skills are conflict resolution skills based on cooperative negotiation strategies, participative group problem solving skills that include the ability to use decentralized communication networks and to communicate openly and supportively. Other integrating skills proposed by West are the ability to set clear goals and the skill to monitor performance and provide feedback both individual and team level. Any training program directed at the improvement of theses skills, either through simulations or on the job training with actual teams, is capable of increase the innovative potential of any team.

Cross-training is one form of training aimed at improving the integrating skills of team members. Cross-training has been defined as "an instructional

strategy in which each team member is trained in the duties of his or her teammates" (Volpe, Cannon-Bowers, Salas & Spector, 1996, p.87). Researchers have suggested that cross-training encourages team members to understand the behavior of their teammates, which positively affects team integration processes. Two forms of cross-training proposed by Marks and colleagues (2002) were found to improve information distribution and team performance, essentially by means of improving the level of shared mental models within teams. Positional clarification provides team members with verbal information regarding the other team members' tasks. Positional modeling involves verbally discussing and observing team members' roles.

A transportable teamwork skill is another training program aimed at improving team members' team-generic skills (Ellis, Bell & Ployhart, under review). This program is an instructional strategy in which team members are trained in integration skills that can be applied in all kinds of teams. Ellis and colleagues proposed that transportable teamwork skills' training improves the information processing systems operating within teams. In their study, participants were trained in a variety of transportable skills before being placed in a team environment. Teams then completed a task simulation, where they were allowed to interact freely with one another. Results indicated that training positively affects both team learning and backup behavior by increasing the amount of knowledge sharing and backup requests in temporary project teams. The results of this study suggest that these types of training programs may be the perfect solution for innovation teams.

Another practical implication concerns the structuring of the innovation

process. The idea generation stage should be separated from the idea implementation stage. As shown by the results, the generation of ideas requires a friendly and supportive environment with time to explore alternatives. Any context that promotes a positive tone in the team is also favorable to the generation of ideas. This may imply to move team members to pleasant places or to go beyond the traditional brainstorming set to make them participate in games that inspire good mood. West (2002) also suggests that the services of a skilled facilitator can help teams maximize their creative output during this stage. Conversely, the implementation stage requires a more implemental setting. That is, team should have frequently predetermined moments conducive to a team-regulatory process. In these moments team members participate in goal resetting, plan their activities, learn how to monitor performance discrepancies, look actively for individual and team feedback, and delineate implementation intentions. According to Gollwitzer and colleagues (Gollwitzer, 1990; Brandstätter, Lengfelder & Gollwitzer, 2001) implementation intentions lead to immediate efficient action initiation once the specified situation is encountered, even under conditions of high cognitive load. For example, in one of the institutes I have studied members of each team met first thing in the morning for 15 minutes to reflect upon the day before and to plan the activities for the day. In another regulatory action, teams gather once a week during lunch break to discuss whatever their members want to, from the last scientific paper to the new movie.

Future Research

Despite the theoretical and practical implications of the results, there are a number of limitations that bring about further investigation. For one thing, this study attempted to integrate an input-processes-output perspective of teams with an information processing perspective at the team level. The team innovation literature would benefit from a further integration of these two perspectives.

From a functionalist perspective, research is needed to examine the effects of different context characteristics on the innovation process. Specifically, we need to better understand whether the factors that positively influence innovative outcomes are the same no matter what the main task of the team is. The results of this study suggest that group safety and support for innovation are necessary for members of R&D teams to generate useful ideas. In turn, R&D teams depend more on goal clarity and commitment, participation, and support for innovation to transform those ideas in novel products or procedures. Furthermore, reflexivity is important during the implementation stage but not during idea generation stage. What happens with teams whose main task is not innovation-related but that from time to time need to introduce some changes in the way they do their work? Are there any differences in the factors most influential in both stages of the innovation process? Teams whose main task is not innovation certainly have clear goals about their task and are committed to them. These goals, however, may not include the need to innovate, in which case goal clarity and commitment would not be good

predictors of innovation implementation. The sparse research that exists comparing teams with different tasks seems to support the idea that different tasks require different group processes. For example, Curral and colleagues (2001) found that teams carrying out tasks with high requirement for innovation had significantly higher levels of participation and support for innovation than those undertaking moderately innovative tasks. We need to further clarify the differences in functioning of teams with low and high innovation requirement.

Future research should also continue to take an integrative perspective by investigating other processes as possible moderators of the relationship between team inputs and sharedness processes and between processes and innovation outcomes. Leadership is a good example of a process that interacts with other processes to positively or negatively affect innovation. West and Hirst (2003, p.310) propose that leadership processes moderate the effects of team and organizational characteristics upon team processes and thereby affect the level and quality of the innovation. I would argue that leadership moderates the relationship between sharedness processes and innovation as well by acting as an innovator suggesting innovative ways of performing tasks and encouraging discussion of different perspectives, or as a directive leader driving structured performance of projects, depending on the innovation stage.

From a perspective of teams as information processors two lines of research may be promising. First, it seems advisable to measure separately clarity of team goals and commitment to team goals, for they may have different effects on team functioning. While testing a model of team regulation, DeSchon and colleagues (2004) found that goal clarity affected the level of effort team

members developed for task accomplishment, while goal commitment affected exclusively the development of team strategies to reduce performance discrepancies. These findings suggest that having clear goals and being committed to them may be different processes and therefore may influence different aspects of the innovation process. Another suggestion for future research concerns the process by which team members come to share knowledge about teamwork, team context, and team task. For example, it may be useful to examine whether shared knowledge mediates the relationship between sharedness process and innovative outcomes. According to Tindale and Kameda (2000, p.124) members of a group can share preferences, attitudes, motives, representations, identities, and cognitive processes to varying degrees and they go on to argue that things that are shared to a greater degree within groups will have greater influence on group outcomes than those things shared to a lesser degree. One example of the influence of sharedness upon group outcomes is found in the common knowledge effect (Stasser & Titus, 1987). That is, shared information is more likely to be recalled than unshared information at the group level. It is therefore necessary to develop good measures of shared things within innovation teams and to look at its particular effect upon idea generation and idea implementation.

What factors facilitate or hinder the development of sharedness processes in a team is another question future research could address. As seen previously leadership behavior is a variable that might account for the development of such processes. Another attribute of teams, more in compliance with an information processing approach that deserves to be closely scrutinized,

is team mental models. Langan-Fox (2003, p.347) advocates that team mental models have the potential to enhance communication and coordination in teams by requiring less communication for the same result. They should also contribute to a faster team member learning, and improve task allocation and decision control through recognition of team members' strengths and weaknesses. TMM may facilitate the development of sharedness processes in teams, which in turn affect their innovative performance, but so far this relationship has not been addresses in research.

A second avenue for research is related to how teams regulate their functioning. To further understand the nature of the relationship between reflexivity and team sharedness processes a longitudinal design is required. I argued before that reflexivity regulates team performance by contributing to increase the level of goal clarity and commitment, participation, and support especially when they are low. However, that presumed influence of reflexivity on team processes can only be observed throughout the development cycle of innovation. Thus, only future studies following a longitudinal design can completely clarify the regulatory influence of reflexivity upon team performance. Another variable that has been seldom used in team innovation research is feedback. Although a considerable number of experimental studies have stressed the role of feedback in regulating behavior no field study of innovation has included measures of feedback (for a review see Anderson et al., 2004). Different types of feedback seem to have different influences on the regulatory process. Locke and Latham (1990) refer that goal setting and individual-level feedback are linked in predicting performance. DeSchon and colleagues (2004)

found support for that relationship at the team level. Teams receiving only individual-level feedback set the highest team goals. However, analysis revealed that team members who received no team-level feedback could not effectively calibrate team-level goals and, as a result, set completely unrealistic team-level goals. In the same study, they found that teams receiving only individual-level feedback were the least committed to the team goals. Finally, the combination of high team mastery orientation and provision of team-level feedback resulted in more positive impacts on regulatory intentions. All these findings suggest that in future research we should pay more attention to the role of feedback. Given that teams are highly dependent on goals and reflexivity to produce innovation it is essential that we examine closer the influence of the different types of feedback on the innovation process.

Concluding Remarks

In summary, team sharedness processes were a significant correlate of innovative performance in R&D teams. Goal clarity and commitment, participation in decision-making, support for innovation, and intragroup safety explained a considerable proportion of the variance in teams' innovative performance. The four sharedness processes studied have dissimilar impacts throughout the innovation process. Support for innovation, and intragroup safety, followed by participation, emerged as the strongest predictors of success during the idea generation stage while goal clarity and commitment,

and participation in decision-making, followed by safety, emerged as the strongest predictors of success during the implementation stage. Team reflexivity appeared as a group-level regulatory mechanism, preventing teams with low levels of sharedness processes of becoming unsuccessful either in generating and implementing ideas. I suggested that the most practical implications one can derive from this study is that team members need to develop their integration skills through well structured programs, and that teams need to dedicate predetermined periods of their daily work to reflect upon their processes and performance. Last, I argued that future research needs to further integrate both functionalist and information processing perspectives in order to further understand the specific contribution of each group process to the overall innovation process.

REFERENCES

Adam, E.E. (1991). Quality circle performance. *Journal of Management, 17*, 25-39.

Agrell, A., & Gustafson, R. (1996). Innovation and creativity in work groups. In M.A. West (Ed.), *Handbook of work group psychology* (pp. 317-343). Chichester, UK: John Wiley & Sons.

Allen, T.J. (1977). *Managing the flow of technology: Technology transfer and the dissemination of technological information within the R&D organization.* Cambridge, MA: M.I.T. Press.

Allred, B.B., Snow, C. C., & Miles, R.E. (1996). Characteristics of managerial careers in the 21st century. *Academy of Management Executive, 10*, 17-27.

Amabile, T.M. (1983). The social psychology of creativity: A componential conceptualization. *Journal of Personality and Social Psychology, 45*, 357-376.

Amabile, T.M. (1988). A model of creativity and innovation in organizations. *Research in Organizational Behavior*, 10, 123-167.

Amabile, T.M. (1996). *Creativity in context.* Boulder, CO: Westview Press.

Amabile, T.M., Conti, R., Coon, H., Lazenby, J., & Herron, M. (1996). Assessing the work environment for creativity. *Academy of Management Journal, 39*, 1154-1184.

Amason, A.C. (1996). Distinguishing the effects of functional and dysfunctional conflict on strategic decision making: Resolving a paradox for top management teams. *Academy of Management Journal, 39*, 123-148.

Ancona, D.G. (1990). Outward bound: Strategies for team survival in the organization. *Academy of Management Journal, 33*, 334-365.

Ancona, D.G., & Caldwell, D.F. (1988). Beyond task and maintenance. *Group and Organization Studies, 13*, 468-494.

Ancona, D.G., & Caldwell, D.F. (1992a). Demography and design: predictors of new product team performance. *Organization Science, 3*, 321-341.

Ancona, D.G., & Caldwell, D.F. (1992b). Bridging the boundary: external activity and performance in organizational teams. *Administrative Science Quarterly, 37*, 634-665.

Anderson, J.C., & Gerbing, D.W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin, 103*, 411-423.

Anderson, N.R. (1992). Work group innovation. In D.M. Hosking, & N.R. Anderson (Eds.), *Organizational change and innovation*. London: Routledge.

Anderson, N.R., & King, N. (1993). Innovation in organizations. In C.L. Cooper, & I.T. Robertson (Eds.), *International review of work and organizational psychology* (pp. 1-34). Chichester, UK: John Wiley & Sons.

Anderson, N.R., & West, M.A. (1998). Measuring climate for work group innovation: development and validation of the team climate inventory. *Journal of Organizational Behavior, 19*, 235-258.

Anderson, N.R., De Dreu, K.W., & Nijstad, B.A. (2004). The routinization of innovation research: A constructively critical review of the state-of-the-science. *Journal of Organizational Behavior, 25*, 147-173.

Angle, H.L., & Van de Ven, A.H. (2000). Suggestions for managing the innovation journey. In A.H. Van de Ven, H.L. Angle, & M.S. Poole (Eds.). *Research on the management of innovation: The Minnesota studies*. New York: Harper & Row.

Arbuckle, J.L., & Wothke, W. (1999). *AMOS 4.0 user's guide*. Chicago: SmallWaters Corp.

Argote, L. (1982). Input uncertainty and organizational coordination in hospital emergency units. *Administrative Science Quarterly, 27*, 420-434.

Arrow, H., McGrath, J.E., & Berdahl, J.L. (2000). *Small groups as complex*

systems: Formation, coordination, development, and adaptation. Thousand Oaks: Sage.

Bain, P.G., Mann, L., & Pirola-Merlo, A. (2001). The innovation imperative: The relationships between team climate, innovation, and performance in research and development teams. *Small Group Research, 32*, 55-73.

Bales, R.F. (1950). *Interaction process analysis: A method for the study of small groups*. Reading, MA: Addison–Wesley.

Bandura, A. (1991). Social cognitive theory of self-regulation. *Organizational Behavior and Human Decision Processing, 50*, 248-287.

Bandura, A. (2001). Social cognitive theory: an agentic perspective. *Annual Review of Psychology, 52*, 1-26.

Banker, R.D., Field, J.M., Schroeder, R.G., & Sinha, K. (1996). Impact of work teams on manufacturing performance: A longitudinal field study. *Academy of Management Journal, 39*, 867-890.

Bantel, K.A. (1993). Strategic clarity in banking: Role of top management team demography. *Psychological Reports, 73*, 1187-1201.

Bantel, K.A., & Jackson, S.E. (1989). Top management and innovation in banking: does the composition of the top team make a difference? *Strategic Management Journal, 10*, 107-124.

Baron, M.R., & Kenny, D.A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173-1182.

Baron, R.A. (1990). Environmentally-induced positive affect: Its impact on self-efficacy, task performance, negotiation, and conflict. *Journal of Applied Social Psychology, 20*, 368-384.

Barrick, M.R., Stewart, G.L., Neubert, M.J., & Mount, M.K. (1998). Relating member ability and personality to work-team processes and team effectiveness. *Journal of Applied Psychology, 83*, 377-391.

Barsade, S.G. (2000). *The ripple effect: Emotional contagion in groups*. Working paper 98, Yale School of Management, Yale University, New Haven, CT.

Beekun, R.I. (1989). Assessing the effectiveness of sociotechnical interventions: Antidote or fad? *Human Relations, 42*, 877-898.

Bentler, P.M., & Bonett, D.G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin, 88*, 588-606.

Bettenhausen, K.L., & Murninghan, J.K. (1991). The development of an intragroup norm and the effects of interpersonal and structural challenges. *Administrative Science Quarterly, 36*, 20-35.

Blau, P.M. (1977). *Inequality and heterogeneity: A primitive theory of social structure*. New York: Free Press.

Bliese, P.D. (2000). Within-group agreement, non-independence, and reliability: Implications for data aggregation and analysis. In K.J. Klein, & S.W.J. Kozlowski (Eds.), *Multilevel theory, research, and methods in organizations: Foundations, extensions, and new directions* (pp. 348-381). San Francisco: Jossey-Bass.

Bollen, K.A. (1989). *Structural equations with latent variables*. New York: John Wiley.

Borril, C.S., Carletta, J., Carter, A.J., Dawson, J., Garrod, S., Rees, A., Richards, A., Shapiro, D., & West, M.A., (2000). *The effectiveness of health care teams in the National Health Service*. Birmingham: Aston Centre for Health Service Organization Research.

Bowers, C.A., Pharmer, J.A., & Salas, E. (2000). When member homogeneity is needed in work teams: A meta-analysis. *Small Group Research, 31*, 305-327.

Brandstätter, V., Lengfelder, A., & Gollwitzer, P.M. (2001). Implementation intentions and efficient action initiation. *Journal of Personality and Social Psychology, 81*, 946-960.

Brodbeck, F.C. (1996). Criteria for the study of work group functioning. In M.A.

West (Ed.), *Handbook of work group psychology* (pp. 285-315). Chichester, UK: John Wiley & Sons.

Bruce, A.K., Armington, C., Hasan, I., & Newbert, S. (2005). *The influence of R&D expenditures on new firm formation and economic growth*. Report for the Office of Economic Research, Washington.

Bunce, D., & West, M.A. (1995). Self perceptions and perceptions of group climate as predictors of individual innovation at work. *Applied Psychology: An International Review, 44*, 199-215.

Burningham, C., & West, M.A. (1995). Individual, climate, and group interaction processes as predictors of work team innovation. *Small Group Research, 26*, 106-117.

Cady, S. H., & Valentine, J. (1999). Team innovation and perceptions of consideration; What difference does diversity make? *Small Group Research, 30*, 730-750.

Campbell, D.T., & Fiske, D.W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological Bulletin, 56*, 81-105.

Campion, M.A., Medsker, G.J., & Higgs, A.C. (1993). Relations between work group characteristics and effectiveness: Implications for designing effective work groups. *Personnel Psychology, 46*, 823-850.

Campion, M.A., Papper, E.M., & Medsker, G.J. (1996). Relations between work team characteristics and effectiveness: A replication and extension. *Personnel Psychology, 49*, 429-452.

Cannon, M. D., & Edmondson, A. C. (2001). Confronting failure: Antecedents and consequences of shared beliefs about failure in organizational work groups. Journal of Organizational Behavior, 22, 161-177.

Cannon-Bowers, J.A., & Salas, E. (2001). Reflections on shared cognition. *Journal of Organizational Behavior, 22*, 195-202.

Carnevale, P.J.D., & Isen, A.M. (1986). The influence of positive affect and visual access on the discovery of integrative solutions in bilateral negotiations. *Organizational Behavior and Human Decision Processing, 37*, 1-13.

Carter, S.M., & West, M.A. (1998). Reflexivity, effectiveness, and mental health in BBC-TV production teams. *Small Group Research, 29*, 583-601.

Carver, C.S., & Scheier, M.F. (1998). *On the self-regulation of behavior.* Cambridge, NY: Cambridge.

Chambel, M.J., & Curral, L. (1995). *Psicossociologia das organizações.* Lisboa: Texto Editora.

Chambel, M.J., & Peiró, J.M. (2003). Alteraciones en las práticas de gestión de recursos humanos y violación del contrato psicológico: Implicaciones para las actitudes y la intención de abandonar la organización de los empleados. *Arxius de Ciències Socials, 8*, 105-131.

Cialdini, R.B., & Trost, M.R. (1998). Social influence: Social norms, conformity and compliance.In D.T. Gilbert, S.T. Fiske, & G. Lindzey (Eds.), *The handbook of social psychology* (4th ed., pp. 151-192). New York: McGraw-Hill.

Coch, L., & French, J.R.P. (1948). Overcoming resistance to change. *Human Relations, 1*, 512-532.

Cohen, J., & Cohen, P. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

Cohen, S.G., & Bailey, D. (1997). What makes teams work: Group effectiveness research from the shop floor to the executive suite. *Journal of Management, 23*, 239-290.

Cohen, S.G., & Ledford, G.E. (1994). The effectiveness of self-managing teams: A quasi-experiment. *Human Relations, 47*, 13-43.

Cohen, S.G., Chang, L., & Ledford, G.E. (1997). A hierarchical construct of self-management leadership and its relationship to quality of work life and perceived work group effectiveness. *Personnel Psychology, 50*, 275-308.

Cohen, S.G., Ledford, G.E., & Spreitzer, G.M. (1996). A predictive model of self-managing work team effectiveness. *Human Relations, 49*, 643-676.

Community Innovation Survey 1998-2000 (CIS III). OCES 2003. Portugal.

Cordery, J.L. (1996). Autonomous work groups and quality circles. In M.A. West (Ed.), Handbook of work group psychology (pp. 225-246). Chichester, UK: John Wiley & Sons.

Cordery, J.L. (2004). Another case of the Emperor's new clothes. *Journal of Occupational and Organizational Psychology, 77*, 481-484.

Cordery, J.L., Mueller, W.S., & Smith, L.M. (1991). Attitudinal and behavioral effects of autonomous group working: A longitudinal field study. *Academy of Management Journal, 34*, 464-476.

Cotton, J.L. (1993). *Employee involvement: Methods for improving performance and work attitudes.* Newbury Park, CA: Sage.

Curral, L.A., Forrester, R.H., Dawson, J.F., & West, M.A. (2001). It's what you do and the way you do it: Team task, team size, and innovation-related group processes. *European Journal of Work and Organizational Psychology, 10*, 187-204.

Damanpour, F. (1987). The adoption of technical, administrative, and ancillary innovations: Impact of organization factors. *Journal of Management, 13*, 675-688.

Damanpour, F. (1991). Organizational innovation: A meta-analysis of effects of determinants and moderators. *Academy of Management Journal, 34*, 555-590.

Damanpour, F., & Evans, W.M. (1984). Organization innovation and performance: The problem of organizational lag. *Administrative Science Quarterly, 29*, 392-409.

David, F.R., Pearce, J.A., & Randolph, W.A. (1989). Linking technology and structure to enhance group performance. *Journal of Applied Psychology, 74*, 233-241.

Dawson, J.F. (2003). *Do We Have Enough? The Accuracy of Incomplete Data from Small Groups.* Paper presented at the Best Paper proceedings of the Academy of Management Annual Meeting, Seattle, USA.

De Dreu, C.K.W. (2002). Team innovation and team effectiveness: The importance of minority dissent and reflexivity. *European Journal of Work and Organizational Psychology, 11*, 285-298.

De Dreu, C.K.W., & De Vries, N.K. (1993). Numerical support, information processing, and attitude change. *European Journal of Social Psychology, 23*, 647-662.

De Dreu, C.K.W., & West, M.A. (2001). Minority dissent and team innovation: The importance of participation in decision making. *Journal of Applied Psychology, 86*, 1191-1201.

Deci, E.L., Connell, J.P., & Ryan, R.M. (1989). Self-determination in a work organization. *Journal of Applied Psychology, 74*, 580-590.

DeShon, R.P., Kozlowski, S.W.J., Schmidt, A.M., Milner, K.R., & Wiechmann, D. (2004). A multiple-goal, multilevel model of feedback effects on the regulation of individual and team performance. *Journal of Applied Psychology*: 89, 1035-1056.

Devine, D.J. (2002). A review and integration of classification systems relevant to teams in organizations. *Group Dynamics, 6*, 291-310.

Drazin, R., Glynn, M.A., & Kazanjian, R.K. (1999). Multilevel theorizing about creativity in organizations: A sensemaking perspective. *Academy of Management Review, 24*, 286-307.

Dunbar, K. (1995). How scientists really reason: Scientific reasoning in real-world laboratories. In R.J. Sternberg, & J.E. Davidson (Eds.), *The nature of insight* (pp. 365-395). Cambridge: MIT Press.

Eden, D. (1985). Team development: A true field experiment at three levels of rigor. *Journal of Applied Psychology, 70*, 94-100.

Eden, D. (1990). Pygmalion without interpersonal contrast effects: Whole groups gain from raising manager expectations. *Journal of Applied Psychology, 75*, 394--398.

Edmondson, A.C. (1999). Psychological safety and learning behavior in work teams. *Administrative Science Quarterly, 44*, 350-383.

Edmondson, A.C., Bohmer, R.M., & Pisano, G.P. (2001). Disrupted routines: Team learning and new technology implementation in hospitals. *Administrative Science Quarterly, 46*, 685-716.

Eisenhardt, K.M., & Schoonhoven, C.B. (1990). Organizational growth: Linking founding team strategy, environment, and growth among U.S. semi-conductor ventures. *Administrative Science Quarterly, 35*, 484-503.

Eisenhardt, K.M., & Tabrizi, B.N. (1995). Accelerating adaptive processes: Product innovation in the global computer industry. *Administrative Science Quarterly, 40*, 84-110.

Ellis, A.P.J., Bell, B.S., & Ployhart, R.E. (under review). Connecting the dots: The effect of transportable teamwork skills training on project team effectiveness. *Administrative Science Quarterly.*

Emery, F.E., & Thorsrud, E. (1976). *Democracy at work: The report of the Norwegian industrial democracy program.* Leiden: Martinus Nijhoff.

Emery, F.E., & Trist, E.L. (1960). Socio-technical systems. In C.W. Churchman, & M. Verhulst (Eds.), *Management science, models and techniques* (pp. 83-97). New York: Pergamon.

Farr, J.L. (1990). Facilitating individual role innovation. In M.A. West, & J.L. Farr (Eds.), *Innovation and creativity at work.* Chichester, UK: John Wiley & Sons.

Farr, J.L., & Ford, C.M. (1990). Individual innovation. In M.A. West, & J.L. Farr (Eds.), *Innovation and creativity at work.* Chichester, UK: John Wiley & Sons.

Feldman, D.C. (1984). The development and enforcement of group norms. *Academy of Management Review, 9*, 47-53.

Ferlie, E., Fitzgerald, L., Wood, M., & Hawkins, C. (2005). The nonspread of innovations: The mediating role of professionals. *Academy of Management Journal, 48*, 117-134.

Firestien, R.L. (1990). Effects of creative problem solving training on communication behavior in small groups. *Small Group Research, 21*, 507-521.

Flynn, F.J., Chatman, J.A., & Spataro, S.E. (2001). Getting to know you: The influence of personality on impressions and performance of demographically different people in organizations. *Administrative Science Quarterly, 46*, 414-442.

Fonseca, P. (2004). *Caracterização das actividades de I&D empresarial.* OCES. Portugal.

Ford, C.M. (1996). A theory of individual creativity action and multiple social domains. *Academy of Management Review, 21*, 1112-1142.

Forgas, J.P. (1994). Sad and guilty? Affective influences on the explanation of conflict in close relationships. *Journal of Personality and Social Psychology, 66*, 56-68.

Forgas, J.P. (1998). On feeling good and getting your way: Mood effects on negotiator cognition and, bargaining strategies. *Journal of Personality and Social Psychology, 74*, 565-577.

Fry, L.W., & Slocum, J.W. (1984). Technology, structure and workgroup effectiveness: A test of a contingency model. *Academy of Management Journal, 27*, 221-246.

George, J.M. (1990). Personality, affect, and behavior in groups. *Journal of Applied Psychology, 75*, 107-116.

George, J.M., & Bettenhausen, K. (1990). Understanding prosocial behavior, sales performance, and turnover: A group-level analysis in a service context. *Journal of Applied Psychology, 75*, 698-709.

George, J.M., & Brief, A.P. (1992). Feeling good-doing good: A conceptual analysis

of the mood at work-organizational spontaneity. *Psychological Bulletin, 112*, 310-329.

George, J.M., & James, L.R. (1993). Personality, affect, and behavior in groups revisited: Comments on aggregation, levels of analysis, and a recent application of within and between analysis. *Journal of Applied Psychology, 78*, 798-804.

George, J.M., & Zhou, J. (2001). When openness to experience and conscientiousness are related to creative behavior: An interactional approach. *Journal of Applied Psychology, 86*, 513-524.

Gersick, C.J.G. (1988). Time and transition in work teams: Toward a new model of group development. *Academy of Management Journal, 31*, 9-41.

Gersick, C.J.G., & Hackman, J.R. (1990). Habitual routines in task performing groups. *Organizational Behavior and Human Decision Processing, 47*, 65-97.

Gevers, J.M.P., Van Eerde, W., & Rutte, C.G. (2003). Time pressure, potency, and progress in project groups. *European Journal of Work and Organizational Psychology, 10*, 205-221.

Gibson, C.B. (1999). Do they do what they believe they can? Group efficacy and group effectiveness across tasks and cultures. *Academy of Management Journal, 42*, 138-152.

Gibson, C.B. (2001a). From knowledge accumulation to accommodation: Cycles of collective cognition in work groups. *Journal of Organizational Behavior, 22*, 121-134.

Gibson, C.B. (2001b). Me and us: Differential relationships among goal-setting training, efficacy and effectiveness at the individual and team. *Journal of Organizational Behavior, 22*, 789-808.

Gigone, D., & Hastie, R. (1996). The impact of information on group judgment: a model and a computer simulation. In E. Witte & J.H. Davis (Eds.) *Understanding group behavior: consensual action by small groups* (pp. 221-

251). Mahwah, NJ: Erlbaum.

Gillespie, D.E, & Birnbaum, E. H. (1980). Status concordance, coordination, and success in interdisciplinary research teams. *Human Relations, 33*, 41-56.

Gladstein, D.L. (1984). Groups in context: A model of task group effectiveness. *Administrative Science Quarterly, 29*, 499-517.

Glick, W.H., Jenkins, G.D., & Gupta, N. (1986). Method variance versus substance: How strong are underlying relationships between job characteristics and attitudinal outcomes. *Academy of Management Journal, 29*, 441-464.

Gollwitzer, P.M. (1990). Action phases and mind-sets. In E.T. Higgins & R.M. Sorrentino (Eds.), *Handbook of motivation and cognition: Foundations of social behavior* (Vol. 2, pp. 53–92). New York: Guilford.

Gollwitzer, P.M. (1996). The volitional benefits of planning. In P.M. Gollwitzer & J.A. Bargh (Eds.), *Psychology of action: Linking cognition and motivation to behavior* (pp. 287-312). New York: Guilford Press.

Gollwitzer, P.M. (1999). Implementation intentions: Strong effects of simple plans. *American Psychologist,* 54, 493-503.

González-Romá, V., West, M.A., & Borrill, C.S. (2002). *Climate strength, integrating group processes and innovation in work teams.* Unpublished paper, University of Valencia, Faculty of Psychology, Department of Methodology, Spain.

Goodman, P.S., & Garber, S. (1988). Absenteeism and accidents in a dangerous environment: Empirical analysis of underground coal mines. *Journal of Applied Psychology, 73*, 81-86.

Goodman, P.S., & Leyden, D.P. (1991). Familiarity and group productivity. *Journal of Applied Psychology, 76*, 578-586.

Goodman, P.S., Ravlin, E., & Schminke, M. (1987). Understanding groups in organizations. *Research in Organizational Behavior, 9*, 121-173.

Gordon, J. (1992). Work teams: How far have they come? *Training, 29*, 59-62.

Gouran, D.S., & Hirokawa, R.Y. (1996). Functional theory and communication in decision-making and problem-solving groups: An expanded view. In R.Y. Hirokawa, & M.S. Poole (Eds.), *Communication and group decision-making* (pp. 55 80-). Thousand Oaks, CA: Sage.

Greene, C.N. (1989). Cohesion and productivity in work groups. *Small Group Behavior, 20*, 70-86.

Griffin, M.A., Patterson, M.G., & West, M.A. (2001). Job satisfaction and teamwork: the role of supervisor support. *Journal of Organizational Behavior, 22*, 537-550.

Gully, S.M., Devine, D.J., & Whitney, D.J. (1995). A meta-analysis of cohesion and performance: effects of level of analysis and task interdependence. *Small Group Research, 26*, 95-105.

Gully, S.M., Incalcaterra, K.A., Joshi, A., & Beaubien, J.M. (2002). A meta-analysis of team-efficacy, potency, and performance: Interdependence and level of analysis as moderators of observed relationships. *Journal of Applied Psychology, 87*, 819-832.

Guzzo, R.A., & Dickson, M.W. (1996). Teams in organizations: Recent research on performance and effectiveness. *Annual Review of Psychology, 47*, 307-338.

Guzzo, R.A., & Shea, G.P. (1992). Group performance and intergroup relations in organizations. In M.D. Dunnette, & L.M. Hough (Ed.), *Handbook of industrial and organizational psychology* (pp. 269-313). New York: Academic Press.

Guzzo, R.A., Yost, P.R., Campbell, R.J., & Shea, G.P. (1993). Potency in groups. *British Journal of Social Psychology, 35*, 151-167.

Hackman, J.R. (1987). The design of work teams. In J. Lorsch (Ed.), *Handbook of organizational behavior* (pp. 315-342). New York: Prentice Hall.

Hackman, J.R. (1990). *Groups that work (and those that don't): Creating conditions for effective teamwork*. San Francisco: Jossey-Bass.

Hackman, J.R. (1992). Group influences on individuals in organizations. In M.D. Dunnette, & L.M. Hough (Eds.), *Handbook of industrial and organizational psychology* (pp. 57-66). New York: Academic Press.

Hackman, J.R., & Morris, C.G. (1975). Group tasks, group interaction process, and group performance: A review and proposed integration. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (pp. 45-99). New York: Academic Press.

Hackman, J.R., & Oldham, G.R. (1980). *Work redesign*. New York: Academic Press.

Haleblian, J., & Finkelstein, S. (1993). Top management team size, CEO dominance, and firm performance: The moderating roles of environmental turbulence and discretion. *Academy of Management Journal, 36*, 844-863.

Hammerschmidt, P.K. (1996). The Kirton adaption-innovation inventory and group problem solving success rates. *Journal of Creative Behavior, 30*, 61-74

Hays, W.J. (1981). *Statistics*. New York: Holt, Rinehart & Winston.

Heckhausen, H., & Gollwitzer, P. M. (1987). Thought contents and cognitive functioning in motivational vs. volitional states of mind. *Motivation and Emotion, 11*, 101-120.

Heinen, J.S., & Jacobson, E. (1976). A model of task group development in complex organizations and a strategy of implementation. *Academy of Management Review, 1*, 98-111.

Hesketh, B., & Neal, A. (1999). Technology and performance. In D. Ilgen, & E. Pulakos (Eds.), *The changing nature of performance: Implications for staffing, motivation, and development* (pp. 21-55). San Francisco, CA: Jossey-Bass.

Hinsz, V.B., Tindale, R.S., & Volrath, D.A. (1997). The emerging conceptualization of groups as information processors. *Psychological Bulletin, 121*, 43-64.

Hirokawa, R.Y. (1990). The role of communication in group decision-making efficacy: A task-contingency perspective. *Small Group research, 21*, 190-204.

Hirst, G., & Mann, L. (2004). A model of R&D leadership and team communication: The relationship with project performance. *R&D Management, 34*, 147-160.

Hoegl, M., & Parboteeah, K.P. (2003). Goal setting and team performance in innovative projects: On the moderating role of teamwork quality. *Small Group Research, 34*, 3-20.

Hollenbeck, J.R., Ilgen, D.R., Sego, D.J., & Hedlund, J. (1995). Multilevel theory of team decision making: Decision performance in teams incorporating distributed expertise. *Journal of Applied Psychology, 80*, 292-316.

Hollingshead, A. B. (1998). Communication, learning, and retrieval in transactive memory systems. Journal of Experimental Social Psychology, 34, 423-442.

Hu, L., & Bentler, P.M. (1999). Cutof criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1-55.

Hyatt, D. E., & Ruddy, T. M. (1997). An examination of the relationship between work group characteristics and performance: Once more into the breech. *Personnel Psychology, 50*, 553-585.

Imano, K. (1995). Labor market and job search behavior of R&D workers. In P. Shapira (Ed.), *The R&D workers: Managing innovation in Britain, Germany, Japan and the United States* (pp.11-24). Westport, CT: Quorum Books.

Ito, J.K., & Peterson, R.B. (1986). Effects of task difficulty and interunit interdependence on information- processing systems. *Academy of Management Journal 29*, 139-149.

Jackson, S.E. (1996). The consequences of diversity in multidisciplinary work teams. In M.A. West (Ed.), *Handbook of work group psychology* (pp. 53-75). Chichester, UK: John Wiley & Sons.

Jackson, S.E., Brett, J.F., Sessa, V.I., Cooper, D.M., Julin, J.A., & Peyronnin, K. (1991). Some differences make a difference: Individual dissimilarity and group heterogeneity as correlates of recruitment, promotions, and turnover. *Journal*

of Applied Psychology, 76, 675-689.

James, L.R., Demaree, R.G., & Wolf, G. (1984). Estimating within-group interrater reliability with and without response bias. *Journal of Applied Psychology, 69*, 85-98.

James, L.R., Demaree, R.G., & Wolf, G. (1993). Rwg: an assessment of within-group interrater agreement. *Journal of Applied Psychology, 78*, 306-309.

James, L.R., Mulaik, S.R., & Brett, J. (1982). *Causal analysis: Assumptions, models, and data*. Beverly Hills, CA: Sage.

Janicik, G.A., & Bartel, C.A. (2003). Talking about time: Effects of temporal planning and time awareness norms on group coordination and performance. *Group Dynamics, 7*, 122-134.

Janis, I.L. (1982). *Groupthink: psychological studies of policy decisions and fiascoes* (2nd Ed.). Boston, MA: Houghton-Mifflin.

Janz, B.D., Colquitt, J.A., & Noe, R.A. (1997). Knowledge worker team effectiveness: The role of autonomy, interdependence, team development, and contextual support variables. *Personnel Psychology, 50*, 877-904.

Jehn, K.A. (1995). A multimethod examination of the benefits and detriments of intragroup conflict. *Administrative Science Quarterly, 40*, 256-283.

Jehn, K.A., Northcraft, G.B., & Neale, M.A. (1999). Why differences make a difference: a field study of diversity, conflict, and performance in work groups. *Administrative Science Quarterly, 40*, 256-282.

Johnson, J.W., & LeBreton, J.M. (2004). History and use of relative importance indices in organizational research. *Organizational Research Methods, 7*, 238-257.

Kahn, R.L., & Katz, D. (1953). Leadership practices in relation to productivity and morale. In D. Cartwright, & A. Zander (Eds.), *Group dynamics: Research and theory* (2nd ed., pp. 554-570). Evanston, IL: Row, Peterson.

Kahn, W.A. (1990). Psychological conditions of personal engagement and disengagement at work. *Academy of Management Journal, 33*, 692-724.

Kanfer, R., & Ackerman, P.L. (1989). Motivation and cognitive abilities: An integrative/aptitude-treatment interaction approach to skill acquisition. *Journal of Applied Psychology, 74*, 657-690.

Kanfer, R., & Ackerman, P.L. (1996). A self-regulatory skills perspective to reducing cognitive interference. In I.G. Sarason & G.R Pierce (Eds.), *Cognitive interference: Theories, methods, and findings* (pp.153-171). Hillsdale, NJ: Lawrence Erlbaum Associates.

Karoly, P. (1993). Mechanisms of self-regulation. A systems view. *Annual Review of Psychology, 44*, 23-52.

Katz, R. (1982). The effects of group longevity on project communication and performance. *Administrative Science Quarterly, 27*, 81-104.

Katz, R., & Tushman, M. (1979). Communication patterns, project performance, and task characteristics: An empirical evaluation and integration in an R&D setting. *Organizational Behavior and Human Performance, 23*, 139-162.

Keller, R.T. (1986). Predictors of the performance of project groups in R&D organizations. *Academy of Management Journal, 29*, 715-726.

Keller, R.T. (1994). Technology-information processing fit and performance of R&D project groups: A test of contingency theory. *Academy of Management Journal, 37*, 167-179.

Kelly, J.R., & Barsade, S.G. (2001). Mood and emotions in small groups and work teams. *Organizational Behavior and Human Decision Processing, 86*, 99-130.

Kenny, D.A., & La Voie, L. (1985). Separating individual and group effects. *Journal of Personality and Social Psychology, 48*, 339-348.

Kidwell, R.E. Mossholder, K.W., & Bennett, N. (1997). Cohesiveness and organizational citizenship behavior: A multilevel analysis using work groups and individuals. *Journal of Management, 23*, 775-794.

King, N. (1990). Innovation at work: the research literature. In M.A. West, & J.L. Farr (Eds.), *Innovation and creativity at work*. Chichester, UK: John Wiley & Sons.

King, N. (1995). Individual creativity and organizational innovation. In C.M. Ford, & D.A. Gioia (Eds.), *Creative action in organizations: Ivory tower and real world voices*. Thousand Oaks, CA: Sage.

King, N., & Anderson, N. (1990). Innovation and creativity in working groups. In M.A. West, & J.L. Farr (Eds.), *Innovation and creativity at work*. Chichester, UK: John Wiley & Sons.

King, N., Anderson, N., & West, M.A. (1992). Organizational innovation: A case study of perceptions and processes. *Work & Stress, 5*, 331-339.

Klein, K.J., Conn, A.B., Smith, D.B., & Sorra, J.S. (2001). Is everyone in agreement? An exploration of within-group agreement in employee perceptions of the work environment. *Journal of Applied Psychology, 86*, 3-16.

Klein, K.J., Dansereau, F., & Hall, R.J. (1994). Level issues in theory development, data collection, and analysis. *Academy of Management Review, 19*, 195-199.

Kolodny, H.F., & Kiggundu, M.N. (1980). Towards the development of a sociotechnical systems model in woodlands mechanical harvesting. *Human Relations, 33*, 623-645.

Kozlowski, S.W.J., & Hattrup, K. (1992). A disagreement about within-group agreement: disentangling issues of consistency versus consensus. *Journal of Applied Psychology, 77*, 161-167.

Kozlowski, S.W.J., & Klein, K.J. (2000). A multilevel approach to theory and research in organizations: Contextual, temporal, and emergent processes. In K. J. Klein, & S.W.J. Kozlowski (Eds.), *Multilevel theory, research, and methods in organizations: Foundations, extensions, and new directions* (pp. 3-90). San Francisco: Jossey-Bass.

Labianca, G., Brass, D.J., & Gray, B. (1998). Social networks and perceptions of

intergroup conflict: The role of negative relationships and third parties. *Academy of Management Journal, 41*, 55-67.

Langan-Fox, J. (2003). Skill acquisition and the development of a team mental model: An integrative approach to analyzing organizational teams, task and context. In M.A. West, D. Tjosvold & K.G. Smith, (Eds.), *International handbook of organizational teamwork & cooperative working* (pp. 321-360). Chichester, UK: John Wiley & Sons.

Langfred, C.W. (2000). The paradox of self-management: Individual and group autonomy in work groups. *Journal of Organizational Behavior, 21*, 563-585.

Larson, J.R., & Christensen, C. (1993). Groups as problem solving units: Toward a new meaning of social cognition. *British Journal of Social Psychology, 32*, 5–30.

Larson, J.R., Foster-Fishman, P.G., & Keys, C.B. (1994). Discussion of shared and unshared information in decision-making groups. *Journal of Personality and Social Psychology, 67*, 446-461.

Latham, G.P., Winters, D.C., & Locke, E.A. (1994). Cognitive and motivational effects of participation: A mediator study. *Journal of Organizational Behavior, 15*, 49-63.

Laughlin, P.R. (1980). Social combination processes of cooperative, problem-solving groups on verbal intellective tasks. In M. Fishbein (Ed.), *Progress in social psychology* (pp. 127–155). Hillsdale, NJ: Erlbaum.

Laughlin, P.R. (1988). Collective induction: Group performance, social combination, and mutual majority and minority influence. *Journal of Personality and Social Psychology, 54*, 254-267.

Laughlin, P.R., & Ellis, A.L. (1986). Demonstrability and social combination processes on mathematical intellective tasks. *Journal of Experimental Social Psychology, 22*, 177-189.

Laughlin, P.R., VanderStoep, S.W., & Hollingshead, A.B. (1991). Collective versus

individual induction: Recognition of truth, rejection of error and collective information processing. *Journal of Personality and Social Psychology, 61*, 50-67.

Lawler, E.E., Mohrman, S.A., & Ledford, G.E. (1998). *Strategies for high performance organizations: Employee involvement, TOM, and reengineering programs in Fortune 1,000 corporations*. San Francisco: Jossey-Bass.

LeBreton, J.M., Ployhart, R.E., & Ladd, R.T. (2004). A Monte Carlo comparison of relative importance methodologies. *Organizational Research Methods, 7*, 258-282.

Levine, J.M., & Moreland, R.L. (1990). Progress in small group research. *Annual Review of Psychology, 41*, 585-634.

Levine, J.M., Resnick, L.B., & Higgins, E.T. (1993). Social foundations of cognition. *Annual Review of Psychology, 44*, 585-612.

Lewin, K. (1939). Experiments in social space. *Reflections, 1*, 7-13.

Lindsley, D.H., Brass, D.J., & Thomas, J.B. (1995). Efficacy-performance spirals: A multilevel perspective. *Academy of Management Review, 20*, 645-678.

Little, B.L., & Madigan, R.M. (1997). The relationship between collective efficacy and performance in manufacturing work teams. *Small Group Research, 28*, 517-534.

Locke, E.A., & Latham, G.P. (1990). *A theory of goal setting and task performance*. Englewood Cliffs, NJ: Prentice-Hall.

Locke, E.A., Shaw, K.N., & Saari, L.M. (1981). Goal setting and task performance: 1969-1980. *Psychological Bulletin, 90*, 125-152.

Lourenço, P.R. (2002). *Concepções e dimensões de eficácia grupal: Desempenho e níveis de desenvolvimento*. Dissertação de doutoramento. Faculdade de Psicologia e de Ciências da Educação da Universidade de Coimbra.

Lovelace, K., Shapiro, D.L., & Weingart, L.R. (2001). Maximizing cross-functional

new product teams innovativeness and constraint adherence: A conflict communications perspective. *Academy of Management Journal, 44*, 779-793.

Macy, B.A., & Izumi, H. (1993). Organizational change, design, and work motivation: A meta-analysis of 131 North American field studies – 1961-1991. *Research in Organizational Change and Development, 7*, 235-313.

Markham, S.E., Dansereau, E, & Alutto, J.A. (1982). Group size and absenteeism rates: A longitudinal analysis. *Academy of Management Journal, 25*, 921-927.

Marks, M.A., Mathieu, J.E., & Zaccaro, S.J. (2001). A temporally based framework and taxonomy of team process. *Academy of Management Review, 26*, 356-376.

Marks, M.A., Sabella, M.J., Burke, C.S., & Zaccaro, S.J. (2002). The impact of cross-training on team effectiveness. *Journal of Applied Psychology, 87*, 1-13.

Marshall, R.J., & Lowther, J.M. (1997). *Teams in the test-tube: Building team performance in R&D organizations.* Paper Presented at the International Conference on Work Teams, Dallas Fort Worth.

Mathieu, J.E., Heffner, T.S., Goodwin, G.F., Salas, E., & Cannon-Bowers, J.A. (2000). The influence of shared mental models on team process and performance. *Journal of Applied Psychology, 85*, 273-283.

Matsui, T., Kakuyama, T., & Onglato, M.L. (1997). Effects of goals and feedback on performance in groups . *Journal of Applied Psychology, 87*, 1-13.

McGrath, J.E. (2000). *Groups, interaction and performance.* Thousand Oaks: Sage.

McGrath, J.E., & Argote, L. (2003). Group processes in organizational contexts. In M.A. Hogg, & S. Tindale (Eds.), *Blackwell handbook of social psychology: Group processes* (pp. 603-627). Oxford: Blackwell.

Milliken, F.J., & Martins, L.L. (1996). Searching for common threads: Understanding the multiple effects of diversity in organizational groups. *Academy of Management Review, 21*, 402-433.

Mischel, L.J., & Northcraft, G.B. (1997). "I think we can, I think we can...": The role of efficacy beliefs in group and team effectiveness. In B. Markovsky, M.J. Lovaglia, & L. Troyer (Eds.), *Advances in group processes* (pp. 177-197). Elsevier Science/JAI Press.

Mohammed, S., & Dumville, B.C. (2001). Team mental models in a team knowledge framework: Expanding theory and measurement across disciplinary boundaries. *Journal of Organizational Behavior, 22*, 89-106.

Mohammed, S., Mathieu, J.E., & Bartlett, A.L. (2002). Technical-administrative task performance, leadership task performance, and contextual performance: Considering the influence of team- and task-related composition variables. *Journal of Organizational Behavior, 23*, 795-814.

Mohrman, S.A., Cohen, S.G., & Mohrman, A.M. (1995). *Designing team-based organizations: new forms for knowledge work*. San Francisco: Jossey Bass.

Moreland, R.L., Argote, L., & Krishnan, R. (1996). Socially shared cognition at work: Transactive memory and group performance. In J.L. Nye, & A.M. Brower (Eds.), *What's social about social cognition?: Research on socially shared cognition in small groups* (pp. 57-84). Thousand Oaks, CA: Sage.

Moreland, R.L., Hogg, M., & Hains, S.C. (1994). Back to the future: Social psychological research on groups. *Journal of Experimental Social Psychology, 30*, 527-555.

Mullen, B., & Copper, C. (1994). The relation between group cohesiveness and performance. *Psychological Bulletin, 115*, 210-227.

Mumford, M.D., & Gustafson, S.B. (1988). Creativity syndrome: Integration, application and innovation. *Psychological Bulletin, 103*, 27-43.

Neck, C.P., & Manz, C.C. (1994). From groupthink to team think: toward the creation of constructive thought patterns in self-managing work teams. *Human Relations, 47*, 929-952.

Nemeth, C., & Owens, P. (1996). Making work groups more effective. In M.A. West

(Ed.), *Handbook of work group psychology* (pp. 125-141). Chichester, UK: John Wiley & Sons.

Nemeth, C., & Staw, B.M. (1989). The tradeoffs of social control and innovation groups and organizations. *Advances in Experimental Social Psychology, 22*, 175-210.

Neuman, G.A., & Wright, J. (1999). Team effectiveness: Beyond skills and cognitive ability. *Journal of Applied Psychology, 84*, 376-389.

Neuman, G.A., Wagner, S.H., & Christiansen, N.D. (1999). The relationship between work team personality composition and the job performance in teams. *Group and Organization Management, 24*, 28-45.

Nicholson, N. (1990). Organizational innovation in context: Culture, interpretation and application. In M.A. West & J. Farr (Eds.), *Innovation and creativity at work* (pp.). Chichester, UK: John Wiley & Sons.

Nijstad, B.A., & De Dreu, K.W. (2002). Creativity and group innovation. *Applied Psychology: An International Review, 51*, 400-405.

Nystrom, H. (1979). *Creativity and innovation*. Chichester, UK: John Wiley & Sons.

Oldham, G.R., & Cummings, A. (1996). Employee creativity: Personal and contextual factors at work. *Academy of Management Journal, 39*, 607-634.

O'Leary-Kelly, A.M., Martocchio, J.J., & Frink, D.D. (1994). A review of the influence of group goals on group performance. *Academy of Management Journal, 37*, 1285-1302.

O'Reilly, C.A., Caldwell, D.E, & Barnett, W.P. (1989). Work group demography, social integration, and turnover. *Administrative Science Quarterly, 34*, 21-37.

Parker, C.P., Baltes, B.B., Young, S.A., Huff, J.W., Altmann, R.A., Lacoste, H.A., & Roberts, J.E. (2003). Relationships between psychological climate perceptions and work outcomes: A meta-analytic review. *Journal of Organizational Behaviour, 24* , 389-416.

Pasmore, W., Francis, C., Haldeman, J., & Shani, A. (1982). Sociotechnical systems: A North American reflection on empirical studies of the seventies. *Human Relations, 35*, 1179-1204.

Paulus, P.B. (2000). Groups, teams and creativity: The creative potential of idea-generating groups. *Applied Psychology: An International Review, 49*, 237-262.

Paulus, P.B. (2002). Different ponds for different fish: A contrasting perspective on team innovation. *Applied Psychology: An International Review, 51*, 394-399.

Paulus, P.B., & Brown, V. (2003). Ideational creativity in groups: Lessons from research on brainstorming. In P.B. Paulus, & B.A. Nijstad (Eds.), *Group creativity: Innovation through collaboration* (pp. 110-136). New York: Oxford University Press.

Paulus, P.B., & Van der Zee, K. (2004). Should there be a romance between teams and groups? *Journal of Occupational and Organizational Psychology, 77*, 475-480.

Paulus, P.B., Dugosh, K.L., Dzindolet, M.T., Coskun, H., & Putnam, V.L. (2002). Social and cognitive influences in group brainstorming: Predicting production gains and losses. *European Review of Social Psychology, 12*, 299-325.

Paulus, P.B., Larey, T.S., Putman, V.L., Legget, K.L., & Roland, E.J. (1996). Social influences process in computer brainstorming. *Basic and Applied Social Psychology, 18*, 3-14.

Payne, R. (1990). The effectiveness of research teams: A review. In M.A. West, & J.L. Farr (Eds.), *Innovation and creativity at work*. Chichester, UK: John Wiley & Sons.

Pearce, C.L., & Ensley, M.D. (2004). A reciprocal and longitudinal investigation of the innovation process: The central role of shared vision in product and process innovation teams (PPITs). *Journal of Organizational Behavior, 25*, 259-279.

Pelled, L.H., Eisenhardt, K.M., & Xin, K.R. (1999). Exploring the black box: An

analysis of work group diversity, conflict, and performance. *Administrative Science Quarterly, 44*, 1-28.

Pelz, D.C., & Andrews, F.M. (1976). *Scientists in Organizations*. Ann Arbor, MI: Institute for Social Research.

Pinto, J.K., & Prescott, J.E. (1988). Variations in critical success factors over the stages in the project life cycle. *Journal of Management, 14*, 5-18.

Podsakoff, P.M., & Organ, D.W. (1986). Self-reports in organizational research: Problems and prospects. *Journal of Management, 12*, 531-544.

Podsakoff, P.M., & Tudor, W.D. (1985). Relations between leader reward and punishment behavior and group processes and productivity. *Journal of Management, 11*, 55-73.

Poole, M.S., & Hirokawa, R.Y. (1996). Introduction: Communication and group decision making. In R.Y. Hirokawa, & M.S. Poole (Eds.), *Communication in group decision-making* (pp. 3-18). Thousand Oaks, CA: Sage.

Pritchard, R.D., Jones, S., Roth, P., Stuebing, K., & Ekeberg, S. (1988). Effects of group feedback, goal setting, and incentives on organizational productivity. *Journal of Applied Psychology, 73*, 337-358.

Redmond, M.R., Mumford, M.D., & Teach, R. (1993). Putting creativity to work: Effects of leader behavior on subordinate creativity. *Organizational Behavior and Human Decision Processing, 55*, 120-151.

Rentsch, J.R., & Hall, R.J. (1994). Members of great teams think alike: A model of team effectiveness and schema similarity among team members. *Advances in Interdisciplinary Studies of Work Teams, 1*, 223-261.

Rentsch, J.R., & Zelno, J.A. (2003). The role of cognition in managing conflict to maximize team effectiveness: A team member schema similarity approach. In M.A. West, D. Tjosvold & K.G. Smith, (Eds.), *International handbook of organizational teamwork & cooperative working* (pp. 131-150). Chichester, UK: John Wiley & Sons.

burnout relationship in software development teams. *Journal of Occupational and Organizational Psychology, 67*, 327-341.

Sosik, J.J., Avolio, B.J., & Kahai, S.S. (1997). Effects of leadership style and anonymity on group potency and effectiveness in a group decision support system environment. *Journal of Applied Psychology, 82*, 89-103.

Spector, P.E. (1987). Method variance as an artifact in self-reported affect and perceptions at work: Myth or significant problem? *Journal of Applied Psychology, 72*, 438-443.

Spreitzer, G.A., Cohen, S.G., & Ledford Jr., G.E. (1999). Developing effective work teams in service organizations. *Group & Organization Management, 24*, 340-366.

Stasser, G., & Titus, W. (1985). Pooling of unshared information in group decision making: biased information sampling during discussion. *Journal of Personality and Social Psychology, 48*, 1467-1478.

Stasser, G., & Titus, W. (1987). Effects of information load and percentage of shared information on the dissemination of unshared information during group discussion. *Journal of Personality and Social Psychology, 53*, 81-93.

Steiner, I.D. (1972). *Group process and productivity*. New York: Academic Press.

Stevens, M.J., & Campion, M.A. (1994) The knowledge, skill and ability requirements for teamwork: Implications for human resource management. *Journal of Management, 20*, 503-530.

Stewart, D.D., & Stasser, G. (1995). Expert roles assignment and information sampling during collective recall and decision making. *Journal of Personality and Social Psychology, 69*, 619-628.

Stewart, G.L., & Barrick, M.R. (2000). Team structures and performance: Assessing the mediating role of intrateam process and the moderating role of task type. *Academy of Management Journal, 43*, 135-148.

Sundstrom, E., DeMeuse, K.E, & Futrell, D. (1990). Work teams: Applications and

effectiveness. *American Psychologist, 45*, 120-133.

Sundstrom, E., McIntyre, M., Halfhill, T, & Richards, H. (2000). Work groups: From the Hawthorne studies to work teams of the 1990s and beyond. *Group Dynamics, 4*, 44-67.

Swift, T.A., & West, M.A. (1998). *Reflexivity and group processes: Research and practice*. The ESCR Centre for Organization and Innovation, Institute of Work Psychology, University of Sheffield, Sheffield, UK.

Tamhain, H.J. (1996). Enhancing innovative performance of self-directed teams. *Engineering Management Journal, 8*, 31-39.

Tamhain, H.J., & Wilmon, D.L. (1987). Building high performing engineering teams. *IEEE Transactions on Engineering Management, 34*, 130-137.

Tannenbaum, S.I., Beard, R.L., & Salas, E. (1992). Team building and its influence on team effectiveness: An examination of conceptual and empirical developments. In K. Kelly (Ed.), *Issue, theory and research in industrial/organizational Psychology* (pp. 117-153). Amsterdam: Elsevier.

Tannenbaum, S.I., Salas, E., & Cannon-Bowers, J.A. (1996). Promoting team effectiveness. In M.A. West (Ed.), *Handbook of work group psychology* (pp. 503-529). Chichester, UK: John Wiley & Sons.

Taylor, G.L., Synder, L.J., Dahnke, K.F. & Kuether, G. (1995). Self-directed R&D teams: What makes them effective? *Industrial Research Institute, Inc.* 1-23.

Thompson, L.L., Nadler, J., & Kim, P.H. (1999). Some like it hot: The case for the emotional negotiator. In L.L. Thompson, J.M. Levine and D.M. Messick (Eds.), *Shared cognitions in organizations: The management of knowledge* (pp. 139-161). London; LEA, Publishers.

Tierney, P. (1999). Work relations as a precursor to a psychological climate for change: the role of work group supervisors and peers. *Journal of Organizational Change Management, 12*, 120-133.

Tindale, R.S., & Kameda, T. (2000). 'Social sharedness' as a unifying theme for information processing in groups. *Group Processes & intergroup Relations, 3*, 123-140.

Tjosvold, D. (1985). Implications of controversy research for management. *Journal of Management, 11*, 21-37.

Tjosvold, D. (1998). The cooperative and competitive goal to conflict: Accomplishments and challenges. *Applied Psychology: An International Review, 47*, 285-313.

Tjosvold, D., & McNeely, L.T. (1988). Innovation through communication in an educational bureaucracy. *Communication Research, 15*, 568-581.

Tjosvold, D., Hui, C, & Yu, Z. (2003). Conflict management and task reflexivity for team in-role and extra-role performance in China. *International Journal of Conflict Management, 14*, 141-164.

Tjosvold, D., Wedley, W.C., & Field, R.H. (1986). Constructive controversy, the Vroom-Yeton model, and managerial decision-making. *Journal of Occupational Behavior, 7*, 125-138.

Trist, E.L., & Bamforth, K.W. (1951). Some social and psychological consequences of the longwall method of coal getting. *Human Relations, 4*, 3-38.

Tushman, M.L., & Katz, R., (1980). External communication and project performance: An investigation into the role of gatekeepers. *Management Science, 26*, 1071-1085.

Uhl-Bien, M., & Graen, G.B. (1998). Individual self-management: Analysis of professionals' self-managing activities in functional and cross-functional work teams. *Academy of Management Journal, 41*, 340-350.

Ulku, H. (2003). *R&D, invention and economic growth*. Unpublished doctoral dissertation. Graduate School of International Economics and Finance. Brandeis University. USA.

Van Dyne, L., & Saavedra, R. (1996). A naturalistic minority influence experiment:

effects on divergent thinking, conflict and originality in work groups. *British Journal of Social Psychology, 35*, 151-167.

Volpe, C.E., Cannon-Bowers, J.A., Salas, E., & Spector, P.E. (1996). The impact of cross-training on team functioning: An empirical investigation. *Human Factors, 38*, 87-100.

Wageman, R. (1995). Interdependence and group effectiveness. *Administrative Science Quarterly, 40*, 145-180.

Wagner, W.G., Pfeffer, J., & O'Reilly, C.A. (1984). Organizational demography and turnover in top management groups. *Administrative Science Quarterly, 29*, 74-92.

Wall, T.D., & Clegg, C.W. (1981). A longitudinal field study of group work redesign. *Journal of Occupational Behavior, 2*, 31-49.

Wall, T.D., Kemp, N.J., Jackson, P.R., & Clegg, C.W. (1986). Outcome of autonomous workgroups: A long-term field experiment. *Academy of Management Journal, 29*, 280-305.

Warr, P.B. (1990). The measurement of well-being and other aspects of mental health. *Journal of Occupational Psychology, 52*, 129-148.

Watson, W.E., Kumar, K., & Michaelsen, L.K. (1993). Cultural diversity impact on interaction processes and performance: comparing homogeneous and diverse task groups. *Academy of Management Journal, 35*, 590-602.

Watson, W.E., Michaelsen, L.K., & Sharp, W. (1991). Member competence, group interaction, and group decision making: A longitudinal study. *Journal of Applied Psychology, 76*, 803-809.

Webber, S.S., & Donahue, L.M. (2001). Impact of highly and less job-related diversity on work group cohesion and performance. *Journal of Management, 27*, 141-162.

Wegner, D.M. (1987). Transactive memory: A contemporary analysis of the group mind. In B. Mullen, & G.R. Goethals (Eds.), *Theories of group behavior* (pp. 185-208). New York: Spring-Verlag.

Weick, K.E., & Roberts, K.H. (1993). Collective mind in organizations . Administrative Science Quarterly, 38, 357-381.

Weldon, E. (2000). The development of product and process improvements in work groups. *Group & Organization Management, 25*, 244-268.

West, M. A. (2002b). Ideas are ten a penny: It's team implementation and not idea generation that counts. *Applied Psychology: An International Review, 51*, 411-424.

West, M.A. (1990). The social psychology of innovation in groups. In M.A. West, & J.L. Farr (Eds.), *Innovation and creativity at work*. Chichester, UK: John Wiley & Sons.

West, M.A. (1994). *Effective teamwork*. Leicester: British Psychological Society.

West, M.A. (1996). Reflexivity and work group effectiveness: A conceptual integration. In M.A. West (Ed.), *Handbook of work group psychology* (pp. 555-579). Chichester, UK: John Wiley & Sons.

West, M.A. (2000). Reflexivity, revolution, and innovation in work teams. In Advances in interdisciplinary studies of work teams (pp. 1-29). California: JAI Press.

West, M.A. (2002a). Sparkling fountains or stagnant ponds: An integrative model of creativity and innovation implemented in work groups. *Applied Psychology: An International Review, 51*, 355-387.

West, M.A. (2002c). *Work group characteristics measure*. Birmingham: Aston Business School.

West, M.A., & Anderson, N.R. (1996). Innovation in top management teams. *Journal of Applied Psychology, 81*, 680-693.

West, M.A., & Farr, J.L. (1990). Innovation at work. In M.A. West, & J.L. Farr (Eds.), *Innovation and creativity at work*. Chichester, UK: John Wiley & Sons.

West, M.A., & Hirst, G. (2003). Cooperation and teamwork for innovation. In M.A. West, D. Tjosvold & K.G. Smith, (Eds.), *International handbook of organizational teamwork & cooperative working* (pp. 297-319). Chichester, UK: John Wiley & Sons.

West, M.A., & Markiewciz, L. (2004). *Building team-based working: A practical guide to organizational transformation*. Oxford: BPS Blackwell.

West, M.A., Borril, C.S., & Unsworth, K.L. (1998). Team effectiveness in organizations. In C.L. Cooper, & I.T. Robertson (Eds.), *International review of work and organizational psychology* (pp. 1-48). Chichester, UK: John Wiley & Sons.

West, M.A., Borril, C.S., Dawson, J. Scully, J. Carter, M., Anelay, S., Patterson, M.G., & Waring, J. (2002). The link between the management of employees and patient mortality in acute hospitals. *International Journal of Human Resource Management, 13*, 1299-1310.

West, M.A., Brodbeck, F.C., & Richter, A.W. (2004). Does the 'romance of teams' exist? The effectiveness of teams in experimental and field settings. *Journal of Occupational and Organizational Psychology, 77*, 467-473.

West, M.A., Garrod, S., & Carletta, J. (1997). Group decision-making and effectiveness: Unexplored boundaries. In C.L. Cooper, & S.E. Jackson (Eds.), *Creating tomorrow's organizations: A handbook for future research in organizational behavior* (pp. 293-317). Chichester, UK: John Wiley & Sons.

West, M.A., Patterson, M.G, & Dawson, J. (1999). A path to profit? Teamwork at the top. *Centrepiece, 4*, 6-11.

West, M.A., Utsch, A., Borril, C.S., & Dawson, J.F. (2002). *Diversity, demands, group processes and innovation in health care teams*. Unpublished paper, Birmingham: Aston Business School.

Whyte, G. (1989). Groupthink reconsidered. *Academy of Management Review, 14*, 40-56 .

Wiersema, M.F., & Bantel, K.A. (1992). Top management team demography and corporate strategic change. *Academy of Management Journal, 35*, 91-121.

Wittenbaum, G.M., Hollingshead, A.B., Paulus, P.B., Hirokowa, R.Y., Ancona, D.G., Peterson, R.S., Jehn, K.A., & Yoon, K. (2004). The functional perspective as a lens for understanding groups. *Small Group Research, 35*, 17-43.

Wood, R.E., & Bandura, A. (1989). Social cognitive theory of organizational management. *Academy of Management Review, 14*, 361-383.

Wood, R.E., & Locke, E.A. (1990). Goal setting and strategy effects on complex tasks. In B. Staw, & L. Cummings (Eds.), *Research in organizational behavior*, Vol. 12. Greenwhich, CT: JAI Press.

Woodman, R.W., Sawyer, J.E., & Griffin, R.W. (1993). Toward a theory of organizational creativity. *Academy of Management Review, 18*, 293-321.

Yammarino, F.J., & Naugthton, T.J. (1988). Time spent communicating: A multiple levels of analysis approach. *Human Relations, 41*, 655-676.

Zaleska, M. (1978). Individual and group choices among solutions of problem when solution verifiability is low. *European Journal of Social Psychology, 8*, 37-53.

Zenger, T.R., & Lawrence, B.S. (1989). Organizational demography: The differential effects of age and tenure distributions on technical communication. *Academy of Management Journal, 32*, 353-376.

APPENDIX A

UNIVERSIDADE DE LISBOA
Faculdade de Psicologia
e de Ciências da Educação

Questionário Equipas Investigação

Este questionário é sobre o funcionamento da sua equipa. Serve para recolher a sua percepção sobre aquilo que a equipa faz, os seus objectivos, o seu padrão de comunicação, o papel do líder no desempenho da equipa, o seu grau de satisfação com o trabalho da equipa. Não existem respostas certas ou erradas a este questionário, queremos apenas saber a sua visão pessoal sobre os assuntos abordados ao longo do mesmo. Não demore muito tempo a pensar sobre cada questão, as primeiras reacções são geralmente as melhores. Assinale as suas respostas na escala que se encontra à direita de cada item.

As suas respostas são confidenciais e *em nenhuma situação* os seus dados individuais serão dados a alguém.

Formação: _____

Género: Feminino ☐ Masculino ☐

Equipa de Investigação: _____

Há quanto tempo trabalha nesta equipa? _____

Que funções desempenha? _____

Há quanto tempo trabalha em equipas de investigação? _____

Já trabalhou noutro tipo de equipas? _____

Alameda da Universidade 1649 - 013 Lisboa
Tel. 21 793 45 54 Fax 21 793 34 08
www.fpce.ul.pt / e-mail: cd@fpce.ul.pt

CLIMA DE EQUIPA

As afirmações que se seguem descrevem o funcionamento de uma equipa no seu dia-a-dia. Por favor responda a todas as questões assinalando o ponto da escala que, na sua opinião, melhor descreve o funcionamento geral da sua equipa.

PARTICIPAÇÃO E APOIO	Discordo completamente		Não concordo nem discordo		Concordo completamente
		Discordo		Concordo	
1 Geralmente partilhamos a Informação na equipa.	1	2	3	4	5
2 O apoio dentro da equipa para desenvolver novas ideias está sempre disponível.	1	2	3	4	5
3 Nós influenciamo-nos todos mutuamente.	1	2	3	4	5
4 Nesta equipa, todas as pessoas dão sempre o seu melhor.	1	2	3	4	5
5 Mantemos contacto regular uns com os outros.	1	2	3	4	5
6 Nesta equipa usamos o tempo de que necessitamos para desenvolver novas ideias.	1	2	3	4	5
7 As pessoas sentem-se compreendidas e aceites por toda a equipa.	1	2	3	4	5
8 Todas as opiniões são ouvidas, mesmo que estejam em minoria.	1	2	3	4	5
9 Nesta equipa as pessoas não há tensões entre as pessoas.	1	2	3	4	5
10 A equipa é aberta e responde bem à mudança.	1	2	3	4	5
11 Os membros da equipa cooperam para desenvolver e aplicar novas ideias.	1	2	3	4	5
12 Fazer parte desta equipa é, para os seus membros, a coisa mais importante do trabalho.	1	2	3	4	5
13 Temos uma atitude de "estamos nisto juntos".	1	2	3	4	5
14 Nós interagimos frequentemente.	1	2	3	4	5
15 Esta equipa é melhor que qualquer outra na mesma área.	1	2	3	4	5
16 Os membros da equipa dão informação uns aos outros sobre assuntos relacionados com trabalho.	1	2	3	4	5
17 As relações entre as pessoas da equipa são sempre harmoniosas.	1	2	3	4	5
18 Os membros da equipa partilham recursos para ajudar a concretizar ideias novas.	1	2	3	4	5

PARTICIPAÇÃO E APOIO	Discordo completamente	Discordo	Não concordo nem discordo	Concordo	Concordo completamente
19 Entre nós existe uma atitude de "dar e receber".	1	2	3	4	5
20 Como equipa estamos muitas vezes juntos.	1	2	3	4	5
21 Os membros desta equipa estão sempre à procura de novas formas de olhar para os problemas.	1	2	3	4	5
22 A equipa atinge quase sempre os objectivos mais elevados com facilidade.	1	2	3	4	5
23 Existe uma tentativa genuína de partilhar informação dentro da equipa.	1	2	3	4	5
24 Esta equipa está sempre à procura de novas soluções	1	2	3	4	5
25 Os membros da equipa dão um apoio efectivo na aplicação de novas ideias.	1	2	3	4	5
26 Os membros da equipa reúnem-se com frequência para conversar, tanto formal como informalmente.	1	2	3	4	5

ORIENTAÇÃO PARA A TAREFA	Raramente	Poucas vezes	Às vezes	Muitas vezes	Quase sempre
27 Os seus colegas de equipa contribuem com ideias úteis e apoio prático para que você possa fazer o seu trabalho o melhor possível?	1	2	3	4	5
28 Você e os seus colegas supervisionam-se mutuamente para manter um padrão de desempenho mais elevado?	1	2	3	4	5
29 Os membros da equipa são capazes de questionar aquilo que a equipa está a fazer?	1	2	3	4	5
30 A equipa avalia criticamente potenciais pontos fracos naquilo que faz, para poder alcançar o melhor resultado possível?	1	2	3	4	5
31 Os membros da equipa aproveitam as ideias uns dos outros para poderem alcançar o melhor resultado possível?	1	2	3	4	5
32 Existe uma preocupação genuína entre os membros da equipa para que esta atinja os padrões mais elevados de desempenho?	1	2	3	4	5
33 A equipa tem critérios claros que os membros tentam cumprir para alcançarem a excelência como equipa?	1	2	3	4	5

OBJECTIVOS	Muito pouco	Pouco	Suficiente -mente	Bastante	Muito
34 Em que medida estão claros para si os objectivos da equipa?	1	2	3	4	5
35 Em que medida vê esses objectivos como úteis e adequados?	1	2	3	4	5
36 Até que ponto está de acordo com esses objectivos?	1	2	3	4	5
37 Em que medida pensa que os objectivos da sua equipa podem realmente ser alcançados?	1	2	3	4	5
38 Em que medida pensa que os outros membros da equipa estão de acordo com os objectivos?	1	2	3	4	5
39 Em que medida pensa que os objectivos da sua equipa são claramente compreendidos pelos outros membros da equipa?	1	2	3	4	5
40 Qual o valor que esses objectivos têm para si?	1	2	3	4	5
41 Qual o valor que esses objectivos têm para o instituto?	1	2	3	4	5
42 Qual o valor que esses objectivos têm para a sociedade em geral?	1	2	3	4	5
43 Até que ponto esses objectivos são realistas e podem ser alcançados?	1	2	3	4	5
44 Até que ponto pensa que os membros da sua equipa estão empenhados nesses objectivos?	1	2	3	4	5

APRENDIZAGEM EM EQUIPA	Muito pouco	Pouco	Alguma coisa	Bastante	Muito
O que aprendeu com esta equipa sobre:					
45 Gerir pessoas (ex. supervisionar, dar feedback, motivar, delegar, dar apoio pessoal e profissional)?	1	2	3	4	5
46 Gestão de equipas (ex. gerir conflitos, planear, tomar decisões, facilitar a discussão)?	1	2	3	4	5
47 Perceber como funciona este instituto (ex. gestão de recursos, procedimentos administrativos, decisões do topo)?	1	2	3	4	5
48 Relações com parceiros externos (ex. clientes, fornecedores, consultores)?	1	2	3	4	5
49 Gerir a mudança (ex. propor ideias, negociar, procurar recursos)?	1	2	3	4	5
50 Conhecimentos técnicos ou científicos?	1	2	3	4	5

REFLEXIVIDADE DA EQUIPA

As afirmações que se seguem descrevem o funcionamento de uma equipa na resolução de problemas. Por favor responda a todas as questões assinalando em que medida considera que cada uma das afirmações descreve o que se passa normalmente na sua equipa.

		Discordo			Concordo	
		Discordo completamente		Não concordo nem discordo		Concordo completamente
1	A equipa revê os seus objectivos com frequência.	1	2	3	4	5
2	Perante as dificuldades, os membros da equipa apoiam-se mutuamente.	1	2	3	4	5
3	Os métodos de trabalho da equipa são discutidos frequentemente.	1	2	3	4	5
4	Em situações de trabalho stressantes a equipa não dá grande apoio.	1	2	3	4	5
5	Discutimos regularmente em que medida a equipa está a ser eficaz no seu trabalho.	1	2	3	4	5
6	Nesta equipa, mudamos os objectivos quando as circunstâncias assim o exigem.	1	2	3	4	5
7	As estratégias da equipa são raramente modificadas.	1	2	3	4	5
8	Analisamos frequentemente em que medida estamos a passar bem a informação entre nós.	1	2	3	4	5
9	Quando as exigências do trabalho aumentam agimos mais como uma equipa.	1	2	3	4	5
10	A equipa revê com frequência a forma de abordar os problemas.	1	2	3	4	5
11	O modo como a equipa toma decisões é raramente alterado.	1	2	3	4	5
12	A equipa está preparada para questionar as práticas e políticas desta organização.	1	2	3	4	5

BEM-ESTAR

A secção seguinte é sobre o seu bem-estar geral e os seus sentimentos em relação ao trabalho. Por favor responda a todas as questões.

Pensando nas últimas semanas, em que medida o seu trabalho o fez sentir-se como descrito abaixo?

		Nunca	Rara-mente	Por algum tempo	Grande parte do tempo	Quase todo o tempo	Todo o tempo
1	Tenso	1	2	3	4	5	6
2	Ansioso	1	2	3	4	5	6
3	Preocupado	1	2	3	4	5	6
4	Confortável	1	2	3	4	5	6
5	Calmo	1	2	3	4	5	6
6	Descontraído	1	2	3	4	5	6
7	Deprimido	1	2	3	4	5	6
8	Melancólico	1	2	3	4	5	6
9	Infeliz	1	2	3	4	5	6
10	Motivado	1	2	3	4	5	6
11	Entusiasmado	1	2	3	4	5	6
12	Optimista	1	2	3	4	5	6