An exploratory study into the influence of
cognition, culture and motivation
in organisational innovation

Presented by
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Knowledge is an experience all the rest is information.

Albert Einstein (1879-1955)

With our thoughts we make the world.

Buddha (560-480 B.C.)

To innovate in an organisation is like knowing how to play jazz.

(Kamoche and Cunha, 2001)
Abstract

The aim of this study was to examine the dominating factors and relationships between them that affect innovation in an organisation. At the same time innovation dynamics and organisational effectiveness were demonstrated. The study was conducted in the context of the Australian innovation landscape with three case study organisations involved in research and development activities being examined. It is well publicised and confirmed by this study that organisations involved in innovation perform well. This study has been motivated by the observation that efficient innovation is not practiced or recognised by many organisations as many determinants are maybe unknown.

It is accepted that as Australia moved through the post-industrial age towards the knowledge-based economy, the success of organisations may depend more on the ability of individuals with a vision who are adaptable to new situations, are life-long learners and could make sense from the increasing amount of information that may lead to tangible results, such as innovations. While the outcomes are very important, it is often the innovation activities and their progression, which are causing most organisational concern. There are still not enough studies showing applicable examples of what is important to enhance or start up innovation in organisations.

This qualitative study extensively examined innovation and four other organisation related literature topics such as: i) organisation, ii) organisational behaviour, iii) organisational innovation, and iv) management to select three factors namely cognition, culture and motivation for the proposed integrated research framework. From this analysis, conclusions were drawn to the research question, and the intangible factors of cognition, culture and motivation were compared to discover what they may have in common that could enhance innovation in an organisation.

The research framework served throughout the exploratory study to establish research methods, to create research instrument and to conduct interviews with a cross-section of members from three research organisations. In the final stage of the primary data
analysis, the model of the Innovation Propensity was established that could reflect the organisational inclination to innovation. The major elements of this new and dynamic innovation model include variables formed around indicators such as the aptitudes to perceive new ideas, the predisposition to participate in innovation activities and the clarity of objectives during innovation. These identified determinants confirmed that organisational innovation is an individual and objective dependant activity requiring cooperation of an individual inventor and other people in an organisation. In addition, results of this research indicate that innovation in an organization has a much greater chance of success if it can be seen as a part of individual’s and organisational objective. Organisational innovation also seems to be sensitive to the recognition of individuals. It is possible that the abovementioned determinants are required for the ‘magic of innovation’ to occur in an organisation (Steiner 1995).

Similar to some of the previous research conducted, this study aimed to unify and generalise its findings in order to deliver a new concept applicable to most organisations across various fields and types of industry. The findings of this research proved to be compatible with the key performance indicators of the examined organisations and demonstrated the similar positive orientation to conducted surveys. As a case study, this research examined and analysed the complex dimensions of organisational innovation, which is rich in detail and provided the practical examples of determinants leading to innovation.
Acknowledgment

After more than twenty-five years of working as a professional mechanical engineer and fulfilling various roles with the array of industries, it was a big challenge for me to undertake this study.

I owe special gratitude to Doctor Yamin from the Australian Graduate School of Entrepreneurship for his guidance, encouragement and advice during the writing of this thesis.

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To all members of CRC organisations who participated in my research dedicating their time for interviews and providing valuable information for the data analysis, I sincerely appreciate it.

And last but not least, I thank my family, without them it would be difficult to complete this thesis.
Declaration

This thesis contains no material which has been accepted for the award of any other degree, diploma, has been previously published or written by another person, except where due reference is made in the text of the thesis. The research presented in this thesis constitutes work carried out by the author unless otherwise stated. The thesis complies with the stipulations set out for the degree of Doctor of Philosophy by the Swinburne University of Technology.

Signed ………………………………………

Dated ………………………………………

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CHAPTER ONE

Introduction and Overview

1.1 Introduction
This chapter presents the overall introduction to the study and includes the background, context and the setting. At the beginning of this chapter, the general overview has been provided in order to introduce the reader to the thesis, to outline the purpose and describe the significance of new findings. The overview of this study also includes segments such as the researcher’s background that has the influence on the interpretation of what is observed and studied, the research question that has been raised during the literature review, proposed framework to explore the unknown areas of organisational activities and methods used to achieve goals set during the study.

1.2 Australian Innovation Landscape and Context of Study
This thesis offers a comparative view of the innovation landscape and the relevance of the researcher’s view to the subject that has been studied. Innovation landscape can provide the background and foreground to the field of the enquiry. It is often the case that the current developments attract the most attention while the studies of the current and historical background are ignored. The author believes that the knowledge of the historic developments may serve as the background to the current innovation landscape and could assist in the understanding of and the appreciation of the studied phenomenon. Innovation theories available today are not equipped to explain the phenomenon of organisational innovation and cannot present credible models for organisations to follow up or offer a unified direction of research into the field (Wolfe, 1994). One of the reasons could be that the subject of analysis does not include the historical background of the field, which is important to any social studies, including innovation in organisations (Bruland and Mowery, 2005). It is therefore proposed that to explain findings of this research related to an organisational innovation in Australia, a short introduction to the historical background of the country may be beneficial. The author’s perspective on innovation is another important dimension throughout the study and is included in this introduction.
1.2.1 Background

There is absolutely nothing anybody could do to change what has happened in the past, however there are often many interpretations of former events, which could alter our understanding of the times we live in and decisions we may make in the future. The brief description of Australian innovation landscape presented below and the short historic background of Australia attached in Appendix A may assist in better understanding a climate to innovate in this country.

1.2.2 Australian Innovation Landscape

The main intention in this study is to develop an understanding why some organisations are capable to develop innovations. It is commonly accepted that profit creation drives the activities of most organisations. Innovation however, is one of the other means that could guarantee the organisational advantage. Successful innovation in organisations depends mainly on its people. The prime concern of management in such organisations should be what makes people capable to innovate and what engages them in innovation activities. On the other hand, the Government’s interest in innovation is to keep the economy in a healthy state. Studies of innovation and organisations practicing it often confirm that innovation is quite an unpredictable process (Amabile, 1988; Damanpour, 1996; Damanpour and Gopalakrishnan, 2001; Lam, 2005; Wolfe, 1994).

It is probably the unpredictability that makes innovation such a mysterious phenomenon. Like with many landscapes that have some prime features or landmarks, the innovation landscape in Australia has some fine examples at the foreground. One of the oldest ones is the Commonwealth Scientific Industry Research Organisation (CSIRO) involved nearly in all of the fields of applied research. Strongly standing is also the cooperation between universities and industry, originated and supported by the Government grants since the year 1991. The result of that cooperation is displayed by the seventy-one Cooperative Research Centres (CRC) that operate in various fields of science and research in Australia. A number of reports and papers were written about the importance of innovation in Australia (Australian Chamber of Commerce and Industry, 2000; Australian Industry Group, 2000a; Commonwealth of Australia, 2001; Group of Eight, 2000; Howard, 1999; Innovation Summit Implementation Group, 2000; Marceau and Manley, 1999; Oliver, 1999; Rogers, 1998; 1999), but like high altitude
clouds, they do not add much value to the landscape. However, it is possible that as the result of previous reports, the Industrial Innovation Working Group was set up in 1999 to be the predecessor of the National Innovation Summit organised by the Government in February 2000. The aim of the summit was to identify some optimal mechanisms that could enhance Australia’s competitiveness through innovation. Further goals were to encourage greater participation from industry, research communities and academia, to raise the capability of generating ideas and to turn them into tangible outcomes. The annual event of the Australian Innovation Festival promotes the importance of development and the implementation of new ideas in the country. The main objectives of the festival are to showcase innovation in Australia across all industries, to demonstrate the value of research, development and commercialisation, and to reinforce the innovation and entrepreneurial process from the ideas to the market. There are a number of other organisations in Australia that help promote and assist innovation activities for example Innovic in the state of Victoria or The Triton Foundation being particularly active on the national level. Innovic’s role is to assist individuals in getting ideas into the market place, whereas The Triton Foundation is committed to promoting Australian Inventions. Special attention should be payed to the establishment in Australia of the Innovation Patent in 2001. This user-friendly patent system encourages the protection of the intellectual property of individuals or small to medium enterprises and therefore provides inventors with more confidence to invest in the development of new ideas.

Although, signs from recent national statistics are not be too optimistic for research and development, and innovation in Australia (Australian Bureau of Statistics, 1996; 1997; 2000; 2005), there is a degree of optimism that at least innovation issues are on the Government and some businesses agendas and that there are private organisations like Invetec, which are capable to commercialise many versatile ideas. Some of the organisational reasons for not focusing on R&D and innovation are pressures for profit, cost savings, reduced tax concessions, weak demands or availability of goods produced overseas (Australian Industry Group, 2000b). Generally, on a national scale performance in manufacturing is constantly improving (Australian Industry Group, 2003) and the search to find a ‘magic formula’ to boost the innovation in Australia continues (Australian Industry Group, 2001). It may be that those searching for answers
could look back at the ‘grassroots’ and discover again that there is no grand ‘quick fix’. It may be that when issues of knowledge and learning, innovative culture or motivation of people are addressed appropriately, the tangible results of innovation may become accessible much quicker. It seems that the significant human side of innovation is somewhere lost in the process or ignored. However, all presented unique landmarks at the foreground of the innovation landscape are not the only cooperation between scientists and the commercial world, but also act as the cooperation between members of organisations who transform ideas into commercial products and processes. Most of the time, members of organisations are the background of innovation blended into the landscape and only some of them may be recognized as important or contributing factors. It is assumed that the ability to find the connection between foreground and background makes innovation like a successful piece of art.

Many factors such as the availability of technology, research and development capabilities, culture accepting and exploring new ideas, people who are prepared to share knowledge, and the financing of some risky new ventures could influence successful innovation. Changes in technology and growing international competition put pressure on organisations to perform better, to deliver new products quicker and to increase continually the efficiency of manufacturing methods in order to compete successfully. That demand for change can be realized by continuous innovation. Manufacturers and research organisations in Australia should look at various strategies of activities in order to maximize their market share and the chances to survive by engaging in the strategically planned innovation. New strategies should be attractive to engage individuals in the common pursuit of change and innovation. This may be accomplished for example by reflecting on personal recognition and providing more satisfaction from work that builds innovation-driving cultures. It is human nature to look for change and better ways of doing things, as well as to question needs and resist the novelties, but it is often the knowledge, wellbeing and the wealth of individuals that increases the probability of successful accomplishment for innovation outcomes. People are the most important assets in organisations, but also the most unpredictable. Successful work outcomes do not have any general formula, but knowledge of human behaviour may help in better management of innovation.
This study has recognised through literature review, that cognition, culture and motivation are important factors, which create an innovation background for many organisations. Culture is like the glue holding background together and gives it meaning, whereas cognition and motivation add to the dynamics of the landscape that depends on the creator. The experience of creating a background is like blending three basic colours of red, yellow and blue during painting. The result is often unique. This final research analysis integrated into the Innovation Propensity Model shows a piece of deeper meaning about what influences an organisation to innovate. The Innovation Propensity Model illustrates the extent of dependence on aptitudes to perceive new ideas, predisposition to participate and clarity of objectives that must exist in an organisation to enhance innovation activities. Though governments are responsible for the creation of policies leading towards growth in innovating activities and outcomes, it is up to the individual organisations to implement the most effective solutions that would make innovation a reality. Therefore, innovations may evolve from the synergy of individual commitment, sharing of knowledge and the clear, unobstructed objectives that individuals and organisations share during activites of creating better products and processes for the future. Although this study like a painting captures and freezes only a glimpse of current innovation landscape, it may have some timeless themes that could be used beyond its scope to increase understanding of the innovation phenomenon.

1.2.3 Integrated Research and Development Organisations

The Cooperative Research Centres (CRC) in Australia are perfect example of integrated efforts of many organisations from universities, industry and the Government that produce innovative outcomes required by users. The existence of CRC’s in Australia is accepted by many people in the research community and recognised by the Federal Government as a critical initiative for Australia to stay competitive in the increasingly knowledge-based global economy. However, to general public CRC’s commercial successes may come at a very high price, though their scientific achievements are highly regarded by industry in Australia (Department of Education, Science and Training, 2003; Gome, 2001). CRC’s are an integral part of Australian innovation system and are known internationally as a successful model for linking researchers, industry partners and other users of research outcomes. CRC’s are making a lasting contribution to the Australian economy, society and the environment. All CRC
organisations operate on fixed seven year based life cycles and need to demonstrate their usefulness and contributions at the end of their tenure to the Government, to get refunded for the next seven years of operation. The CRC Program was established in 1990 with the intention to bring researchers and research users together and to make their combined work more effective. The program emphasizes the importance of collaborative arrangements to maximize the benefits of research through an enhanced process of utilization, commercialization and technology transfer. It also has a strong education component with a focus on producing graduates with skills relevant to industry needs. Since the beginning of the CRC Program in year 1990, 158 CRCs have been selected over nine selection rounds. In 2004, there were 71 CRC’s operating in six sectors: i) environment, ii) agriculture and rural-based manufacturing, iii) information and communication technology, iv) mining and energy, v) medical science and technology, and vi) manufacturing technology. More general information about CRC’s is available in Appendix B.

1.2.4 Research Origins - Author’s Perspective

The purpose of this paragraph is to introduce the reader to the author’s background. The role of researcher is critical in the exploratory studies when some relations to issues and outcomes are under investigation. The author of this thesis has a background in mechanical engineering and is the Chartered Professional Engineer and the Member of The Institution of Engineers Australia. Over twenty-five years ago, the author was awarded a Master’s Degree in manufacturing techniques. Since that time, he has devoted his career to the engineering field working as a production engineer, designer or an industrial researcher. The author’s fascination towards finding how products are made and how they work in his early teenage years, developed into a life-long adventure with the profession of engineering. The author’s experience in Australia spans through a range of industries reinforcing his skills in project management, technical problem solving and evaluating, research and development, creative thinking, planning and organising, conducting feasibility studies, cost estimating, forecasting and budget control, the administration of contracts and the design of projects, process and tools. Skills and the ability to solve technical problems by applying relevant solutions gave the author the opportunity to have his own consulting business providing services
to industry for nearly half of his working career. The engineering tasks often related to fixing existing problems, with some expectations to deliver or perform ‘miracles’ in time of the crisis. This type of environment provided many challenges and opportunities to learn from the unfortunate mistakes in the workplace that organisations have made in the past. It was during the time of consulting to industry that some of the ‘magic moments’ happened. Consulting has one great advantage over working full time. It does not restrict the service provider in the selection of opportunities and of choosing a viable solution as long as this is justifiable and benefits the organisation. Consulting also enables the provider to avoid internal politics, personal rivalries and allows the individual to examine internal abnormalities within an organisation without bias. In this sort of environment the author was able to assess many opportunities to solve problems and most importantly was able to network and cooperate with people across a wide spectrum of organization structures. The opportunities to be proactive often exist in organisations, but are sometimes limited due to the internal arrangements and the bureaucracy. The author’s role as the catalyst made him aware of how important networks, ability to communicate, sharing of knowledge and experience with others are. He observed that people behave differently in situations of crisis or during a process of change in the organisation, when new rules govern the process of change and transition. It became apparent that human factors influence the process of change more than anything else does. Culture of teams within the organization plays a critical role on performance as well as on the attitudes and motivation of individual people. Magic moments happened when the right group of randomly gathered people could think and come up with similar solutions or directions to solve technological problems and thereby were able to generate new ideas and inspired each other during the process of development. Communicating at this higher level was definitely unique and related to the make up of the team, their age, experiences and the attitude of members. Fragility and uniqueness of the team composition became apparent when somebody left the group and all suddenly, the magic disappeared. The ‘vibe’ and outcomes after the change were never the same. That uniqueness of the moment made the author start to believe in the other side of the discovery and development process, the hidden often unspoken and momentary experience of innovation. This study and the undertaken research is the author’s exploration and search for such ‘magic moments’ that may
Nearly five years ago, a long passion for industrial research was extended by the professional enquiry into the human side of the research and development process and the commencement of the PhD study and research. At the same time the author began to work at Swinburne University Faculty of Design, supervising graduate students in their final study of new product development, which included research, development and implementation of innovative products.

In addition to his professional life, the author has travelled extensively throughout Europe and Asia. The ability to speak four European languages has always been an advantage in communicating and learning. The great drive in the author’s life, apart from engineering, has always been learning about other nation’s cultures, through travelling. The author acknowledges that the challenges of this study would not be as manageable if they were not supported by his personal life and professional experiences.

1.3 Aim and Scope of Study

The overall aim of this study is to investigate factors of innovation and learn about their relationships that could enhance innovation in an organisation. The principal reason for selecting organisations from a manufacturing sector for this study was to deal with the uniform field of enquiry that may create a greater opportunity for the generalisation of research findings. The research strategy was to analyse compatible data in order to explore differences and to draw up common conclusions. This study is intended to develop the final innovation concept that may be applicable to all types of organisations and industries. This study investigation does not differentiate the types of innovation such as technical or administrative and treats them all at the same level of an abstract meaning.

It is recognised that the samples of organisations and personnel in this study may not allow distinguishing results into all levels of the organisational hierarchy, but may produce meaningful overall conclusions. The level of analysis covers a whole spectrum of organisations from people who are responsible for getting innovation off the ground
and implemented, and may use this research findings in the very informative way, to those who are managing it and are capable to alter their own vision, change organisations policies and strategies to have greater success rates with innovation. It is therefore assumed that all participants in the organisations should benefit from this study, however the greater benefits from some answers to questions “how?” and “why?” could flow into organisation’s managers and the Government’s policy makers.

1.3.1 General Issues
This study is concerned with innovation in the setting of Australian research and development organisations. Most organisations, especially in industrialised countries, are facing the growing pressure to sustain their profits and to provide some sort of assurance to the investors about their future growth. This puts organisations under constant pressure to reinvent their activities in order to satisfy the growing demands. One of the ways to make progress effectively is through continuous innovation. While there are many tangible ways to improve organisational performance, it is difficult to deal with mostly unknown intangible innovation factors. This research examines the role of cognition, culture and motivation that influence functioning of organisations. Not all organisations are set up or know how to get engaged in innovation activities. Many of them may require the substantial transformation of practices and attitudes of their employees. There are no generally available formulas to resolve these issues, but some guidelines could be provided from the findings of this research. This study seeks to identify particular factors that are indispensable to innovation and could contribute to the successful discovery and implementation activities. The results from the analysis of data indicate the importance of factors such as aptitude to perceive new ideas, predisposition to participate in implementing them, and the clarity of objectives as the indicators of organisational propensity to innovate. It has been identified and concluded that any type of an organisation from a variety of industries could be assessed in the light of these indicators to determine their readiness for innovation.

1.3.2 Significance of Study
It is expected that this study will be of interest to all organisations, either engaged or anticipating to be engaged in innovation. This study brings together disconnected issues of cognition, culture and motivation related to organisational innovation. In particular it
highlights the importance of factors that are essential for innovation to occur. The final analysis presents the Innovation Propensity model consisting of three elements namely aptitudes to perceive new ideas, predisposition to participate in implementing them, and the clarity of objective, as the main determinants of an organisation predisposition towards innovation. The Innovation Propensity model could also serve as a measure in assessing organisational needs in order to improve its performance. This model could be of interest to practicing human resource specialists who may need to evaluate organisation readiness for innovation or improvement of its general performance. The recognition of all the elements in the model, however does not give the guarantee for successful implementation of innovation as every organisation may have different components that link model elements together. The challenge to generalise findings of this study appears to be in identifying linking components that are more related to individual behaviour than to any other organisational variable. However, it has been observed that the integrity and the practicality of the model depend on the coexistence of all elements within the proposed model structure.

This study has a number of significant features. In particular, it uses the multidiscipline framework of cognition, culture and motivation developed from the literature review, to examine factors that may predispose an organisation towards innovation. The study uses the integrated framework and triangulation method to examine the data. The main data analysis focuses on the triangulation method and the comparison of this research results with the surveys and externally collected organisational performance data. In addition, the study offers a rare method to analyse intangible factors that influence innovation. It provides dynamic and multifaceted model of essential ingredients that may make innovation in an organisation possible. In the author’s opinion, the presented research model has universal properties due to the generic nature of the variables, and thus may be used in most types of organisations, industries, and perhaps even across national boundaries.

1.4 Conceptual Framework

The research framework in this study has been established as a result of extensive literature review through five different topics. Those topics are Innovation, Organisational Innovation, Organisation, Organisational Behaviour and Management.
The initial framework is made up of three independent factors supported by the literature reviews and the analysis of the research environment in Australia. Framework factors are cognition, culture and innovation. On their own, they represent recognised and verified frameworks with many internal elements that singularly could influence innovation. However, the aim of this research was to use this framework as an ‘umbrella’ to seek the answer to the research question derived from a multidisciplinary integrated framework that may assist in a deeper understanding of how innovation activities could be successfully implemented within organisations.

1.5 Research Question

Though not clearly specified, but preoccupying the researchers mind for a long time was the question of what the essential factors that may determine innovation in an organisation are. The formulation of the research framework derived from the literature review helped to express this preliminary question in more detail. It was clear from the proposed framework that the next stage of this research should concentrate on the exploration of ingredients for cognition, culture and motivation, considered to have some commonalities related to organisational innovation. As suggested by Stake (2003), the formulation of more specific question could be the result of ongoing focus on the exploration and analysis of the literature. The prime question for this research is “what do the intangible factors of cognition, culture and motivation have in common that may enhance innovation within an organisation?” This research question has been used to organise the study and the development of research methods that will provide deeper insight into innovation activities and form conclusions that will guide organisations in becoming more innovative enhancing their overall performance.

1.6 Research Method

This study accepts the theories related to the development of exploratory research methods proposed by Eisenhardt (1989), Strauss and Corbin (1990) and Yin (2002), and adopts some of the stipulated principles to develop unique research approach and method. The nature of the proposed question places this study in the exploratory category, which will seek answers to issues pertaining to organisational innovation. Kumar (2005) and Yin (2002) claim that though the answers to questions of “what?” may often be satisfied, there are always possibilities to further explore phenomenon
with other questions of “how much?” or “how many?”. Cavana et al. (2000) supports the use of exploratory research. In his opinion, such studies usually allow for a good grasp of the phenomenon being examined. With the exception of exploratory research, there seems to be no other attractive research method available when research is assisting in the discovery of new determinants influencing a process.

For the purpose of this study, Cooperative Research Centres have been selected as the most appropriate representatives of the integrated, divers, complex and dynamic type of organisations. Three major players, namely the Government, universities and industry influence their activities and performance.

The case study approach has been selected to build on the opportunity to have an insider’s view and an outsider’s opinion of the phenomenon under investigation (Carson et al., 2001). The cross-sectional view of the organisations was obtained by interviewing organisational members at different hierarchical levels. Most of the interview participants were selected by the organisations.

The interview protocol was based on the established and verified models of cognition by O’Reilly (1991), culture by Milliken (1990) and motivation by Vroom (1964). These authors have proposed frameworks that support innovative activities. Recorded interviews were transcribed to a text format for qualitative analysis using Nvivo computer software. This research explored the common themes emerging from each case study by using the technique of intersection in the software. It allowed an efficient reduction in data and an interpretation of research findings, which lead to final conclusions.

1.7 Research Design and Limitations

The decision to conduct this research within qualitative paradigm was based on the understanding that this approach may provide more meaning from the collected data from which significant findings can be drawn. Primary data collection through interviews was based on semi-structured research instrument that assures the highest probability to obtain rich data for analysis. This study followed basic steps proposed by Eisenhardt (1989) and Yin (2002) namely: i) development of research problem or
theory from the literature review, ii) identification of some of the major variables, iii) definition of the unit of analysis, iv) development of the research instrument, v) research design, vi) selection of case studies, vii) collection of data, viii) data analysis and interpretation, and finally, ix) theory building and generalisation. The use of multiple case studies was justified in order to obtain greater generalisation of data for comparative analysis between the examined cases.

Three types of data were used in the study, namely: interviews, surveys and the organisation’s performance indicators. These various sources of the data provided the opportunity to contrast results between cases and to create a credible explanation for the emerging patterns. Results from this research may provide a new insight into the innovation activities.

The author acknowledges that even though the current research may provide a unique approach to innovation research, some of its limitations may be beyond his control and his knowledge (Perry, 1998). One such limitation is that the researcher did not control the initial selection of interview participants in the organisations.

1.8 Overview of Thesis

Chapter One provides an overview of the entire research study. It identifies the research question as well as the limitations of the research.

Chapter Two examines five topics of the literature: Innovation, Organisation, Organisational Innovation, Organisational Behaviour and Management. Innovation focuses on how researchers defined innovation and what in their opinion contributes to and hinders the process of innovation. This part includes extensive discussion about dimensions and various aspects of innovation including existing theories and models. Review of Organisation presents available images of organisations, theories and models, in the aspect of their receptiveness to change and innovation. Organisational Behaviour review traces individual and organisational attributes that may help to discover common links necessary to conduct innovation. Organisational Innovation explores issues and capabilities that are important for innovative organisations in modern times. Review of Management focuses on the many aspects of managing an
organisation in a complex and dynamic environment with some analysis of the nature of management and current work arrangements. This chapter concludes with a discussion of the development of the research framework based on the findings from the examined literature review.

**Chapter Three** presents available options to conduct the research based on the proposed framework. The discussion of methods provides justification for the choice of the method that leads to the development of a research instrument. In addition, this chapter describes the selection process of organisations for case study, the data management, process of data analysis and explains how theory could be built from the presented research. In the conclusion important aspects of research quality are discussed that may guarantee the credibility of research findings.

**Chapter Four** shows the detailed process of the analysis of three types of data used in this study. The process of coding interviews is described in detail with reasons for selecting proposed methods. The analysis of primary qualitative research data leading to the formulation of new innovation concept is explained next. The rationale for collecting additional survey information from the examined organisations is presented with the description of two conducted surveys. The use and processing of research data about organisations performance is explained to reinforce this study stand. Chapter four ends with notes about methods for interpretation of primary data and how to make sense from all available research evidence.

**Chapter Five** introduces one of the most popular computer softwares NVivo used to assist in this study qualitative data analysis.

**Chapter Six** describes the first case study organisation examined giving detailed information about organisational settings, describing human dimensions, performance outcomes and presenting results from interviews, surveys and performance data analysis.

**Chapter Seven** portrays the second case study organisation presenting detailed information about organisational settings, describing human dimensions, performance
outcomes and presenting results from interviews, surveys and performance data analysis.

Chapter Eight presents the third case study organisation displaying detailed information about organisational settings, describing human dimensions, performance outcomes and showing results from interviews, surveys and performance data analysis.

Chapter Nine shows the comparison between the information obtained from all three examined case study organisations.

Chapter Ten describes the development of new innovation framework, which is the result of the final analysis of interview data from the three examined case study organisations. Findings from the literature review and some material from interviews support the justification for the new innovation framework.

Chapter Eleven discusses this study and evaluates materials from literature review and the presented research data. This chapter also presents conclusions from the analysis of three organisations and the research findings. The final part contains the implications of the findings and the possible directions for future research in the field of innovation.

1.9 Contribution of Research
This mainly qualitative research uses a multidiscipline approach based on cognition, culture and motivation, to establish common elements that construct the essential factors for an organisational innovation. Therefore, this study makes the contribution to the development of alternative methods of innovation research. On the other hand, findings of this research highlight the basic principles which are very often ignored in organisational management or policy making, that human intangible factors are some of the most important determinants when considering economic and technical aspects of innovation. The current research provides a unique approach to understand the organisational innovation expressed by the proposed model of Innovation Propensity.

1.10 Summary
This chapter provided a background to the thesis, introduced the study challenges and issues, and justified the qualitative research method to examine a multidiscipline
framework in order to discover the common and essential factors that influence an organisational innovation. It also introduced the research aims and scope. The research framework and the main question outlined the development of consequent research method and design of the research program. Based upon the introductory chapter, this thesis proceeds to present the study and research program in detail.
CHAPTER TWO
Literature Review

This chapter provides a review of innovation literature with special emphasis on the discussion about various interpretations of the subject. The understanding of innovation is than expanded to the elements, sources and factors that may contribute to the successful innovation. The review of literature also explores the topics of organisation, organisational innovation, organisational behaviour and management that seek to explain the influence on innovation. Due to vast amount of literature compiled and reviewed by the author relating to these topics, explicit details has been placed in the Appendices C, D, E, F, and G, while essential features is discussed in this chapter. The search through various sources such as journals and books was conducted with the aim to find answers about what is essential to organisational innovation. The review of the five main topics of literature in this thesis revealed some common themes related to intangible factors influencing individuals and organisations. These topics emerged from the discussion of social and cultural issues, the aspects of knowledge and cognition in an organisational settings or general themes dealing with motivation. The detail analysis of all five literature review topics revealed that the majority of emphasis captured by about four hundred phrases was on the importance of knowledge and cognition in relation to creativity or innovation. The second feature that was widely discussed was about social and cultural side displaying three hundred and fifty phrases related to an organisation and innovation activities. Though considerable, but not dominating in any section of the review was the subject of motivation captured in one hundred and twenty instances. It has also been observed that some of the authors deal with multidiscipline issues of cognition, culture or motivation. Several extracts of these integrated relationships are presented in the relevant part of literature review at the end of each topic in this chapter. The demonstrated examples support the complex nature of innovation in an organization.

The range of other related subjects included in the appendices are also equally important fulfilling background to the whole literature review. They helped to highlight the complexity of the innovation field and allowed better understanding of the dynamics of the phenomenon. The additional subjects discussed in part innovation and included in
Appendix C are: Stages of Innovation, Innovation Activities, Determinants of Successful Innovation, Research and Development, Commercialisation, Dimensions of Innovation, Invention and Innovation, Sources of Innovation, Intangible Factors and Innovation, and Theories and Models of Innovation. The additional organisation issues reviewed and included in Appendix D cover: Organisational Theories and Models, Types of Organisations, Flexibility of Organisation, Organisation Design, University - Industry Cooperation, Science and Technology Relationship, Organisation and Change, Organisational Learning, Role of Tacit Knowledge, Organisational Arrangements, and Organisational Performance and Effectiveness. Part organisational behaviour has additional information in Appendix E about: Theories of Motivation, An Individual Attributes to Innovation, Personal Outlook on Creativity, Decision Making, and Incentives at Work. Themes additional to organisational innovation that are included in Appendix F are: Organisational Aspects of Creativity, Managing Innovation, and Organising for Work and Innovation. Part management includes in Appendix G discussion about: Management Practices, Managing Knowledge in Organisation, Evolutionary Management System, Theories Applicable to Management, and Work Identity. This chapter ends with the analysis of the selected common features from the literature review of all topics that lead to the integrated research framework consisting of cognition, culture and motivation. This framework allowed the researcher to put forward the research question and formed the basis for developing the research proposal. The selection of appropriate methodology, analysis, and interpretation of the data are presented in the subsequent chapters.

2.1 Innovation

2.1.1 The Rationale of Innovation

There is generally no disagreement among researchers that innovation contributes to technological, social and economic developments (Van de Ven, 1986) with knowledge being one of main drivers (Nelson and Winter, 1977). Continuous progress throughout human history was mainly possible due to the exceptional creativity of some individuals and accumulation of common efforts in putting ideas into practical use (Kanter, 1983; Dosi, 1988). The practice of implementing ideas as well as outcomes of those creative thoughts is now commonly known as innovation (Amabile, 1988). The first scholar to address the topic of innovation in modern times was Joseph Schumpeter, an Austrian
economist. He saw innovation as the process encompassing the birth of ideas and their
development through various stages to the production of marketable outcomes that
could change the economy (Schumpeter, 1934). However, some of the timeless
characteristics of innovation such as change in the structure of the innovation systems
that influences the dissemination of knowledge and innovations could be only revealed
through the historic analysis of the various stages of industrial development (Bruland
and Mowery, 2005; Lazonick, 2002).

While most researchers recognise positive effects of innovation and its outcomes, there
is little agreement among them as to the meaning of the term innovation. Debates range
between those supporting innovation as a process or an activity and others claiming that
it is a product of that activity (Read, 2000). The extant literature on innovation is vast
and often crosses disciplinary boundaries in other fields such as management,
sociology, psychology or science. Probably for this reason, research is disintegrated and
inconsistent (Wolfe, 1994). There is limited theoretical base in research that is capable
of integrating multiple streams of innovation (Drazin and Shoonhoven, 1996). Various
studies of innovation concentrated on different characteristics. For example, Christensen
(1997) distinguished sustained and discontinuous levels of innovation while other
authors described it as incremental or radical (Foster and Kaplan, 2001; Grulke, 2002;
Leifer, 2000; Utterback, 1996).

Innovation efforts may be enhanced or hindered by an individual, project, organisation
or environment factors (Cohen and Levinthal, 1990; Fiol, 1996). Another view is that a
conducive environment for innovation could be created by organisational structure,
culture and process (Amabile, 1988; Kanter, 1993; Hamel, 2000). However, from a
future benefits perspective, radical innovation that transforms the environment and the
markets may have the greatest significance to the organisations (Hamel, 1996; Hamel
and Prahalad, 1994).

Among many available descriptions of innovation, one proposed by Jorde and Teece
(1990) seem to captures the essence of the whole phenomenon. They argue that
innovation can be a search, discovery, development, improvement, adoption and
commercialisation of new processes, products, organisational structures and procedures.
Jorde and Teece emphasised that the factors of uncertainty, risk management and reward for ingenuity can all contribute towards the boundaries of knowledge.

Early studies about innovation recognized distinct separation between technical innovations comprising of new products, technologies and services, and administrative innovations which include new procedures, policies and organisational forms (Daft, 1978). However, recent developments unify innovation by process of diffusion (Rogers, 2003) or adoption (Gopalakrishnan and Damanpour, 2000). Regardless of what models or innovation philosophies are used, Fiol (1996) argues that innovating organisations are like sponges and have huge absorbing capacity to generate innovative outputs. On the other hand Wolfe (1994) is more specific in stating that existing literature supports three main streams and approaches to organisational innovation such as diffusion (Rogers, 2003), organisational innovativeness (Daft, 1978; Tang, 1999) and process theory (Downs and Mohr, 1976; Van de Ven, 1986).

According to Schumpeter (1942) it is competition that comes from the introduction of a new commodity, technology, or source of supply, which is the most effective drive for innovation among firms with similar products and technologies. In essence, the capability to innovate is important for survival and the success of the organisation (Utterback, 1996). However, Schumpeter (1942) was not specific in identifying the forces that enhance competition. Those forces were more explicit in the ongoing processes of learning, searching and exploring which resulted in new products, techniques, and forms of organisations or markets.

Innovation is often seen as an interactive, cumulative and path-dependent process, unfolding along technological trajectories (Dosi et al., 1988), but often remains differentiated and complex (Daft, 1978). Special arrangements and networks that can be formed along industry clusters include clients, suppliers, support industries and competitors, which within some industries may lead to enhancement of innovation (Porter, 1990). These special systems are constituted by actors and elements, which interact in the production, diffusion and the use of economically useful knowledge through interactive learning centres (Dodgson, 2000; Dodgson and Bessant, 1996; Lundvall, 1992). The process of innovation is more often studied with only a few researchers concentrating purely on the analysis of products, methods of production and
their relationships (Utterback, 1996; Abernathy and Utterback, 1978; Utterback and Abernathy, 1975).

Privatisation and globalisation is forcing industries around the world to be more efficient and innovative (Porter, 1990). Increasing globalisation of trade, innovation and learning are regarded as central mechanisms for maintaining the competitiveness of firms at a higher level for regional and national economies (Lundvall, 1992). A common view among some researchers is that the adoption of innovation may increase effectiveness and competitiveness of an organisation (Daft, 1978; Damanpour and Evans, 1984; Zaltman et al., 1973). However, few studies specifically addressed innovation and organisational performance from the perspective of change (Damanpour et al., 1989; Damanpour and Gopalakrishnan, 2001). Whilst innovation is often associated with major products or methods of production, a vast number of them is based on the cumulative effect of incremental change or the creative combination of ideas and methods (Tushman and Nadler, 1986). Van de Ven (1986) disputes the need to distinguish innovation into various types or aspects as many organisations simultaneously practice it at different levels. Despite fifty years of intense studies about innovation there are few conclusive examples in the literature about factors influencing innovation. Results are commonly inconsistent and do not provide deeper insight (Wolf, 1994). Some authors believe that socialisation culture within organisations hold the key to innovation (Tushman and O'Reilly, 1997). Lazonick (2002) tend to be more specific and states that social conditions affect innovation change over time and across various productive activities. Supporting risk taking, tolerating mistakes, and stimulating creativity could be some of the determinants for innovative culture based on social control mechanisms (Tushman and O'Reilly, 1997). In addition, managing culture by gaining commitment through individual choice provides the right kind of intrinsic rewards linked to the outcomes based on selecting the right employees for the job and may give the ultimate results (Kanter, 1983). Kanter states that continuous change in the organisation is promoted or hindered by a strong culture from the top management. Managers however face ‘Innovator’s Dilemma’, of whether to maintain the same line of production with a view to short-term profitability or seek new opportunities to provide long-term benefits (Christensen, 1997).
2.1.2 Defining Innovation

The word innovation descends directly from the Latin word *innovo*, which means ‘to renew’ (Collins Latin Dictionary, 1997). The first written record regarding innovation appeared in France in 1297. During its seven hundred year history innovation has been interpreted and defined in a variety of ways. Until recently, it had a rather negative connotation suggesting rebellious, revolutionary, troublesome and useless acts, which tend to interfered with well established practices (Oxford English Dictionary, 1996). Despite its negative association, the meaning of the word was linked to the process of change within the establishments. Today, many sources define innovation in two ways, either as something new or different introduced or the act of innovating, introducing of new things or methods (Macquarie Dictionary, 1982; New Webster’s Dictionary, 1992; Oxford English Dictionary, 1996).

The use of the word innovation in modern times is attributed to the 1930’s economic theories of Joseph Schumpeter. He argued that the concept of innovation is a process of change that brings new combinations of creative and useful ideas while destroying old norms, values and processes. Further, he suggested that innovation is a priority for any entrepreneur who is interested in developing a new business. Innovation tends to constantly evolve and provides incentives to create new life cycles or extend existing life cycles thereby enhancing the survival of the organisation (Schumpeter, 1934; 1939). Innovation involves a series of scientific, technological, organisational, financial and commercial activities (Australian Bureau of Statistics, 1996). According to Nonaka and Takeuchi’s (1995) innovation unlike a relay race is a diversified cross-functional activity, which relies on continuous and concurrent improvement. It requires coherent teamwork and support. Innovation needs close examination of issues such as uncertainty, risk taking, competition and the availability of creative talents along with the rewards and incentives that can be provided by the organisation. Due to the macro and micro nature of issues associated with innovation, its interpretation varies according to the mindset of scientists and researchers. Common definitions of innovation proposed by some authors emphasize two themes: one related to ideas and the other to the implementation of ideas.
The ideation stage includes: the creation of ideas for problem solving (Kantar, 1983), generation of new ideas (Urabe, 1988) and development of ideas (Van de Van, 1986). Whereas the ideation stage of innovation involving the creation and development of new ideas is well researched and publicized, the common perception is that it is individually orientated (Amabile and Conti, 1999). On the other hand Kono (1988) argues that activities aiming at increasing organisational creativity in Japanese industry show that the successful practice of idea generation may occur in a group environment. In general, the definition of innovation seems to emphasize the idea implementation process more than idea generation. In order to accommodate an organisation and its stakeholders needs, it is important that the idea generating needs are accepted (Kanter, 1983). Only then the idea may be developed and transformed (Mogee, 1993; Van De Van, 1986) and finally diffused as part of the overall implementation process (Rogers, 1995). It should be also noted that there is no standard recipe for implementation of innovation and this may vary according to personal needs in a particular situation.

Some authors view implementation as an active push for change at social and organisational levels (Kanter, 1983), while other authors take either a transactional view (Van De Van, 1986) or an engagement in communicating the change (Carlson, 1991; Rogers, 1995). Furthermore, the change process can lead to activities that result in new product, process or services (Amabile, 1996; Mogee, 1993; Urabe, 1988). It is assumed that integration of scientific, technological, organisational, financial and business activities tends to provide synergy among various elements of the innovation implementation process without necessarily identifying a specific process or method of implementation (Dodgson, 2000; Sundbo, 2001). The success of the implementation may depend on the individual’s response (Rogers, 1995), the organisational decision-making process (Urabe, 1988) and the introduction of new or improved products, processes or equipment through commercialisation (Dodgson, 2000). Few authors have acknowledged the significance of activities related to both ideation and implementation of innovation. For example, Rogers (1995) recognised a gap between the two stages and proposed a link through the diffusion process. At the same time he argued that innovation has a continuous impact on those involved in the process, functions within the system and the structure of the organisation. On the other hand, Dossi (1988) saw ability to recognise solutions to problems as a means of filling the gap in the innovation process.
The implementation of new ideas embodies a complex process and includes business community and consumer needs within the social and cultural values (Carlson, 1991; Dodgson, 2000; Kanter, 1983; Nelson and Winter, 1977; OECD, 1997). Some authors have discussed perception of ideas (Rogers, 1995; Sfinno-Project, 2000), while others have argued the ability to make ideas into reality as filling the gap between ideation and implementation (Kanter, 1983; Mogee, 1993; Robert and Weiss, 1988). The effectiveness of innovation may rest in the balanced management of idea creation and implementation. Perhaps the sense of balance between the purpose and methods of constant search for change carries the true meaning of innovation (Drucker, 1985). The cycle of innovation may be finalized by the commercialisation of new ideas or invention in the market, but its implications have a spiral effect (Sfinno-Project, 2000). The ability to understand and recognise change is attributed to personal virtues of an entrepreneur who is engaged in the process of change and systematically anticipates, recognises and exploits opportunities in order to create commercial value (Robert and Weiss, 1988; Rogers, 1995). This process of change starts as a discovery and generation of new creative idea or invention which through a process of implementation is successfully accomplished. A vision of commercialisation facilitates the conversion of intangible ideas into a reality of tangible outcomes that have value in transactions (Sundbo, 2001). The value of innovation can be fully recognised in the Schumpeterian sense, when ideas are put into a productive use (OECD, 1997). The following discussions will analyze two recognised themes: idea creation and idea implementation to identify relevant variables and their effects on innovation. At the same time the links between variables will be explored to distinguish common and key elements that constitute innovation as a process of change during commercialisation.

2.1.2.1 New Ideas

According to Amabile, et al. (1996) all innovations begin with creative ideas. Creativity provides intellectual substance in the form of new ideas, concepts or discoveries that may later become products, processes or services. The importance of newness to innovation was for the first time highlighted in Schumpeter's (1934; 1939) concept that established the link between ‘new combination’ of elements or ideas and creativity. He saw creativity mainly as a destructive force. New creative ideas are often perceived in the modern business environment as determinants that carry innovation values benefiting customers. It is undisputed that innovation brings new change and challenges
to the established order and creativity may be a key to its success. Businesses that are most likely to survive are those adopting the ‘human process’ of creating and sharing new ideas in a culture that encourages the innovation process (Blayden and Miller, 2003). There are no recipes for new ideas or creativity and the probability of market success of innovative products is relatively low. Only one out of about 12 refined and fully evaluated ideas may have a chance to get into production (Kono, 1988). A flexible and open minded approach is required when searching for ideas, remembering that all stages of implementation process are interconnected and never perfect and completely finished (Strickland and Coulson, 2001). Ideation process includes exploring various perspectives and possibilities, which includes inventing, selecting and choosing ideas. A favourable climate and common interactions must exist for sharing ideas and knowledge to stimulate innovation activities in an organisation. Tsai (2001) claims that deliberate distribution of information and knowledge can enhance and foster innovation, while lack of knowledge could be one of the main barriers (Leonard and Sensiper, 1998; Nonaka, 1991). The following part of this thesis will present some of the available literature to enhance understanding of creativity and innovation.

2.1.2.2 Creativity

“Creativity often involves making connections between things that may seem unconnected” (Stern, 1998, p3). According to Basadur (1995) it is a form of rearranging existing variables into new combinations. Von Stamm (2003) recognised creativity as an ability to generate new ideas, alternatives or possibilities, which serve as essential building blocks for innovation, while Csikszentmihalyi (1997a) argued that it represented a unique, integrated social phenomenon. Most of the things that are interesting, important, and human in our lives are the results of individual ingenuity that was recognized, rewarded, and transmitted through learning (Csikszentmihalyi, 1996). Creativity may results from ability to identify and to generate ideas, as opposed to innovation which results from selecting appropriate ideas that are developed and commercialised. However, after all creativity might not be that different from innovation, as it demands that product or idea must be different from what is already known and used (Amabile, 1988). Assessment of creativity has been mainly associated to the examination of personal characteristics using the traditional psychological approach. Amabile’s view about creativity emphasises personality, cognitive abilities and a problem solving approach that could be induced into organisation. Unsworth
(2001) on the other hand argues that by its nature creativity is neither externally nor internally driven. She recognised that externally driven responsive creativity and internally driven contributory creativity were based on the response to presented problems. At the same time Unsworth recognised that creativity by discovery could be either expected in nascent conditions or proactive when personally driven.

Few studies attempted to integrate psychological and social approach to creativity (Cummings and Oldham, 1997; Deazin et al., 1999; Ford, 1996). Though conventional social approach recognises the importance of interactions to generate ideas, this method does not recognise its influence on sense making and interpretation. Deazin et al. (1999) argued that creativity in an organisation relies on sense making ability when complex and ambiguous problems need to be solved. In addition, to separate individual creativity from the organisational environment is to ignore an energising influence of the innovation activities. Thus, according to Deazin et al., it is mainly ability of individuals to compete in the organisation and select meanings in complex arrangements that provide creativity. Csikszentmihalyi (1996) is of the similar view about the importance of individuals in the creative process, arguing that curiosity and drive are main contributing factors. However creativity may also results from presence of talent and chance (Csikszentmihalyi and Howard, 1996). Following the similar viewpoint about individuals, Schwarz-Geschka (1994) claims that culture encourages creativity in the most effective way. This is especially visible when comparing two diametrically different cultures, Western and Japanese. Individualism and self-interests of Western society are a sharp contrast to group-oriented values of harmony and conformity in Japan. Religious values embedded in Japanese family and national ethics result in virtues of discipline and concentration. Flexibility in thinking, openness to new things, willingness to learn are some of characteristics of creativity present in the Japanese society. Human relationships are recognized in Western and Japanese cultures as an important factor, but they are managed in different ways. Creativity is mainly recognized in the West as an individual act, while it is ‘group creativity’ in Japan that contributes to individual creations. Scarce resources and limited space equipped Japanese society with the ability to continually react in incremental ways to the changing conditions. Environment conditioned Japanese to be naturally innovative. Westerners think in categories of black and white that results often in logical, ad hock, sporadic and radical creativity, while Japanese think in shades of gray producing more
intuitive outcomes (Schwarz-Geschka, 1994). Creative actions represent infrequent, though very important episodes of human behaviour. Creativity and innovation seem to be closely linked with their meanings becoming almost interchangeable. Many modern organisations comprise a big potential for creative actions, but fail to benefit from them through poor records of acceptance to change (Ford, 1996). The challenge is for management to empower individual processes to facilitate creative change. That change is mainly embedded in the habits of individuals, contrary to the organisational domain, neither desiring nor requiring pervasive creativity. Among many available factors influencing organisational creativity, Ford recognized positive effects of groups. However, the primary focus in the available literature has been accredited to the personal attributes of the creator with such characteristics as: sense making, knowledge, personal motivation, or goal clarity, being among main contributors of creativity (Ford, 1996). Other recent studies assess creativity as the natural phenomenon of human’s brain cognitive functions, responding to the problem solving challenges under conditions of uncertainty (Simonton, 2000). Individuals use either combinatorial abilities to produce novel combinations out of familiar ideas or transformational abilities to come up with analogical reasoning to transfer ideas from one domain to another. The type of creative response depends on firm background knowledge base of individual (Buchanan, 2001). On the other hand de Bono (2000) argues that creative problem solving involves two different types of thinking processes such as: lateral thinking being the source of ideas and an analytical approach associated with critiques and turning ideas into useful products. Generation and implementation of ideas require individuals with creative capabilities to utilize both types of thinking in the organisation. There is no single type of cognitive process, which is responsible for creative thinking or mental functioning involved in analytical reasoning or experimental design (Dunbar, 1999). It is true to some extend that new ideas, inventions or scientific discoveries are still happening by chance. Albert Einstein claimed that he never came upon any of his discoveries through the process of rational thinking. Contrary to that, William Tiller believes that we are all spirits and having a physical experience, as we ride the river of life together, we interact with physical reality by our intentions, we create things (Tiller and Dibble, 2001). Nevertheless, it is widely recognised among researchers and scientist that creativity is a deliberate method of problem solving, contributing to new breakthroughs (Isaksen, 1988). It is also no longer a perception that creativity belongs to advanced human elite. To the contrary most researchers believe
that it is a basic human endowment, which could be enhanced by methods such as brainstorming or analogy to unlock creative potential (Dormen and Edidin, 1989). Dormen and Edidin claimed that understanding the genesis of creativity, assessing own creative potential and recognising ability to break free of the old ways of thinking are three steps for a more creative personal life. In their opinion creativity is about discovery that involves going beyond having information or facts. The difficulty to establish common definition of creativity is highlighted by Isaksen (1988) who points to challenges faced by Rhodes (1961) who examined fifty-six definitions of creativity and concluded that most overlapped and intertwined. Many definitions were leading to a conclusion that creativity is a complex and interdisciplinary phenomenon. However, among all definitions he identified four common strands of information, which were reflecting on: i) person having individual personality, intellectual attitudes, values and behaviour, ii) process stages of thinking to overcome an obstacle or achieving novel and useful outcome, iii) press for relationship between people and environment in conductive situation to creativity, iv) product characteristics carrying new thoughts about ideas, inventions, designs or systems and embedded in the artifacts. Rhodes called those characteristics four ‘P’s’ of creativity. In his opinion those four ‘P’ factors are only identifiers of a larger, more complex concept of creativity. The most common areas for study of creativity are found in the arts and the science displaying common cognitive (fluency, flexibility, originality, elaboration) and affective (curiosity, complexity, risk-taking, imagination) characteristics of the creative person (Isaksen, 1988). According to Kono (1988), the outputs of creativity can be expressed by: patents, publications (papers, books, and professional presentations), new products, new materials, new production methods and new tools or methods of analysis. Those outputs are creative when: i) no one has previously discovered or invented the product, ii) the product has been developed faster than a similar one in other organisations, iii) it has a value to the society and the theory or sound principal behind it. “Creation involves the making of new combinations, whereas innovation involves the input of resources to implement the creation” (Kono, 1988, p107). Primary creations require more time and freedom to eventuate and are mainly related to universities (basic research), where secondary creations are related to industry and have greater potential to be evolved into tangible goods. Unlike primary creations, secondary creations require clear goals and timing for completion. Teaching creativity at universities is not effective because formal organisations are often too conservative to allow new staff to practice creativity openly.
In many cases it is a matter of only a few first years of work and creativity is ‘bitten out’ of people. However, successful organisations like Sony, Honda or 3M have benefited from creativity allowing its executives to work outside of its traditional structures to enhance it (O’Keefe, 2004). There are also known cases where some of the methods for idea generation did not require much creativity at all. Results from Millennium Product survey suggested that the majority of generated ideas come from logical and structured approach to problems solving, rather than using lateral thinking (Brunel University, 2002). “Listening to the voice of your product” is another way to increase creativity (Goldenberg, et al., 2003, p4). He proposed to base analysis for a product idea on common patterns of an existing product’s desired functions. This methodology is based on the practice of idea generation used in engineering product development. Technique involves using one or a few patterns such as subtraction, multiplication, division, unification and attribute change as the essential rearrangement, removal or replication of product features in a new way to get inspiration. Goldenberg’s method is based on Algorithm for Inventive Problem Solving, known as TRIZ, developed by a Russian engineer Genrich Altshuller. TRIZ methodology originated from patent analysis and identified a series of common patterns among new product ideas. In order to better understand innovation, more personal and organisational aspects of creativity will be reviewed further.

2.1.2.3 Implementation of Ideas

Implementation relates to activities leading to something being accomplished, fulfilled or fully realized. To implement is to carry or to put something into effect (Macquarie Dictionary, 1982; New Webster’s Dictionary, 1992). Implementation is a complex activity found in various disciplines such as manufacturing, management, information technology or social science (Nash et al., 2001) and there is no standard recipe for implementation of innovation (Wolfe, 1994). Implementation is rather related to group or organisational activities, whereas creation of ideas is attributed to individuals. There is a need to unify those two activities to examine common variables governing innovation characteristics (Axtell et al., 2000). While the ideation stage of innovation can be characterised by vision and high hopes, the implementation stages are often characterised by disillusions and dirty politics (Hage, 1980). However, in the end it is most probably the value benefit/cost analysis, which may determine the fate of the most new implementations (McDaniel, 2000).
Contrary to big expectations from commercialisation of innovations little attention has been given in the current literature to implementation of the ideas. Existing knowledge about implementation is often similar to “cooking with a list of ingredients but without the recipe” (Sabherwal and Robey, 1993, p. 549). Therefore, more research is necessary to find out how those ingredients are combined. There are some examples in the literature distinguishing implementation into different aspects such as: product (Fidler and Johnson, 1984), process (El Sawy et al., 2001; Smeds, 2001), technology (Dodgson, 2000), ideas (Axtell et al., 2000), innovation (Sheets, 2004), collaboration (Schmitz, 1997) or change (Aquila, 2005; Clayson, 2003; Howes and Quinn, 1978) along with some common factors influencing the process such as: knowledge sharing, need for strategy, allocation of human resources, organisational environment or communications. The skilful integration of these factors can determine the success of innovation implementation. The aim of various implementation processes is to reduce uncertainty by minimizing risk and complexity factors. The ever-present risk in new ventures with the complexity of innovation can lead to a greater resistance to implement change (Fidler and Johnson, 1984). Schmitz (1997) argues that either at individual or team level, organisations must recognise and reward performance of employees helping in implementation process. Management of human and socio-political issues is a critical in determining success of any process (Zaidifard, 1998). The traditional way of understanding implementation is that of being part of the development cycle starting after product model has been designed and built, and finishing when full outcomes are delivered (Ginzberg, 1981). The alternative view has been proposed by Lucas (1978) to include all stages of the process including original idea proposals, feasibility studies, analysis, design, development and delivery of outcomes. Some authors claim that synergy between various stages may reduce complexity of the implementation process (Dodgson, 2000; Sundbo, 2001). Innovation process is finalised when ideas are put into a productive use (Schumpeter, 1934). The introduction of innovation to the market marks the end of all implementation activities (OECD, 1997). Another view is that various stages of implementation represent the process of commercialisation (Dodgson, 2000). The development and transformation of ideas during the implementation process may be possible due to their successful diffusion (Rogers, 1995) but requires a supportive organisational environment (Axtell et al., 2000; Clegg, 2002). Implementation is possible to the unique organisational culture, but failures of planning and management as well as low employee participation may prevent it from happening.
Other factors of concern may be lack of commitment from management and inability to assess problem situation (Lusin, 2004; Nash, 2001). Factors, which encourage implementation, could differ from those that may promote the creation of ideas. Knowledge of factors affecting both stages of innovation may give confidence to organisations to pursue innovation more vigorously. Effective communications and feedback are some of the important determinants (Axtell et al., 2000), but even with the abundance of ideas there are only few opportunities worth exploring (The Triton Foundation, 2004). A few available studies indicate that for one successful outcome there are at least a few thousand raw ideas required (Smith, 2000; Stevens and Burley, 1997). Typical industrial products would require about three thousand new raw ideas, where drug companies may need eight thousand ideas or more to develop one commercially successful product. The numbers of ideas worth exploring and submitting further are usually self-assessed by inventors and could represent about ninety percent of the total pool. Usually, only about seven percent of patented ideas are worth pursuing further due to increasing complexity of tasks, number of people involved and committed finance. Majority of activities are R&D and marketing related and in the final stage only one project may be worthy of a full-scale launch bringing financial rewards. It is worth mentioning that the commercial value of ideas is often realised after obtaining patent rights for a project. The strategic patenting without intention to commercialise can bring vast sums of money to the inventor or the organisation, however there could be more value when ideas are fully implemented (Stevens and Burley, 1997). Schepers et al. (1999) and Smith (2000) claim that a few hundred of submitted ideas are required to be screened to about five projects worth major investment and development efforts. Commitment of the organisation to research and develop program carries a fair degree of cost, risk and uncertainty, therefore knowledge about implementation process is critical to the success of innovation (Fidler and Johnson, 1984). Smith (2000) claims that reduction of government incentives for R&D in Australia reduces opportunity to compete and commercialise more innovations. The biggest disadvantage in his opinion is a very small number of technology incubators helping inventors to generate and develop commercially viable business propositions. The alternative way for analysis of viable ideas is to evaluate them from the patent stage. This approach gives far better credibility to determine their commercial value and indicates larger probability for success of projects. In order to present a general view of the implementation process,
stages of innovation process will be discussed further in this review to present some elements that forms the foundation of innovation process.

2.1.3 Relationships of Innovation Factors

Majority of authors in the analyzed innovation literature presented views about innovation in relation to one or two themes of cognition, culture or motivation. The author’s attention was to expose some of those parts of literature review with the complex multidisciplinary themes. Those selected themes from innovation topic of literature review are:

- creativity relevant skills utilize cognitive abilities and task motivation that may lead to achieving set goals in the organisation (Amabile, 1988),
- global landscape can demonstrate that different cultural values affect an individual’s cognition and in turn influences decision making and innovation (Busenitz and Lau, 1996),
- some of the personal attributes such as: emotions supplying the energy for motivated behavior and domain-related knowledge available prior to creative activity allow for divergent thinking about open-ended problems (Ford, 1996),
- need for achievement and social prestige is important as the job motivator (Kono, 1988),
- it is questionable whether culture-free aspects of cognition, emotion and motivation ever existed (Markus and Kitayama, 1991),
- there is a relationship between human and structural intangible factors, as human intangible factors are based on competence (knowledge and skills), attitude (motivation, behaviour and conduct) and intellectual agility (innovation, imitation, adaptation and packaging), whilst the structural intangible factors reflect on: relationships (including customers, suppliers, alliance partners, shareholders), organisation (including infrastructure, process and culture), and renewal and development (Roos et al., 1997).

2.2 Organisation

2.2.1 Introduction

Organisations are formed when people come together to combine their talents and efforts in order to achieve common goals (Northcraft and Neale, 1990). There may be
no ideal vision for organisation, though it should provide an environment where employees can fully utilise the opportunity to explore their potentials (Csikszentmihalyi, 2003). These opportunities may lead to higher levels of commitment and loyalty (Douglas, 2004).

The birth of modern industrial organisation evolved from the late seventeenth century manufacture made up by a master and one or two apprentices (Smith, 1904). The legacy of free market capitalism with nongovernmental intervention as the dominant model of economic activities is still practiced until today (Clark, 1991). In general the birth of modern industrial manufacture wouldn’t be possible without vast social transformations (Heilbroner, 1975). The concept of industrial organisation made of distinct purpose, deliberate structure and people has many common characteristics with other types of organisations such as government, research, schools or army (Robbins et al, 2000). Organisations and their processes cannot be understood and accomplished without continual renewal and human interactions that is recognised as a major resource (Penrose, 1995; Pfeffer, 1982). It may be argued that many of the great social transformations in the world like spread of the Christianity or rise of the Roman Empire, may not have happened without the organisational approach (Hall, 1987). It is practically impossible to generate one single theory encompassing a perfect, all-purpose view of an organisation. Organisations in the simple term are “consciously created arrangements to achieve goals by collective means” (Thompson and McHugh 1990, p13). However, all theories of organisation and its management are based on implicit images or metaphors, which provide distinct pathways that the organisation may follow which, may or may not stimulate specific type of innovation (Morgan, 1997). For example, bureaucratic organisation may not stimulate radical innovation.

A perception or an image of what organisations represent is often as important as the outcomes they may produce and there are no universal models available. The strength of professional bureaucracy comes mainly from an experience of its members. External controls in such case might have a detrimental effect on productivity and innovation. For example, similar to bureaucracy producing standard outputs and not well suited to the adoption of new things due to the presence of a convergent thinking is professional bureaucracy (Mintzberg, 1983). In comparison competitive and turbulent global environments often require operation of organisation as open system (Morgan, 1997).
Morgan agrees that organisations like humans combine various needs depending on the stage of their development in life with individuals and groups operating most effectively when their needs are satisfied. The attractiveness of this new theory to management is in possibilities to motivate employees to “higher level needs in a way that could increase involvement and commitment without paying them any more money” (Morgan, 1997, p38).

The organisation can also be portrayed as an integrated unit performing common functions while constrained by the boundary of a closed system or interacting with the environment as an open system (Stacey, 1996). The reality is that modern organisation is a complex and integrated system that comprises of people who interact with each other to produce surviving strategies for themselves and for the system (Dodgson and Bessant, 1996). Cooperation or competition within these arrangements integrates resources between organisations to create common interests in sharing benefits. “Shared values, shared beliefs, shared meaning, shared understanding, and shared sense making are all different ways of describing culture” in the organisation (Morgan, 1997, p138). Organisations created by specific social developments, unique to general national characteristics, people and the environment are creations that can easily be recognised to have shared meanings (Schein, 1992). Those meanings may involve: knowledge, values, ideology, laws and day to day rituals which may be sensitive and difficult to recognise from outside (Hofstede, 1991; Morgan, 1997).

Some organisations try to improve their performance by analysing the process strength and weakness patterns and develop a mental model based on the learning from their experience (McGill and Slocum, 1993). To embrace innovation, organisational culture needs to be flexible and involve new learning. Complex organisational relations recognised by McGill and Slocum (1993) represent four different approaches such as: i) knowing/thinking by book, ii) understanding organisation’s values, iii) thinking/analysing and acting upon, and iv) learning by enhancing experience as cognitive methods, that may reinforce process of learning and could affect performance. According to Weber (1947) three types of behaviour can influence social domination: charismatic, ruling by a virtue of personal qualities of hero, prophet or demagogue, with loosely constructed administrative apparatus; traditional, based on respect to the past and tradition as right ways of conducting affairs, often by inherited status; and rational-
legal, where power is formally bounded by rules of law, operating as a bureaucracy surrounded by regulations and procedures. A real danger is in the rational-legal type of identity that may present a threat to democracy, human spirit and values by being able to subordinate masses of people (Morgan, 1997).

The organisations perhaps ought to satisfy needs for spatial and social distances between individuals, groups and departments by change to physical structures in order to create the climate for innovation (Pfeffer, 1982). The other view is that system of networks may better characterise complexity and recognise propensity of an organisation to innovate (Tichy and Fombrun, 1979). These social networks can be identified through repeated interactions among organisation's members and maybe characterised by: type, patterns of relationships, causes for networking and consequences of patterns. Understanding informal network principles improves communications, increases productivity and encourages innovation in the work place (Pfeffer, 1982). Mesjasz (2002) argues that ability for self-observation and use of knowledge in the social organisation using metaphors is increasingly important for inquiries into process of thinking, mind or consciousness.

### 2.2.2 Organisational Culture

Organisations are complex and dynamic social creations where culture represents one of the greatest determinants to understand them (Delobbe, 2002; Kanter, 1983). In the opinion of Hall (1987) two major factors contribute to the characteristics of the organisations: i) people’s attitudes and behaviours, and ii) organisational system. Christensen and Overdorf (2000) presented another view and identified: resources, process and values, as shaping organisational capability, which over a time evolve into one entity viewed as common culture. Robins (2001) claims that culture performs a number of functions in the organisation such as: defines boundaries, conveys a sense of identity for its members, facilitates the generation of mutual commitment, enhances social system stability, and serves as a sense-making and control mechanism that guides and shapes the attitudes and behaviour of employees. Organisational capability to change often depends on its cultural domain focused on flexibility, adaptability and innovation as integral components of culture (Parry and Proctor-Thomson, 2003). In the opinion of many sociologists and psychologists, culture is defined as the system of
values and meanings shared by a group or a society (Fiske, 2000; Parson, 1960; Popenoe, 1988; Schein, 1992). Patterns of these common assumptions can be learned and are often developed as a result of internal integration towards external adaptation (Arditi, 1994; Schein, 1992). Some authors consider culture as a learning identity and stress that teams play an important role in shaping it (Katzenbach and Smith, 1993; Maccoby, 2003; Sullivan, 1999). The influence of culture on entrepreneurship has been researched for nearly thirty years at national, regional or organisational level and its complexity and multifaceted relations have been revealed (George and Zahra, 2002; Hayton et al., 2002). Examination of the global landscape reveals that some cultures produce more entrepreneurs than others (Busenitz and Lau, 1996). It may be a case that cultures promoting risk taking or independent thinking and reward for such behaviour can also develop propensity to promote innovation (Hayton et al., 2002; Hindle and Yencken, 2001; Hofstede, 1991). Van Muijen and Koopman (1994) argue that less bureaucratic organisations are better prepared to manage innovation. Replacement of top-down style of management with shared responsibility could create a culture of sociability encouraging pursuit of common objectives and give employees the opportunity for self-discovery and a sense of relevance (Goffe and Jones; 1996; Noer, 1997). Better communications and understanding between management and employees may create a culture of trust beneficial to organisational performance (Carnes, 2001; Niedermeier and Rhodes, 2002; Lawson, 2004). Although many elements can identify organisational culture, Schrodt (2002) argues that employee morale emerges as the strongest identification. It is recognised that corporate culture has strong effect on employee participation and involvement that influences organisational performance (Denison, 1985). Various factors may influence the success of an organisation, but most authors agree that unique culture is one of the strongest determinants (Hayton et al., 2002; Maccoby, 2003; Quinn et al. 1996; Zien and Buckler, 1997). Hernandez and Iyengar (2001) claimed that differences in attributes between Eastern and Western countries and cultures could predict cultural differences in human motivation. Cultural diversity emerges mainly as a result of natural selection of human factors through universal psychological mechanisms (Fiske, 2000; Jaskyte, 2003). In the age of open market economy and globalisation, knowledge of cultures may directly affect organisational performance (Adler et al., 1986; Harrison, 1972; Hofstede, 1991; 1998). Synergy from cultural differences and diversity may contribute to innovation when people’s behaviour is sufficiently understood (Adler et al., 1986), however cross-
cultural exchanges while they enhance creative human energies could be disruptive at the same time (Tyler, 2002). Hofstede (1980) identified that especially two factors shape personal image of an organisation: power distance and uncertainty avoidance. In his opinion those two factors create either a picture of hierarchical pyramid like structure with distributed authority and activities or a model of a village like arrangement based on cooperation, providing ad hoc solutions without formalities. Person-organisation fit becomes an important factor in the international work relations as individuals from various backgrounds seek social identity that may provide them with meaning and connectedness (Markus and Kitayama, 1991; O’Reilly et al., 1991). Measuring core dimensions of organisational culture may prove to be difficult due to the complexity and number of critical factors. Not many of the earlier developed models had factors including innovation (Harrison, 1972; Likert, 1967; Peters and Waterman, 1982, Robbins, 1990). Synthesis of various models existing in the literature gave Van der Post (1997) a list of one hundred and fourteen different dimensions describing organisational culture, but none included innovation. Recent cultural models including Delobbe et al. (2002) recognise innovation and some of the common factors such as recognition-supportiveness, commitment-solidarity that determine also innovative organisation. The model developed earlier by Quinn (1988) includes focus on organisational innovation as one of the four cultural quadrants. However, Negroponte (2003) argues that one of the basic criteria’s for a good system of innovation is diversity. His argument was that the stronger the culture the less likely it may harbour innovative thinking. Other researchers are more specific and use term innovative culture to incline a strong support for innovation (Chandler et al., 2000). While Chandler et al. thought that a reward system and supervisory support are both positive to innovation culture, Brannen (1991) and Jassawalla (2002) saw that group activities had encouraging influence. Few authors claim that risk-taking culture determines successful innovation (Jassawalla, 2002; Smith, 1998), but majority of available literature states that a system, which provides rewards and recognition for achievements truly enhances innovation efforts (Amabile et al., 1996; Vroom, 1964; Woodman et al., 1993).

2.2.3 Self Identity and Organisation

Though relation between work satisfaction and productivity is not always clear, there is strong desire among working people to have an identity and a good quality working life
A concept of self is probably unique to human beings because the ability to think consciously about itself can be demonstrated and it reflects on human behaviour (Leary and Buttermore, 2003). The self-awareness gives people the possibility to deliberately control own behaviour. Leary and Buttermore claim that the self-awareness demonstrates human’s intricate cognitive processes. Interest in all concepts of self, for example: self-management, self-control, self-assessment, self-goal setting, etc. is derived from the supposition that if an individual is self-committed to the course of action than work may not be abandon and that could result in much better performance as if task would be imposed on workers (Robbins et al., 2001). This type of behaviour is also known as reinforcement theory. Robbins et al. argues that self concepts may give people feeling of being in charge of their own fate and therefore to perform better, but that may differ with the types of individual personality. The other aspect of self was presented by Wells (1992), who argued that the experience might have the most significant impact on the sense of self, especially in the relation to self-esteem in producing required outcomes.

### 2.2.4 Organisational Performance and Effectiveness

Effective performance of an organisation may not depend only on successful management. Tushman and Nadler (1986) argue that effective organisations need to manage current work for today and simultaneously create innovations for tomorrow. In addition Tushman and Nadler claim that organisations need to have sufficient internal diversity in strategies, structures, people and processes to facilitate good performance. It is the role of management to control the organisation for the desired levels of performance (Mintzberg, 1983). On the other hand the search for greater profitability may involve innovation in technology and work place, coordination of resources and utilisation of people’s skills and knowledge, and therefore could result in a more democratic and egalitarian social order in the organisation (Thompson and McHugh, 2002). Performance is usually assessed by comparison of actual results of activities with planed standard outcomes. Thompson and McHugh state that measurement of performance has two basic purposes: to measure results and to use them to motivate workers. They argue that there is a considerable body of evidence to suggest that environment in which organisations operate, its age and size have impact on its structure and therefore on performance, while Mintzberg (1983) believes that older and
larger organisations have more formalised practices and behaviour. Sethi (1997) claims that there is no difference between an organisation that supports and nurtures self-esteem of its employees and one that supports a high performance. In both cases an organisation needs to implement seven basic policies, which may include: respect, responsibility and resources, risk taking, rewards and recognition, relationship, role modelling and renewal. Sethi states that those factors are link with the ‘six pillars’ of self-esteem such as: living consciously, self-acceptance, self-responsibility, self-assertiveness, living purposefully and personal integrity.

Whether an organisation is effective or not often depends on the perspective that it is judged by, which can be: economic, political or moral (Hall, 1987). According to Hall views about effectiveness in producing satisfactory results are often conflicting and may be assessed on the basis of: system-resources, organisational goals, goals and effectiveness, and participant-satisfaction. Contrary to that Baer and Frese (2003) state that organisational performance could be well represented by firm goal achievement and return on assets. The European Foundation for Quality Management (EFQM, 1999) proposed to assess an organisation outcomes based on financial and non-financial factors. While financial outcomes should include: share price, dividends, gross margins, net profit, sales and meeting the budgets, non-financial outcomes could be characterized by: market share, time to market, volumes and success rates. EFQM proposed that these factors could be used to measure, monitor, understand, predict and improve the organisation’s key performance outcomes. The other perspective on the importance of measuring is presented by Hultink and Robben (1995) who saw the development cost and speed to the market as vital in the short-term perspective, while return on investment more important in the long run. Hultink and Robben stated that either in short or long term, four factors such as: customer acceptance, meeting quality guidelines and product performance with customer satisfaction are probably the most important to an organisational performance.

2.2.5 Relationships of Organisational Factors

Analysis of Organisational literature presented an interesting material based on human, rather than structural side of its identity to demonstrate some of single relationships between factors of cognition, culture and motivation. These examples are:
• differences in attributes between Eastern and Western countries can predict cultural differences in human motivation (Hernandez and Iyengar, 2001),
• process of change in an organisation that can originate from problem solving, R&D, innovation and diffusion or social interactions (Hoverstadt, 2004),
• learning ability can be expressed by ‘team’s play’ as an important role in shaping organisational culture (Katzenbach and Smith, 1993; Maccoby, 2003; Sullivan, 1999),
• some of the most important barriers to sharing tacit knowledge are lack of culture mentoring and assisting others, inequality in status among participants, and physical and time separation (Leonard and Sensiper, 1998),
• organisational culture needs to be flexible to free its employees from current practices and embrace new learning (McGill and Slocum, 1993),
• ability for self-observation and use of knowledge in the social organisation using metaphors is increasingly important for inquiries into a process of thinking, mind or consciousness (Mesjasz, 2002),
• organisations are socially created identities with common patterns of shared meanings, which may involve: knowledge, ideology, values, laws and day to day ritual (Morgan, 1997; Schein, 1992),
• integrative organisation settles conflicts, directs motivation towards institutionalised goals and ensures that many parts of a society work together (Parson, 1960),
• comprehensive understanding of human behaviour is essential to a successful organisational innovation where issue of resistance to change, sense of security, motivation, possession of knowledge, future economic consequences and other dilemmas may be examined sufficiently in the light of organisational behaviour without properly conducted communications about the process of change (Rogers, 1999; Tichy, 1974),
• cognitive restructuring by identifying with a new role model or mentor, or scanning the environment for new relevant information are helpful during a change process that involves unfreezing of expectations, creation of guilt or anxiety and a provision of psychological safety that converts anxiety into motivation to change (Schein, 1987),
• effective cooperation requires motivated individuals attracted to joint undertakings by the perception of mutual benefit (Slatyer, 2000),
• learning in the organisation is tied to refining the process by which individuals are socialised into the required behaviour patterns (Thompson and McHugh, 1990),

• motivation to belong to a group is related to personal, social and material rewards available through the association (Thompson and McHugh, 2002).

• some patterns of interrelations in the social system may lead to a collective thought process and further an ability to provide common solutions to problems (Weick and Roberts, 1993).

2.3 Organisational Behaviour

2.3.1 Introduction

Hampton et al. (1982) claims two distinct theories steering the field of organisational behaviour, one being motivational and the other behavioural. Clarifying further, he states that motivation theories may include expectancy, need or achievement, affiliation and power, while behaviourism assesses instrumental conditioning, work-related behaviours, aversive and affirmative control. On the other hand Thompson and McHugh (2002) saw organisational behaviour as the manifestation of individual’s experiences, and their transactions and interaction through their unique identity in the organisational environment. Another view is proposed by Robbins et al. (2001) who saw organisational behaviour as a field of study replacing intuition with science and examining the impact of individuals or groups on behaviour within an organisation. According to Hodgetts (1991) behaviour in an organisation can be categorised to individual and group as they share common determinants such as norms, values, perceptions or attitudes. He distinguished three ways to examine behaviour in the organisation: i) psychological - looking at mental processes such as memory and perception or effects of heredity and environment on intelligence, ii) sociological - including social behaviour within society, organisations or groups, iii) anthropological - mainly concerned with cultures and the ways people learn and how they behave. In the opinion of other authors, the ongoing interest in organisational behaviour is driven, by individual’s needs and behaviour that are closely related to organisational innovativeness (Dess et al., 1999; Janssen, 2000; 2003; Rogers, 2003).
2.3.2 Role of Motivation

One of the principal interests in organisational behaviour is to increase the motivation of workers in order to gain greater productivity from them. Thompson and McHugh (2002) state that deeper understanding of motivation can be gained from biologically based needs and drives for goals or from cognitive notions of processing information on rewards, costs or options for goal related outcomes of actions. The other view is that “motivations are viewed as choices made about or perceived predispositions to, certain behaviours and outcomes” (Thompson and McHugh, 1990, p266). The problem with a proper assessment of the relationship between performance and job satisfaction may lay in the other social, cultural, organisational or environmental factors, which are difficult to incorporate into behavioural equation (Thompson and McHugh, 2002). Thompson and McHugh acknowledge that most needs can be classified on the basis of operant stimuli as: i) intrinsic - influence from attachment to work, ii) extrinsic - influence from external factors such as pay level, perks, leisure time. Motivation theories such as Herzberg’s (1987) self-actualisation and the individual’s growth through job enrichment, do not include job content or environmental factors and are examples of the view on a worker as a passive identity (Thompson and McHugh, 2002). In contrast to that opinion Lee and Lawrence (1985) saw motivation as related to individual’s decision-making and identified four major factors influencing it such as: goals representing values, interests and perceptions of individual opportunities and possibilities; strategies as formulas for achieving goals or reaction to threats; coalition seen as an exchange of commitment to group interests for support in goal strategies which cannot be resolved individually; and power to assess success of goal strategies and coalition membership on the basis of estimated personal power capable to affect events. Thompson and McHugh (2002) observed that motivation issues in an organisation could be also understood as a struggle for influence and power. They argued that to cope with the realities of uncertainty in the organisational life, individuals face the choice of either accommodating necessities and gradual redefinition of their own values, or adopting a strategy aiming towards the assimilation with the possible consequences of being subjected to other people’s goals. For Preiss and Spooner (2003) motivation especially in R&D Australian organizations is paradoxical when the federal law provides tax incentives to organizations at the input point of R&D expenditure, instead of on the generation of revenue from the outputs of commercialisation that could
increase efficiency and encourage more innovation. Decision processes during R&D activities often require knowledge, creativity and motivation. The problem is not about motivation to do research, but rather what mechanisms need to be applied to gain more applied developments and commercial outcomes. The perception is that organisational reward systems can have a considerable impact on innovating activity (Vroom, 1964). Many firms use an efficiency-wage model as a motivational instrument to increase labour productivity (Spatz and Nunnenkamp, 2002). Commitment and motivation of knowledge workers represents an especially sensitive issue to many organisations, where ability to turn knowledge into effective actions is increasingly critical to organisational performance (Malhotra and Galletta, 2003). Fry (2003) incorporated intrinsic motivation with spiritual motivation of managers that are necessary in an organisation to create vision and values empowering individuals and groups. In contrast Langowitz (1991) saw the motivation of organisations to innovate very closely related to the alignment of individual’s and corporate goals. A novel proposition of innovativeness in society comes from Sundbo (2001) who incorporated two opposite human properties of selfishness and sociability. According to Sundbo, it is a dynamic drive of both factors with realisation of personal ideas and gains in power and status on one hand, and the collective engagement of members in the development of solutions on the other hand that make innovation possible in the organisation. The recognition of selfishness related to human nature, especially in cultures such as in America is recognized by some prominent authors such as Mintzberg et al. (2002) to be important for business, but the remedy resides with the equally important characteristics of human engagement. Janssen (2000) claims that though job demands often instigate work actions, in many cases workers are required to undertake prescribed work behaviour. Innovative behaviour of employees, which is not confirmatory to the accepted behaviour norm and often presents a source of individual-group or organisation conflict, can be seen as a result of a perceived fairness in an effort-reward decision on the behalf of the individual (Janssen, 2003).

2.3.3 Cognition

The word cognition comes from the Latin *cognoscere*, which means ‘get to know’ (Collins Latin Dictionary, 1997). Cognition relates to the acquisition of knowledge and can be present in decision-making, learning or information-processing (Lord and Maher,
1990). It can be assumed that an individual’s cognition produces organisational behavior reflecting on organisational performance and therefore depends on an individual, his interpretations and performance in the group context (Schneider and Angelmar (1993). Austin (1997), and Larsen and Christensen (1993) argue that group diversity is positively related to cognitive processing capability of individuals, while Klimoski and Mohammed (1994) state that there is not enough evidence to claim the existence of group cognition. Typically, cognition can be displayed in many educational organisations through publications, while industry tends to create innovations and new ventures (Boone and Smith, 1996; Busenitz and Lau, 1996; Forbes, 1999). Cognition can take various forms. Some authors describe it as: theories in use (Argyris, 1977), symbol system (Lenat and Feigenbaum, 1992), interactive (McClelland and Rumelhart, 1986) and dominant logic (Prahalad and Bettis, 1986) or mental models (Senge, 1990). Cognition can optimise personal effectiveness within a given situation, by creating simple mental models that allow piecing together previously unconnected information, leading to inventing new products or services (Mitchell et al., 2002). The most recently used popular approach to study cognition in an organisation takes behaviour based paradigm (Maes, 1994). Christensen and Overdorf (2000) claim that cognitive models used in the organisation reflect the type of customer responses given to innovations. Clark (1997) on the other hand states that real cognition exists when a system is able to understand, explain and describe other systems. Gershenson (2002) claims that human cognition depends on our nature as well as the way we perceive and describe it. Allinson et al. (2001), Markus and Kitayama (1991) extend this further by saying that it is a difference in self-construct that reflects on our cognition, but they doubt whether culture-free aspects of cognition, emotion and motivation ever existed. Cognitive similarity expressed by how a person perceives, thinks, learns, solves problems and relates to others may lead to better interactions with others due to shared interests and common ways of communicating, while mismatch may result in conflicts (Rickards and Moger, 1994; Tullet, 1995; Witkin et al., 1977). Kirton (1989) observed that conflicts in the organisation often resolve between innovative and highly adaptive people due to their different cognitive styles. Organisations therefore should find the best ways to make decisions, which can lead to effective problem solving. According to Nonaka and Takeuchi (1995) success lies in the creation, expansion and integration of tacit and explicit knowledge through social interaction. To better understand organisational developments and map ‘territory’ Schneider and Angelmar (1993) proposed a cognition
framework based on structure, process and style of an organisation to determine individual or group cognition, but Jelinek and Litterer (1995) argued that to understand “entrepreneurial organization requires a shift from the static, deterministic paradigm of transition organization and theory to a cognitive paradigm which focuses on individual sensemaking and collective decision process”. Shepherd and Krueger (2002) described this new phenomenon of individual sensemaking and collective decision process as social cognition of entrepreneurial teams within an organization environment. Social cognition relates to team cognition and team ability to process individual members information through socially shared interactions. According to Larsen and Christensen (1993), group shared cognition is often reflected in the creation of group-level intellectual products such as innovations. Cannon-Bowers et al. (1993) stated that shared mental models do not imply group cognition, but rather the fact that group members may have compatible models that lead to common expectations of goals and values, while Tsai and Ghoshal (1998) had opposite views.

At the individual level, cognition considers person’s perception, memory and process of thinking (Estes, 1975), while at the group social level, cognition examines person subjected to influence of forces within a situation and his cognition and motivation (Fiske and Taylor, 1984). Moreland et al. (1996) saw social cognition as team’s processing information for their members. Shepherd and Krueger (2002) concluded that team cognition is present when its members respond on behalf of a team. The role of cognition in the organisation may relate to members being able to form a mental model of reality and act appropriately in the specific situation using specific behaviour pattern. The transfer, integration and creation of knowledge often affect the success of new, culturally integrated organisations where all kinds of thinking and practice are equally valuable (Slatyer, 2000). Differences in cognition across cultures, social groups and domains of practice are best explained from historical developments that led to those differences (Engestrom, 1999). On the other hand Hernandez and Iyengar (2001) argue that cognition is most sensitive to national cultures. Examination of the global economic landscape allowed Abramson et al. (1993), Busenitz and Lau (1996) to assume that some cultures produce more entrepreneurs than others. Allinson and Hays (1996) argued that the existence of an intuition-analytical dimension of cognitive style and recognition of analytical thinking might no longer be relevant to research, but Forbes (1999) discovered that cognition plays significant role in pre- and post-founding process
in new venture creation. Factors representing intention, scanning, interpretation and action are pre-performance factors and can be demonstrated as elements of motivation (Kozlowski and Gillin, 2005). Cognitive and symbolic activities have also recognition as one of the most important intangible assets in current and future business environments (Drucker, 2001; Penrose, 1995).

Over the years various ways have been proposed to conceptualise and to measure cognition. Allinson and Hayes (1996) suggested the use of intuitive practices in the organisational thinking recognising at the same time analytical methods and incorporated two of the domains into Cognitive Style Index (CSI) multidimensional model to measure cognition either at individual or group level. This method of measuring cognition has been criticised by Epstein et al. (1996) as potentially flawed because both analytical and intuitive domains serve different purposes and therefore require separate analysis. However Taggart and Valenzi (1990) argue that one factor should not be assessed without the other, as feelings and logic are often difficult to separate. In recent years organisational sensemaking is gaining popularity as this process contributes significantly to the creation of innovations and new ventures (Forbes, 1999). The model of organisational sensemaking proposed by Milliken (1990) identified three stages where: scanning refers to the process of data collection, interpretation gives meaning to data, and action puts cognitive theories into practice. Milliken claims that each of the three tasks is very complex and may generate a certain degree of uncertainty.

2.3.4 Innovative Behaviour

Pierce and Delbecq (1977) recognised personal attitudes and values of an organisation’s members as some the most critical and influential variables affecting innovation. They suggested that poor understanding of behavioural factors often results in huge organisational innovation variance. However, the understanding of human behaviour is not simple, as it includes different needs, motives, values and expectations of every individual (Putti, 1987). To nurture and promote innovation in the organisation Brown (1991) proposed the establishment of a risk investment fund, which could award employees for successful undertakings without any adverse implication in their career. Thompson and McHugh (2002) argue that organisations need to be perceptual and
allow members to comprehend their experience and provide them opportunity to learn and to reinforce individual identities while building common behavioural patterns. The emergence of third-order organisations has changed the role of organisational information and behaviour of employees (Weinberger, 2005). Open access to organisational information is the essence that created an opportunity to manipulate information in a creative way without corporate interference. In addition, Nam Choi and Price (2005) identified person-value fit and person-ability fit that may represent constructs indicating person predisposition to innovation in the organisation. Nam Choi and Price confirmed that individual’s beliefs often reflect on their attitudes and work behaviours and therefore may influence their fit to innovation. Janssen (2003) adds that innovative behaviour is intentional and needs a careful assessment by an employee as it may result in conflicts with co-workers or organisation after a disclosure. Perception of effort-reward fairness is another important determinant that may inhibit back employees with their innovative initiatives (Janssen, 2000). Behaviour could be motivated by a range of reasons, but workers in organisations tend to perceive first what is good for them and then what may be good for an organisation (Csikszentmihalyi, 2003; Dayton, 2005). Dayton believes that innovation may get ‘additional coaching’ if it can enhance one of worker’s ‘5P’ concerns: power, pay, prestige, perks or privileges. His view is supported by Tullock and McKenzie (1985) about most of the things that have a price at which they may be obtained, and therefore adjustments in behaviour are made according to price. In addition, Csikszentmihalyi (2003) argues that the trust of employees, which derives from respect to others, has the most important role for the organisational behaviour. Perception of the climate for innovation is a complex and dynamic phenomenon and depends on leadership, individual problem solving styles and abilities, and work group relations (Scott and Bruce, 1994). To mobilise initiatives in the organisation towards innovation requires first of all good communications and participation (Gerd, 2000; Mayfield and Mayfield, 2004). However it is often an unconventional behaviour of individual’s that is required in innovation (Steiner, 1995). Steiner states that times of breaking ‘free’ from structured thinking and asserting an individual touch gives innovation a ‘magic touch’.
2.3.5 Relationships of Organisational Behaviour Factors

Selected organisational behaviour issues reveals mainly information related to cognition and motivation, however some cultural and social elements are still present. Selected opinions on the topic are:

- learning in a social environment is subjected to cognitive and symbolic activities; the emphasis in social learning is on the cognitive process, which accordingly influences the motivation (Bandura, 1977),
- different cultural values affect an individual’s cognition and in turn influence decision making and organisational performance (Busenitz and Lau, 1996),
- differences in cognition across cultures, social groups and domains of practice are best explained from historical developments that led to those differences (Engestrom, 1999),
- at the group social level, a person is examined by the length of influence of forces within a situation and his cognition and motivation (Fiske and Taylor, 1984),
- general employee’s contribution to organisational productivity is related to motivation, focus of attention, skills and knowledge (Hendy, 2005),
- cognition is culturally sensitive (Hernandez and Iyengar, 2001),
- Japanese middle-aged managers are more motivated by socially beneficial values, while Americans emphasise individuality and openness (Howard et al, 1983),
- knowledge is recognised as the competitive advantage and valuable resource, which can be exchanged during innovation (Janssen, 2000; Nahapiet and Ghoshal, 1998),
- understanding of individual’s motivation within an organisation setting requires the knowledge of patterns governing individual’s self within a social structure (Luft, 1984),
- commitment and motivation of knowledge workers can represent especially sensitive issue to many organisations, where ability to turn knowledge into effective actions is increasingly critical to organisational performance (Malhotra and Galletta, 2003),
- social cognition can be interpreted as teams processing information for their members (Moreland et al., 1996),
organisational success lies in the creation, expansion and integration of tacit and explicit knowledge through social interaction (Nonaka and Takeuchi, 1995),

expectancy is based on cognitive theories of motivation (Peters, 1977),

knowledge sharing in the organisation can be culturally sensitive (Pettigrew and Fenton, 2000).

motivation is a form of culturally sensitive rational exchange between an individual and an organisation through values of pay, security or promotion (Robbins et al., 2001),

phenomenon of individual sensemaking and collective decision process in an organisation can be described as social cognition of entrepreneurial teams (Shepherd and Krueger, 2002),

success of new culturally integrated organisation is often affected by the transfer, integration and creation of knowledge (Slatyer, 2000),

importance of an individual as ‘motivated tactician’ may be replaced in future organisations by groups as social organisations (Thompson, 1998),

motivation can be explained in terms of cognitive notions of processing information on rewards, costs or options for goal related outcomes of actions (Thompson and McHugh, 2002),

perception is that organisational reward systems can have a considerable impact on innovating activity (Vroom, 1964),

2.4 Organisational Innovation

2.4.1 Introduction

Organisational innovation is often described as the creation or the adoption of an idea or behaviour that is new to that organisation (Daft, 1978; Damanpour, 1991; Damanpour and Evans, 1984; Hage, 1980) or simply a theory of how innovation occurs in organisations (Amabile, 1988). Adoption may include products, processes, services, systems or programs and represents most aspects of innovation present in a modern organisation (Daft, 1989; Damanpour and Evans, 1984). Some studies have used different terminology and have concentrated on diffusion, innovating or innovativeness, where their main aim was to determine characteristics enhancing organisational innovation (Damanpour, 1991).
The main focus in early studies has been on rates and speed of innovation adoption, shifting interest from incremental innovation in 1960’s to radical change in 1980’s. The other areas of research on organisational innovation include systems theory, strategy, performance, investment in R&D, and networks (Hage, 1999). There is an opinion that much of the existing organisational research does not produce a stable result due to a large number of organisational innovation determinants (Downs and Mohr, 1976). The other reasons for instability in the earlier studies may be failure to distinguish between various types of innovation (Daft, 1978). Wolfe, (1994) claims through analysis of literature trends on organisational innovation that diffusion of innovation, organisational innovativeness and process theory are three main approaches preoccupying the field of research. A similar view of three interdependent perspectives of: structural forms, process of organisational learning and knowledge creation or capacity for change and adaptation as factors determining innovation in the organisation was presented by Lam (2005). Lam claimed that although there are potentially important overlaps and interconnections between various perspectives, there is no coherent framework of organisational innovation which combines all these three factors. Damanpour (1988) claimed that the most common factors investigated are influence of individuals, and internal and external organisational environment variables. In contrast Mintzberg (1979) revealed that structural forms and propensity to innovate have the strongest relation in the organisational context. However, it is still unclear how and under what conditions organisations change from one structure to another (Lam, 2005). By contrast cognition and organisational learning is emphasised as most critical to problem solving and innovation by other authors (Nonaka, 1991; Nonaka and Takeuchi, 1995). A need to secure competitive advantage is seen as the main driver for innovation of many organisations and nations. Recent studies of innovation consider more evolutionary approaches including economic, technological and behavioural aspects at the organisational level (Castellacci et al., 2005). Other studies of organisations conducted by authors like Hage (1980), Kanter (1983) or Porter (1980) added to our understanding of innovation within the organisation, but they were conducted using only quantitative analysis and examining correlations of known factors. Zajac (1991) observes that using other methods of research may enrich understanding of organisational innovation a bit further. The latest promising direction for future research emerges from the recognition of organisational innovation as precondition for technological innovation, rather than reaction to external forces. Contrary to that, the other theory suggests that changes in the
environment create ambiguity and uncertainty, which prompts the organisation to scan, to interpret and learn, thus producing innovation (Lam, 2005).

Successful organisations should practice and treat innovation like any other objective such as quality or productivity (Drucker, 1985). Tushman and O'Reilly (1997) claimed that organisations could be ambidextrous, promoting both, change and stability. Though stability, consistency and efficiency is necessary to secure today's successes, flexibility, speed and change can ensure tomorrow's future. Paradoxically, the presence of stability in the organisation is necessary to fully realise the value of innovations (Tushman and O'Reilly, 1997). In comparison to corporate culture or corporate innovation only limited studies give consideration to the influence of individual’s on innovation (Jenssen, 2003; Nam Choi and Price, 2005; West et al., 2004). Van de Ven and Rogers (1988) argue that interpretive methods that include views of involved people should be used to examine innovation’s intricate and uncertain characteristics. Many organisations today operate under conditions of rapidly changing environment but often fail to benefit from examining employees opinions leading to creativity due to the lack of vision or poor records of acceptance to change (Amabile, 1988; Kanter, 1983). According to Mintzberg (1983), proficiency in management and continuous innovation are some of the pre-requisites for organisational long-term survival. Management in organisations must empower the individuals to facilitate creative change, as often the organisational domain is neither desiring nor requiring pervasive creativity (Ford, 1996).

Innovation in organisations often exposes some of the basic problems of the modern society, as it seems to be dependent on continuous launching of new products and services. Adaptation to new external conditions is a result of organisation’s capability to manage projects and labor relations in a complex environment (Hage, 1999). The complexity of various scenarios may reduce the need for centralization, formalization and direct control over the labor tasks and at the same time increases the demands on the employees to be multi-skilled knowledge workers. It is almost unquestionable that the wealth and well being of individuals, organizations and nations is increasingly dependant on the creation of innovations through the dissemination and use of knowledge (Drucker, 2001). New knowledge is critical to the development of new ideas and outcomes and therefore organisations confront challenges in distributing knowledge throughout (Tsai, 2001).
Hage (1999) suggests that the notion of stimulating innovation in the organisation may become one of the most challenging tasks of our time. The free market and global environment could be the only factors in the near future that might affect social, economic and technological changes (Gopalakrishnan and Damanpour, 1997). Considerations of a changing environment require quick adaptation and response to new circumstances. Innovation is one of the effective means of adapting to change. Due to increased competition in the market, the life of products and technology is also decreasing. Innovativeness as well as the level of organisational performance may maintain the balance between the life of products and technology, and between organisation’s social and technical systems (Damanpour and Evan, 1984). Organisational change ranging from managerial hierarchies and control to training staff may be essential to innovation effectiveness, but this could be a difficult balancing act (Nadig, 1999). The pressure from innovators and entrepreneurs that often drive co-evolutionary changes in the industry and technology at organisational level may not be enough to sustain innovation. Although for more than fifty years most developments were coined as the result of ‘knowledge-based economy’, science and technology based innovations are the latest emergent phenomenon (Bruland and Mowery, 2005). On the other hand organisations are necessary and powerful identities within a social context, without which significant creative endeavors may never be realized (Ford, 1996).

2.4.2 Perspectives on Organisational Innovation Studies

Since the 1960’s when interest in organisational innovation started to grow, views and perspectives changed. An example of Becker and Whisler (1967) study demonstrates early interests that have been mainly humanistic in trying to link innovative behaviour to the personal characteristics of participants and structural linking innovative behaviour to the organisational structures. Zaltman et al. (1973) argued that different types of structures are required to generate innovation proposals and implement them. He claims that low formalization, decentralization and high complexity are required for the first stage of innovation, whereas high formalisation, centralisation and low complexity are necessary for implementation. Later research by Pierce and Delbecq (1977) put forward a proposition of examining both perspectives, humanistic and structural by uniting them into an interactive process. The interactive approach allows capturing temporary settings and activities characteristic to development and
implementation process in the organisation (Van de Ven and Rogers, 1988). Although the integrated approach to interactive analysis may present a better understanding of organisational innovation, this perspective is far more complex than traditional. To examine interactive process, a case study method may be appropriate to use, but generalisation of results could present some challenges for a researcher (Slappendel, 1996). The other perspective of organisational innovation was recognised by Nelson and Winter (1977) who looked at the economic site of innovation expressed by allocation of effort that influence a demand for pay-off from innovation and factors that influence cost of innovation.

2.4.3 Innovation Measures

The process of measuring performance or a work product provides feedback and directives, which could be used to improve future organisational performance (Ulrich and Eppinger, 2000; Wikipedia, 2005). Innovation measures can include quantitative, qualitative or combination of both methods. There is perception in the research community that quantitative methods enable researchers to map practice into performance, whereas qualitative studies can only do that to a very limited extent (Brusoni et al., 1998). At the same time Brusoni et al. confirms that the link between quantitative and qualitative studies exists, but it is a very labour intensive process to prove it. On the other hand Tidd (2001) argues that any weakness in the relationship may be caused by methodological shortcomings or by the random unpredictability of innovation. Many observers of economic environment agree that innovation can be confirmed by the economic growth and organisational performance (Hulten, 2000). Hulten claims that in the case of measuring product innovation, the price, quantity and outcome quality are some of the most important indicators. Global Entrepreneurship Monitor (GEM) studies conducted in many countries over five years, as part of a global effort to examine economic growth factors, indicate that innovation and entrepreneurship are related in the organisational context (Hindle and Rushworth, 2003). Other studies confirm existence of the same relationship and highlight reluctance of many European entrepreneurs to take risks (Cordis, 2002).

The general problem examining Science and Technology is that it can only be measured indirectly, using input and output or some other variables that may impact the innovation process. Those indicators are only proxies to innovation and should not be
used in isolation (Organisation for Economic Cooperation and Development, 1994). However, Godin (2000) claims that bibliometrics have been used extensively for nearly fifty years to count innovation outcomes and to provide statistical data despite some fear from the authors that government’s may want to control them. In his opinion, the earliest efforts for measuring innovation were mainly driven by National Foundation of Science and OECD. Godin (2001) goes even further saying that statistical data was enriched in the 1970’s by ‘movement’ for social indicators to allow measurements of social and economic progress simultaneously. Due to continuous efforts of OECD to measure innovation it become less of the fuzzy logic and now has very practical application in improving the outcomes (Godin, 2002).

Patents are one of the most often used indicators of technology and innovation outputs at organisational and national level, however there is a drawback as not all inventions turn to innovations (OECD, 2001b). Oslo Manual (OECD, 1997a) provided the uniform classification and terminology to be used when assessing innovation. OECD recognises that one of the key factors in patenting is a commercial strategy and some patents serve only as a strategic deterrent to competition. Patent counts are often related to population levels in the country, number of researchers in the organisation, GDP or BERD indicators to indicate innovation intention. OECD (2001b) proposed to use more indicators to broaden the field of inquiry such as: types of innovation (products, processes, invented/adopted by firm), size of innovative output (share of output in new goods), cost of innovation, goals of innovation, factors hampering innovation, patents, sources of information, cooperation for innovation and basic information about organisation such as turnover, employment and structure. Another important classification for measurement included separation of organisations into manufacturing and service industries. During the past ten years many countries conducted some sort of Innovation Scoreboard based on OECD (1981; 1996a; 1996b; 1997a; 1997b; 1999; 2001a; 2001b; 2001c) proposed guidelines in order to assess their innovation (European Commision, 2002). The latest OECD surveys include additional data such as participation in life-long learning, number of graduates between the age of 20-29, or even the home internet assess (Commission of the European Communities, 2000a; 2000b, 2001; European Commission, 2002). OECD conducted many surveys in order to capture various indicators and conditions enhancing innovation. Community Innovation Survey (CSI) for example had the aim of providing more helpful indicators to policy
makers among member countries. A popular way to assess innovation at the organisational level is to include its capabilities such as owner’s technical education, prior working experience in business or R&D, technical skills of the workforce, investment in training and R&D (Romijn and Albaladejo, 2002). Among external factors Romijn and Albaladejo included: frequency of networking, proximity of supporting institution and extent of support received. R&D expenditure has positive influence on innovation, but general productivity may not be related to firm size or growth (Klette and Kortum, 2002). On the other hand, Bontis et al. (1999) proposed to use Intellectual Capital (IC) as the indicator of organisational capabilities and included intangible factors such as: competency (skills and knowledge), attitude (motivation, leadership qualities) and intellectual agility (ability to be innovative and entrepreneurial by adapting and cross-fertilising). Baum et al. (2000) acknowledged the influence of IC in creating organisational value but argued that current measuring systems are increasingly disconnected and incapable of capturing a true value in the new economy. As the example he said that nobody really knows how much Amazon.com is worth. Baum et al. analysed internal and external determinants and identified eight factors that influence organisation’s value: customer satisfaction, innovation, alliances, ability to attract talented people, brand investment, technology, quality of major processes, products or services, and environmental performance. Statistical analysis of his data confirm that joint ventures, manufacturing and marketing alliances may produce higher value for organisation and shareholders, but a real customer satisfaction comes from innovation. On the other hand Pothukuchi et al. (2002) argues that performance of international joint ventures is more sensitive to organisational culture than to national culture of its partners. In addition Wind and Mahajan (1997) claim that since innovation processes changed very little over the years, researchers evaluating innovation should concentrate instead on the environment, which changed considerably. Damanpour (1996) goes further stating that it is uncertainty of environment, which makes organisational innovation very sensitive.

A different and commonly used method to assess innovation is to compare it to organisational performance. Yamin et al. (1999) stated that although innovation has an impact on performance, companies need to be high innovators to perform well. In comparison KuczmarSKI (2000), KuczmarSKI and Shapiro (1996) concentrated their effort on relating innovation to a return on investment, not entrepreneurship and argued
that after all shareholders reward returns not the risk. Contrary to that statement, Goldsmith and Matherly (1986) used Kirton Adaptation-Innovation Inventory (KAI) index and concluded that innovators generally have more self-esteem than innovation adaptors. Kuczmarski (2001) proposed to evaluate some of the organisational metrics such as: diagnostics, benchmarking, allocation of priorities, compensation for initiatives, internal and external communications, and measurable goals to improve organisational outcomes and therefore innovation, while (Chiesa et al., 1996) claims that to understand innovation process, innovation capabilities and other involved organisational processes must be assessed.

Measuring innovation should always include inputs and outputs, however to establish a relationship between innovation and performance is even more problematic (Tidd, 2001). Two types of performance measures could be used: one concerned with financial performance such as return on investment or share prices, the other of market performance and growth. Damanpour et al. (1989), and Damanpour and Gopalakrishnan (2001) emphasise that product innovations are adopted at a higher rate than process innovations and highly performing organisations tend to give equal importance to adaptation of product and process innovation. Another common assumption supported by Boyne et al. (2004) is that innovative organisations achieve better performance. Jin et al. (2002) claims that it is an organisational innovativeness that leads to better organisational performance, but states that not many studies include organisational behaviour as the main driver of growth. Limited evidence suggests that smaller organisations are more flexible and quicker to adapt any changes, which may result in innovative behaviour sooner than for the large organisations (Damanpour and Evan, 1984). Damanpour and Evan argue further that a balance rate between administrative and technical adoption of innovation is more important than the number of either innovation types alone. In Jin et al. (2002) opinion there are also some important similarities between providers and customers of innovative products or services that could be used to explore a dual perspective of innovation phenomenon. According to Loof and Heshmati (2002) positive investment and sales from innovation make them truly innovative. Crepon et al. (1998) recognised that organisation’s effort towards research increases proportionally with numbers of patents and innovative sales and proposed to distinguish innovation inputs in form of R&D expenditure from innovation outputs, which explicitly affect productivity. On the other hand Patterson (2000a;
2000b) believes that innovation and behaviour are closely related and they classified a
person’s behaviour into four main areas: i) Motivation to Change (MTC) - describes
whether an individual is open to frequent change and new ways of tackling issues at
work, ii) Challenging Behaviour (CB) - describes an individual's degree of active
engagement in championing change or maintaining the status quo, iii) Consistency of
Work Styles (CWS) - describes an individual's preferred approach to work, iv) Adaptation (AD) - describes an individual's preference to adopt tried and tested work
methods as opposed to doing things differently. She proposed a further classification of
people in the organisation and established Innovation Potential Indicator (IPI), which
includes the set of eight categories indicating person’s predisposition for innovation:
i) Individuals with high MTC - are tolerant of ambiguity and issues that are less 'clear-
cut'; are likely to be interested in new ways of thinking and to strive for achievement;
show intellectual curiosity and enjoy solving problems for the challenges they may
offer; actively seek change and are open to new experiences; ii) Individuals with low
MTC - do not welcome shifting work goals and too frequent change; prefer stable
environments and are keen to resolve ambiguity; approach new ideas and ways of
working with caution and prefer the familiar settings; iii) Individuals with high CB -
believe it better to seek forgiveness than to ask for permission; are unlikely to bow to
authority if they hold strong beliefs about a particular issue; will challenge others' points
of view; iv) Individuals with low CB - strive for group consensus; are less likely to take
risks; will accept the group consensus and harmony even if they hold strong beliefs
about a particular issue; v) Individuals with high CWS - prefer to engage in a
disciplined and structured work style; are highly conscientious; actively seek
organization and a structured environment; vi) Individuals with low CWS - prefer an
unstructured environment and variety; prefer to juggle lots of conflicting demands; do
not enjoy situations that require a methodical and planned approach; vii) Individuals
with high AD - do not believe they need to be radical to achieve significant progress;
prefers analytical step-by-step approaches and 'precision'; viii) Individuals with low AD -
are more likely to work outside current systems and parameters to find new ways of
tackling problems; look for novel ways to achieve solutions and aim for originality.
Tushman and Nadler (1986) on the other hand argue that regardless the type of
innovation and the field of organizations involved, the most innovative ones are these,
which could manage innovation for today and for tomorrow.
2.4.4 Relationships of Organisational Innovation Factors

Organisational Innovation comprises many determinants related to organisation and innovation but remains one of the least studied topics. Common themes selected from this topic were few, but of the substantial value to innovation:

- survival and prosperity of organisations in the world depend on their capability to innovate (Amabile, 1988),
- Intellectual Capital (IC) indicator made of competency (skills and knowledge), attitude (motivation, leadership qualities) and intellectual agility (ability to be innovative and entrepreneurial by adapting and cross-fertilising) can indicate organisational capabilities (Bontis et al., 1999),
- Successful organisations require a degree of improvisation, like in jazz, to quest for discovery and exploration in the pursuit of innovation along social, economic and technical dimensions (Kamoche and Cunha, 2001),
- formal organisational arrangements provide structures, systems and procedures, which direct and motivate individuals, but informal settings such as networks give the required boost to deal with complexity and uncertainty (Tushman and Nadler, 1986).

2.5 Management

2.5.1 Introduction

Common themes in the definition of management include: the process of working with and through individuals and groups to accomplish organisational goals (Hersey and Blanchard, 1988). The view of Putti (1987) on management puts it more in the light of organised effort that may guide human and physical resources towards objectives. Other authors emphasise integration that allows efficient relationship between inputs and outputs, and effective completion of work (Robbins et al., 2000). Hersey and Blanchard (1988) claim that most important managerial functions include planning, organising, motivating and controlling. In Hersey and Blanchard opinion emphasis on behaviour at work is critical because it can account for up to sixty percent higher outputs from individuals. The goal of management in the organisation should be creation of value through the labour of people working together for a common cause (Csikszentmihalyi, 2003). Csikszentmihalyi recognised that such a workplace would attract the most able individuals, their spontaneous effort to work and could retain them within an
organisation for a long time. In Csikszentmihalyi’s opinion, creation of a workplace conducive to personal growth is especially important for knowledge workers, who search for jobs that will allow to expand their imagination and to provide opportunities. Knowledge workers and many other employees value their autonomy and need scope for initiative, which wise management could provide, by blending individuality and cooperation and at the same time give them fulfilment in personal development.

Many organisations have difficulties with management, because they cannot integrate disruptive processes that require the unification of its resources, processes and values to a new course (Christensen et al., 2004). Integration within organisations always comes at a cost. Christensen et al. argues that organisations can be successful if they have resources to succeed, their processes facilitate what needs to be done and their values allow them to give enough priority to a new undertaking.

Putti (1987) argues that most of the determinants affecting organisational management and performance are: regulatory, economic, financial, technological and marketing, and could be classified into: social, technological, economic and political factors. Mintzberg’s (1973; 1996) studies revealed that managers often engage in a large number of various, unpatterned activities of a short duration, which were constantly interrupted. He classified managerial roles into: interpersonal, informational and decisional, and stated that many managers can perform them in the random order. Robbins et al. (2000) believes that in reality managers are neither all-powerful nor helpless and too many internal constraints do not allow for any sensible generalisation of what management is about. In his opinion, shape of a modern organisation, management style and its effectiveness is attributed to the rapidly changing environment and is subjected to internal and external pressures. Very often the degree of an organisation’s success is determined by its ability to strategically manage people’s views on the limits of future possibilities (Smith, 1994). However, Mintzberg (1994) warns that while strategy in planning is about analysis, the strategy in thinking is about synthesis and both aspects of strategy are two different things. It is recently observed that some organisations go further than strategic management and engage in the process of strategic innovation by changing the way the game is played, which may mean to do business directly with customers in order to gain additional advantage (Charitou and Markides, 2003).
2.5.2 Management and Leadership

Management and leadership are quite similar terms that share some common functions. While both terms are relevant to issues concerning industrialised societies, the origin of leadership goes back to classical Greek philosophers Aristotle. Management as discipline originated at the beginning of the twentieth century from the work of Fayol (1947), who identified the need in the organisation for controlling, organising, planning and staffing. Both functions of leadership and management share the same skills and abilities, which are difficult to differentiate, as managers are often people who do things right and leaders are people who may do the right thing (Northhouse, 2004). In addition, Fayol (1984) included coordination and commanding as other important management functions. In his words: “Management, thus understood, is neither an exclusive privilege nor a particular responsibility of head of an organisation or its senior members; it is an activity spread across all members of the ‘body corporate’ - the total personnel structure of the organization” (Fayol, 1984, p13). Northhouse (2004) distinguished different requirements for management and leadership and proposed that management is about planning, organising, staffing and controlling with reactive and less emotional skills required, while leadership emphasises the process of influence by proactive and emotional engagement. In addition, Northhouse (2004) argued that effective management should be combined with leadership abilities.

Thompson and McHugh (1990, p359) observed that new theories are “naturally replacing the old as grateful managers learn to recognise the more sophisticated account of human needs and behaviour”. Classical management perspectives of great practitioners such as Taylor (1911), Bernard (1938) and Fayol (1949) are replaced by modern academic opinions. Works of Drucker (1975) or Mintzberg (1973) about management had impact on organisations in the 1970’s and onwards. One of a concern expressed in their work was to identify common organisational criteria and functions to increase effectiveness. Drucker (1977) saw manager and his function as absolutely indispensable in the organisation. A much broader than Drucker’s view on management was presented by Mintzberg (1983), who characterised coordination of manager’s work in five fundamental factors such as: i) mutual adjustment to accomplish the coordination of work by a process of informal communications, ii) direct supervision to achieve coordination by having one person responsible for work of others, by instructing and
monitoring their actions, iii) standardisation of work processes when the contents of the work can be specified or programmed, iv) standardization of work outputs when product or process parameters are known, v) standardization of worker skills and knowledge when the kind of training required to perform the work is specified. Mintzberg’s (1983) concluded that greater environment complexity may create organisations based on mutual understanding and adjustment, while stability of environment could result in increased bureaucracy. He captured two important hypotheses with this theory that: “The more dynamic the environment, the more organic the structure” (p137) and “The more complex the environment, the more decentralized the structure” (p138). Mintzberg believed that the focus on coordination shifts in the organisation with increasing complexity of work, starting with mutual adjustments and progressing through all stages, but finally always evolving to a higher level of the mutual adjustment. However, according to Kanter (1983), the style of management, which can win participation and cooperation, is one of interacting and listening. Changes in industrial environment, work experience and inclusion of cultural background contributed to creation of a unique Evolutionary Management System widely used in Japan (Urabe, 1988). According to Urabe, the objective of that system was to integrate techno-economic and cultural aspects of managing workplace.

Recently managers are seen as becoming a distinct occupational group preoccupied with self-serving interests. Many new management theories are invented purely for the self-glorification of managers, though there is untapped pool of knowledge from employees about informal job-controls and patterns, which could be used effectively in organisations (Dodgson, 2000; Kauffman, 1996; Maccoby, 1999; Uhl-Bien, 1998). The perception among many employees is that changes to work relations, behaviours and relationships occur within the organisation as a result of management power to suit first of all their own purposes. Therefore fully self-managing teams within decentralised service delivery and flexible management practices could serve demands of customers and set the scenery to drive new directions for organisations in the future (Dodgson, 2000). Taking into consideration the complexity of work relations and environmental issues, small cooperative organisations are probably the best set for any new ventures (Thompson and McHugh, 2002).
2.5.3 Relationships of Management Factors

It is presumed that like in case of the scientific research, innovation in the organisation requires very little of management, but a lot of leadership. The examples of some of the common themes from Management topic are illustrated below:

- decision-making process in an organisation may depend on culture, risk, fear of the unknown or choice as a determining factor (Branscomb, 2001; Economist, 1999; Tudge, 2003),
- general form of an organisation depends on the number of employees, the level and the motivation of those employees, and the nature of the work to be done (Fayol, 1984),
- constant push for higher economic growth without considering current social and environmental impact and the expectation that people may by working harder instead of smarter contribute in the longer run to loss of identity, dignity and consequently ability to do any meaningful work (Jones, 1996),
- an interaction between explicit and tacit modes of knowledge is central to organizational knowledge creation and can happen through social interactions of ‘knowledge conversion’ (Nonaka and Takeuchi, 1995),
- to achieve desired performance in the organisation, management must have a combination of three skills: essential competencies in problem solving, social judgement and knowledge (Northhouse, 2004),
- social networks such as communities of practice are well equipped to share knowledge and experience in the process of innovation (Scarbrough and Swan, 2000),
- the search for greater profitability may involve innovation in technology and work place, coordination of resources, utilisation of people’s skills and knowledge, and therefore can result in a more democratic and egalitarian social order in the organisation (Thompson and McHugh, 2002),
- creation of knowledge often happens in a social setting of open communities and is determined by cultural values (Ursin, 2000).

2.6 Conclusion from Literature Review

The literature review in this thesis covers the general topic of Innovation, specific Organisational Innovation, science behind an Organisation and Management, and
Organisational Behaviour. The search through literature was conducted with the aim to find some common determinants related to all five topics. These common themes emerged from the integration of social and cultural issues, the aspects of knowledge and cognition in an organisational setting, and general issues dealing with motivation of individuals in relation to innovation. The computer assisted detail analysis of all five written topics of literature disclosed major emphasis on knowledge and cognition in the relation to creativity or innovation. The second theme was about social and cultural influences on an organisation and innovation activities. The considerable, though not dominating in any part of the review was the subject of motivation. At this stage, only some determinants that indicated integrated and complex multidisciplinary relationships were analysed further. These integrated meanings highlighted the complex nature of organisational innovation but without themes related to innovation efficiency.

Innovation topic revealed importance of cognitive abilities and task motivation that may lead to achieving set goals (Amabile, 1988; Ford, 1996). Kono (1988) argued that social prestige becomes often an important job motivator for individuals involved in a creative work. Organisation aspect exposed sensitivity of knowledge creation and sharing to culture (Katzenbach and Smith, 1993; Leonard and Sensiper, 1998; Maccoby, 2003; McGill and Slocum, 1993; Mesjasz, 2002; Morgan, 1997; Schein, 1992; Sullivan, 1999; Thompson and McHugh, 1990; Weick and Roberts, 1993). On the other hand, it highlighted that cognitive restructuring is essential to a successful organisational innovation where issue of resistance and anxiety could be converted into motivation to change (Rogers, 1999; Schein, 1987; Tichy, 1974). It was apparent that it might be also possible to predict differences in human motivation using different cultural values (Hernandez and Iyengar, 2001; Parson, 1960; Slatyer, 2000; Thompson and McHugh, 2002).

Organisational Behaviour topic contained examples of social cognition based on individual sensemaking and collective decision process by social interaction (Busenitz and Lau, 1996; Engestrom, 1999; Moreland et al., 1996; Nonaka and Takeuchi, 1995; Pettigrew and Fenton, 2000; Shepherd and Krueger, 2002; Slatyer, 2000), which could be exchanged during innovation (Janssen, 2000; Nahapiet and Ghoshal, 1998;). This displayed that motivation may take a form of rational, cognitive processing of information exchange on rewards, costs or options (Peters, 1977; Thompson and
McHugh, 2002) towards goal related and culturally sensitive outcomes between an individual and an organisation (Howard, 1983; Malhotra and Galletta, 2003; Robbins et al., 2001; Thompson, 1998). However, an understanding of individuals' motivation within an organisation setting may require the knowledge of patterns governing their self within a social structure (Bandura, 1977; Fiske and Taylor, 1984; Luft, 1984).

Organisational Innovation topic revealed that discovery and exploration towards innovation requires a degree of improvisation with knowledge and motivation coming often from informal settings such as networks that may give a required boost to deal with complexity and uncertainty (Amabile, 1988; Bontis et al., 1999; Kamoche and Cunha, 2001; Tushman and Nadler, 1986).

Management topic showed that a search for greater profitability may involve change in technology and organisation by coordination of resources, utilisation of people's skills (Branscomb, 2001; Economist, 1999; Northhouse, 2004; Tudge, 2003), through social interactions of 'knowledge conversion' (Nonaka and Takeuchi, 1995; Ursin, 2000) and therefore could result in a more democratic and egalitarian social order to share knowledge and experience in the process of innovation (Jones, 1996; Scarbrough and Swan, 2000; Thompson and McHugh, 2002).

Above reviews revealed mainly single relationships between themes of three major factors under investigation such as: culture and cognition, culture and motivation or cognition and motivation. However, in very limited instances, the examined relationships involved all three factors. The examples with discussion about innovation and meanings for these integrated relationships are presented further in this section.

As far as the general theme of innovation, the majority of conducted research considered it as a process, with the exception of the publications from Utterback (1996), Utterback and Abernathy (1975) or Von Hippel (1986; 1988), who researched the issues of innovation in relation to product and methods of manufacturing. Innovation was often portrayed as a complex process (Carlson, 1991; Daft, 1978; Drucker, 1985; Dodgson, 2000; Dodgson and Bessant, 1996; Fidler and Johnson, 1984; Gopalakrishnan and Damanpour, 1997; Kanter, 1983; McDaniel, 2000; Nelson and Winter, 1977; OECD, 1997), requiring creativity (Amabile, 1988; Isaksen, 1988; Ford, 1996; Nash et
al., 2001; Wolfe, 1994; Woodman et al., 1993) or abilities to make sense of ambiguous problems (Deazin et al., 1999) and to be managed in a complex organisational environment (Damanpour and Evans, 1984; Dodgson, 2000; Hage, 1999; Lucas, 2004; Sundbo, 2001).

Stacey (1996) remarked that the presence of humans in any systems creates the highest degree of complexity. Organisations because they naturally constitute people, need to be recognised as complex dynamic systems (Dodgson and Bessant, 1996; Dzinkowski, 1999; Kanter, 1983; Mintzberg, 1979; 1983; Poole, et al., 2000) where interactions leading to innovations should be strategically managed (Charitou and Markides, 2003; Latour, 1987; Smith, 1994; Trood, 2002). It is assumed that the integration of cognition, culture and motivation presents enough complexity and challenge in studying their influence on innovation, therefore no further investigations were carried out into examination of other themes or gaps in the presented literature.

2.6.1 Conceptual Framework

The search and analysis of literature supporting this study discovered only a few instances where three major themes of cognition, culture and motivation coexisted. In the first instance, Markus and Kitayama (1991) questioned whether culture-free aspects of cognition, emotion and motivation could ever exist. They examined Asian and American cultures and concluded that the differences in self as interdependent or independent factor have specific consequences for cognition, emotion and motivation. The other example of the multidisciplinary existence of three factors was discovered in Roos’s et al. (1997) description of intangibles. He claimed that the human intangible factors could be classified into competence (knowledge and skills), attitudes (motivation, behaviour and conduct) and intellectual agility (innovation, imitation, adaptation and packaging), while the structural intangible factors could reflect on: relationships (including customers, suppliers, alliance partners, and shareholders), organisations (including infrastructure, process and culture) or renewal and development. Roos et al., (1997) recognised that relationship between knowledge, motivation and culture may hold human and structural intangible factors together. These few instances where three of the selected factors of cognition, culture and motivation were present prompted further literature search that resulted in allocation of a few
additional articles confirming the existence of the phenomenon, however no theoretical model has been found incorporating them into a usable framework leading to innovation. For example, the study conducted by Erez (1992) examined the patterns of the communication system in Japanese corporations in the light of cultural values, and in relation to productivity. This study confirmed decisively the existence of the relationship between cognition, culture and motivation. It demonstrated that the interpersonal communication system is shaped by the cultural values in line with the traditional patterns of communication in Japanese society. This congruence was affirmed by two important consequences: i) on the motivational level by sharing of common values, which create harmony and commitment to those values, ii) on the cognitive level by sharing of knowledge, ideas, and information that enhance the level of productivity. On the other hand, Eisenberg (1999) explored cross-cultural differences in moderating effects of rewards on creativity in Japan and USA. He suggested that the relationship between rewards and intrinsic motivation and creative performance is not fixed and may be affected by differences in basic personality constructs such as values or needs. In his opinion the problem could be that different cognitive, emotional and motivational patterns of both cultures may have different meaning, emotional value and motivational impact for individuals with collective or individualistic attitudes. A similar study of two different cultural streams, conducted by Chiu et al. (2000) and comparing Chinese and Americans, settled on the findings that knowledge is embedded in the culture, and like cultures, which are moderated by epistemic motives, knowledge and motivation have dynamic correlation with cognition. In contrast, Hernandez and Iyengar (2001) based their analysis on research conducted by Markus and Kitayama (1991) but compared American culture to an expanded analysis of Asian countries such as China, Korea and Japan. Hernandez and Iyengar research revealed that people from cultures stressing independence are more personally agentic, whereas people from cultures stressing interdependence are more collectively agentic, which results from culturally contrasting differences in cognition and human motivation. The other interesting finding that came out from that research was that people influenced by dual cultures had greater flexibility and could self-direct cognition. The analysis of current R&D environment in Australia and the world trends towards internal sustaining of research activities pointed to the benefits of university and industry alliances through cooperation. However, these ventures in many instances would not have the chance to exist if either the local or the federal governments did not support them. Universities around the world are renowned
for education efforts and the creation of new knowledge, while commercial organisations take a more practical approach and try to implement new knowledge. Both institutions have different and unique cultures reflecting their working environment. The integration of those two different types of institutions would not happen without motivation from the government to ‘force’ them into cooperation and by providing fiscal advantages (Slatyer, 2000; Trod, 2002). Taxpayer’s money is used to fund the creation of new arrangements from which more commercially streamed research could eventuate. All players in new partnerships have to show their willingness and enough motivation to keep such diverse and integrated organisations functioning. The author of this thesis reflected that it had to be something within cognition, culture or motivation holding these organisations together like glue that could result in innovation as one of the possible outcomes. The quest to find out what is behind cognition, culture and motivation propelled the process of this study further into the research and analysis from which results are presented in consequent chapters.

The inclusion of an additional article by Erez (1992) is of particular significance to this research because it supports the author’s thinking that cognition, culture and motivation enhance productivity and innovation in the organisation. Markus and Kitayama (1991) questioning of culture-free aspects of cognition, emotion and motivation prompted many other questions such as: is it possible?, what could hold culture, cognition and motivation together?, what relationships are possible in a type of arrangements where either cognition, culture or motivation are dominant? These queries evolved into the framework consisting of cognition, culture and motivation as presented in Figure 2.1. The role of the proposed framework was to serve as the overall umbrella and allow a further exploration of knowledge about organisational innovation. The development of research described in this thesis was based on the proposed framework and research methods presented in the next chapter.
2.6.2 Research Question

Following the development of the research framework, the next task of this study required the formulation of the main research question. During the earlier stage of the study the author contemplated the possibility of the existence of one single factor that could have the most dominating impact on the innovation. This thought was influenced by reading works of Peter Drucker who suggested that innovation in an organisation could be treated in the same way as any other objective such as quality, customer satisfaction or efficiency. Therefore it might be possible that ‘innovation as objective’ could be a driving force for organisational philosophies or polices. However, as the further study revealed the complex nature of the innovation process, it was wiser to stay ‘open and independent’ to the prime findings from the literature and to continue the search and exploration of the proposed framework for what else was out there behind the innovation phenomenon? The consequent formulation of the research question was: what the intangible factors of cognition, culture and motivation have in common that may enhance innovation in an organisation? The final question allowed for the continuation of an exploration and a further analysis of findings, which are described in the subsequent chapters of this thesis.
CHAPTER THREE
Research Methods and Implementation

3.1 Introduction

The purpose of this chapter is to discuss the research methods and the framework adopted for the research. This chapter describes in chronological order all steps taken to explore the influence and the relationships between selected intangible factors namely i) cognition, ii) culture and iii) motivation that may enhance the performance of the organisation. It provides a rationale for the decision to adopt the case study approach and the selection of the case study organisations. The description of the research instrument is also discussed.

In addition, this chapter outlines the benefits of using qualitative and quantitative methods to conduct the current research. It presents the structure of the research design protocol required for the collection of the data. The chapter concludes by addressing the issues determining the quality of research.

3.2 Research Approach

Extensive examination of the literature revealed that although the subject of innovation is well researched there is limited attention given to the unification of the theory of innovation. The fragmented view of innovation along with the lack of unified innovation theory is supported by many researchers (Axtell et al., 2000; Downs and Mohr, 1976; Damanpour, 1987; Read, 2000; Sundbo, 2001; Wolfe, 1994; Zaltman et al., 1973). Deviation from conventional approach of examining organisation as the unit of analysis to individual factors in research such as decision-making, communication or management may be seen as one of the main reasons for the innovation research fragmentation. Subramanian and Nilakanta (1996) argue that relationships of the multiple organisational factors such as innovativeness, organisational characteristics and performance are dynamic and complex, therefore innovation needs to be examined as a multidimensional construct. Mintzberg (1979) states decidedly that measuring real organisational terms means getting out there into the organisations instead of simply
collecting the completed questionnaires. He emphasises that observation and recording of activities as they happen is the only way of gaining deeper insight into the dynamics of the organisation.

This research supports Eisenhardt’s (1989) viewpoint that it is much easier to define reality when triangulating different perceptions of people rather than using a single measure. However, Perry et al. (1999) argues that perception of the reality is based on the understanding that the degree of truth in research may not be permanent. Thus in order to create general theory it may be appropriate to use the multidiscipline approach to research.

It is known that case study research can have theory building and theory testing elements. Some controversy exists about how much activity for each theory development should occur in the research and whether the extensive literature review should be undertaken prior to collecting data (Carson et al., 2001). Eisenhardt’s (1989, p536) view that there should be “no theory under consideration and no hypothesis to test” contrasts sharply with that of Yin (1994) who endorses a prior knowledge of the phenomenon. Eisenhardt (1989) proposes open approach to research saying that it is ideal, because it eliminates the possibility of being bias and therefore to limit the findings. A similar difference of opinion exists between more analytical approach of Glaser (1992) who argues that identification and specification of research issues should be left to the perception of the researcher, to the attitude of Strauss and Corbin (1990) who allow the researcher to predetermine the subject of enquiry before starting the research.

The author saw positives in both types of approaches and assumes that more knowledge about the field of research or any other related subjects tends to enrich research by providing more information for future theory building.

The other important factor, which determines multidimensional qualitative research approach, is the nature of questions, which this study aims to answer. Those questions are:

- what the intangible factors of cognition, culture and motivation have in common that may enhance innovation performance in the organisation?
• what is the relationship between organisation’s practices and performance?
• what are the universal factors that may determine innovation in the organisation?

According to Kumar (2005) the nature of questions can place research in four different categories that reflect the viewpoint of its objectives:
• descriptive, depicting phenomenon,
• exploratory, finding new phenomenon,
• co-relational, attempting to discover relationships between factors of the phenomenon,
• explanatory, attempting to explain why and how the relationships exist.

Yin (2002) claims that the existence of ‘what’ questions pertains research into an exploratory study, which can also answer at a later stage further questions of a type “how much” or ‘how many’. Exploratory studies usually allow for good grasp of the phenomenon (Cavana et al., 2000). Yin (2002) adds that an organisational setting is well suited for the case study. Researcher usually does not have control over the events in the organisation, but can empirically investigate a contemporary phenomenon without clear boundaries in a real-life context (Eisenhardt, 1989). The case study presents itself as a method of choice when the phenomenon is not readily distinguishable (Yin, 2003). Yin argues that since case studies rely on analytical generalization, a multiple studies offer a greater opportunity for theory building, as they are more compelling and are regarded as robust. At the same time, a case study presents an opportunity for discovery and theory development (Yin, 2003). Similarly, Miles and Evans (1987) argued that a case study presents the best choice to research practical problems. While each individual case can reveal a discovery, the replication across cases may result in a significant theoretical breakthrough (Yin, 2002). One of the benefits for researcher of case studies is the opportunity to have an insider’s view and outsider’s opinion of the phenomenon under investigation (Carson et al., 2001). On the other hand a multiple sources of data increase the construct validity of the conducted research (Yin, 1994).

Tang (1999) proposes two basic approaches to study innovation in organisations. One is top-down, which may rely on aggregated information and perspectives provided by the
management, while the other is bottom-up method that demands the researcher to gather information from the individuals whose work in the organisation is related to innovation activities. This study adopts two of the proposed approaches. Tang also supports the view of Eisenhardt (1989) and Yin (1994) that while quantitative methods tend to be more efficient and require less effort and time for analysis, the qualitative approach allows researcher to scrutinize an organisation in action at the closer range and thus gives better understanding of the phenomenon examined in the study.

In addition, Glaser (1978) claims that research of a social process can often reveal other aspects of the phenomenon, which could be used as the core variables in the analysis. Though Glaser (1996) argued the importance to identify those variables that interact empirically, at the same time he stressed that analytical scrutiny is necessary to see what properties these variables have and how they interact with each other. Glaser and Strauss (1967) claim that the ongoing emphasis on quantitative research and verification of existing theories had detrimental effect on the emergence and testing of new theories. Another aspect that supports qualitative approach is about the presence of a method that may assess reason for the research and could provide intimate connection with the empirical reality (Glaser and Strauss, 1967; Miles and Huberman, 1994).

The advantage of qualitative techniques is that they offer the opportunity to collect rich and comparable data across organisations. These techniques may also ground the case studies in numerical expression. Unlike qualitative research, quantitative techniques often enable researchers to map data directly onto organisational performance, whereas qualitative studies can only do this to a limited extent. However, in many instances quantitative attributes can be integrated into the qualitative research design and analysis of the data that may help to enrich our understanding of the research findings. Denzin and Lincoln (1998) argue that qualitative research is made up of a set of interpretive practices. This requires a multiple theoretical perspectives to the research question. The qualitative studies may not automatically lend themselves to quantitative analysis. It is often possible to turn qualitative results into quantitative ones, but the link between the two types of data must be drawn explicitly at the beginning of the research to ensure comparability among responses. In the case when mix research methods are used, collection of quantitative data needs to be administered additionally in order to provide consistency, clarity and repeatability of results.
According to Guba and Lincoln (1994) the issues of paradigms in qualitative research is a superior to research methods, as paradigms may be viewed in the form of systems of basic beliefs that guide the investigator. In comparison to quantitative research, qualitative research is often multidimensional and pluralistic with respect to paradigms development as it brings a set of assumptions related to the social world and may be suitable for certain topics of enquiry, therefore the preferred term ‘approach’ rather than paradigm to explain the associated meaning should be used (Punch, 1999). He further acknowledges the importance of the political nature of social research, which is human constructed and thus embedded with certain ideologies, which may be influenced by cognitive authority and power. This study supports Punch’s view that the issue of paradigms is not of a great concern as they may be in the constant state of change and many research issues thus could be contested as not affecting qualitative and empirical nature of the majority of conducted research.

It may be also argued at this point that since current study has a multidimensional form it may be difficult to determine one single paradigm to operate. The most common paradigms used are positivistic and constructivist. The choice of constructivist ontology related to the nature of reality perhaps is more relevant to the current study. Charmaz (2003) believes that categories, concepts, questions about data, and subsequent theoretical analysis may emerge from the researcher’s interactions within the field of inquiry. She recognises the importance of researcher’s constructive input to compose the story from data, which may not automatically unfold itself before an objective viewer. Other authors argue that constructivist approach is not about discovery of the hidden theory, but rather of interpreting the facts to make sense (Guba and Lincoln, 1994). On the other hand, Lee (1991) argues that while there may be positive elements in using either positivist or interpretive approach to organisational research, a combination of both could give the best results.

This research is about innovation process and the factors that are perceived as having an influence on organisational innovation and therefore tends to fit constructivist approach. On the other hand interpretive epistemology in the form of relationship between researcher and those being researched leads itself into an exploratory type of research. Investigations conducted during this study are in fact an enquiry into the minds of participants for their interpretation of events, reasons behind actions and decisions,
which contributed to the performance of their organisations. By using two types of research methodologies it enabled the author to use interviews as a means of identifying the critical issues and subsequent quantitative data to further enrich the understanding of the examined research phenomenon.

Phenomenologists claim that person’s view of the world comes from the phenomenon of individual experiences, which helps to make sense of the world (Moustakas, 1994). There is no other objective reality, but the one, which people know through their experience and means (Patton, 2002). Patton claims that human understanding is a result of experience followed by explication and interpretation. The current study had two elements of phenomenological perspective namely: i) the reality constructed by the interviewed participants, ii) the reality interpreted by the researcher. Lofland and Lofland (1984) understood phenomenological experience as an event where researcher gains experience during the research process and ‘enters’ into other person’s perspective and experience. Despite some strength and weaknesses of the phenomenological perspective it allows the researcher to observe the change process over time in order to understand people’s behaviour and adjustment to new emerging issues, and thus contributes to the development of new theories (Easterby et al., 1991).

As stated previously, the author has many years of experience as an industrial researcher with direct involvement in the innovation process. This experience provides greater appreciation of the construct along with deeper understanding of organisational settings and activities that lead to new outcomes.

The grounded theory method proposed by Glaser and Strauss (1967) is well suited to the present research study as it aims for discovery and exploration offered by the qualitative approach, rather than verification of pre-formulated and preconceived hypothesis by the quantitative research models.

Process of coding data in this research can give insight of activities but will not aim directly at producing analytical data. Exploratory research imposes a form of process order, in which after possible constructs the research data leads to the establishment of relationships between variables. This trait could be continued further through
assessment of research results in order to examine the strength of those relationships in the tangible form as recommended by Marcoulides (1998).

Some authors claim that qualitative exploratory research can be especially suitable for the examination of interactive relations among non-quantitative variables that exist in the organisation, which could lead to the discovery of new human behavior and organisational activities (Read, 2000).

Qualitative data supplemented by quantitative evidence will be used to enrich research findings. Yin (2003) recognised that the use of factor theories is unnecessary in case studies, but accepted the fact that it is sometimes difficult for the researcher to avoid using this application to prove the point. He also states that “theory development prior to the collection of any case study data is an essential step in doing case studies” because it provides “strong guidance in determining what data to collect and the strategies for analysing the data” (Yin, 1994, p36). Conversely, Eisenhardt (1989) is not in favour to that approach and proposes to have only an initial definition of the research question before embarking on collecting the data. Mintzberg (1979b) on the other hand insist that regardless of an interest or sample size, there is a need to have a focus on systematic collection of specific data. Eisenhardt (1989) elaborates further that though investigators should formulate a research problem and possibly specify some potentially important variables in reference to extent literature, they should avoid thinking about specific relationships between variables and theories as much as possible, particularly at the outset of the process.

Some of the requirements of grounded theory are that it should stay together logically as a whole and should be clearly stated and interrelated to the supported data. The theory should be useful in explanation, description and prediction of new phenomenon under study (May, 1997). The continuous and rigorous process of collection, organising and reflection on the data is central to the grounded theory approach and rewards the researcher with an intense and demanding style of research by stimulating deeper thinking and understanding coupled with new and emerging challenges. Finally, the process of developing a grounded theory is concluded when the researcher is convinced that the conceptual framework forms a systematic theory that reasonably accurate states the matters under study presented in a form that makes it possible for others to use in
studying a similar area. The researcher according to own knowledge may also see no reason to change that belief. This belief is not because an arbitrary judgement, but it tends to be reflected in rigor of the research and the process adopted for discovery leading to a final conclusion. The researchers can always try to mine their data further, but little value is gained when core categories are saturated (Glaser and Strauss, 1967).

3.3 Research Method

Exploratory studies are taken to comprehend the nature of the issue that have been the subject of relatively few studies (Cavana et al., 2000). As this exploratory research study may be the first stage in a sequence of future studies, there is a need to explain how it has been conducted. Despite adopting slightly different approach there are some similarities in the methods in line with Eisenhardt (1989) and Yin (2002) method of case study research. This includes the basic steps proposed by Eisenhardt and Yin as follows:

- development of research problem or theory from the literature review,
- identification of some of the key variables,
- definition of the unit of analysis,
- development of a research instrument,
- research design,
- selection of cases,
- collection of data,
- data analysis and interpretation,
- theory building and generalisation.

The strategies adopted for this research did not change from the beginning to the end and it focused on:

- qualitative approach adopted to gain deeper insight of the research issue,
- use of multiple case studies to obtain greater generalisation of data through comparative analysis between cases,
- collection of data through face to face or telephone interviews,
- semi-structured interview framework to obtain richness of the data,
- collection of supplementary personal information from interview participants,
- review of available organisational documents and content analysis,
• review of externally published articles, papers and reports about the organisation.

It is argued that qualitative approach to the analysis rather than quantitative provides more meaning and personal significance. However, it maybe possible that only comparison of various types of data for each organisation could assist in forming some conclusions leading to generalisation. This may also provide the opportunity to contrast the results between cases. On the other hand, quantitative research could be easier to conduct as it may not have the same depth while representing only limited pre-selected information.

3.4 Researcher’s Perspective

Author’s personal experience of the professional engineer in the field of engineering as product creator, researcher, and one who has developed many new products and help to commercialise them, equipped him with the knowledge and the understanding of the industrial research environment. The challenge however during this research was to remain unbiased during the data collection process to minimise interference and to eliminate any potential bias. A personal judgement specific to the chosen research process was that a researcher should use discretion and ethics during data collection in order to provide unbiased view of the participants. This view was contradictory to the opinion of some qualitative researchers such as Glaser and Strauss (1967) and Strauss and Corbin (1998) calling for participation in research by the researcher. One of the issue emphasised during the data collection process was confidentiality of the participants, which provided a feeling of trust and allowed them to share their deeper ‘insight’ along with other required information in accordance with the interview protocol. However as Patton (1990) pointed out the subjective experience may often incorporate the objective things and person’s reality beyond perception. In Patton’s opinion it is not beyond reality that the person starts research with the inherent bias, but the important issue is that such possibility is acknowledge by the researcher.

3.5 Reflection on Methods and Literature

Identification of the significant research issues in chapter two lead to the establishment of the conceptual model made of three separate factors: cognition, culture and
motivation, within the organisational environment. It is acknowledged that while extensive literature review helped in the initial stages of the study to acquaint the researcher with the available knowledge in the area of interest, the later stages used that knowledge to formulate the theory and to help make sense of the data (Glaser, 1978; Kumar, 2005). Glaser claims that similarity in the research exists in the way the literature findings and at the later stage the data is compared in understanding the emerging theory. This study uses three different established and validated frameworks to build the integrated research model, which consists of cognition, culture and motivation to assess organisational innovation identity. These three individual factors form a core of the tool to collect the data from the target organisations.

3.6 Unit of Analysis

In order to compare data from various sources and to reflect in the most meaningful way on organisational innovation and performance, current study uses organisation as the unit of analysis. Stake (2003) believes that the choice of the object to be studied often determines the method of research. The issue of choice and selection is explained further in this chapter.

3.6.1 Sample Size

In a general sense, the issue of appropriate sample size in a qualitative research remains unresolved. Yin (1994) argues that it is not expected to be resolved at all and states that qualitative research does not seek statistical generalisation but instead is aimed at developing a theoretical framework. Another view is that generalisation can be made on conceptual grounds from one case to the next based on the underlying concepts and not on universal theory (Miles and Huberman, 1994). On the other hand Patton (1990) claims that the validity, meaningfulness and insights deriving from case studies have more merits in the richness of information and observational ability of the researcher than the sample size and argues that there are no rules for sample size in qualitative research. According to Glaser and Strauss (1967) saturation of data indicates empirical grounding of the theory based on the completion of data collection. In this case additional data may not bring any new aspects to the theory. Miles and Huberman (1994) however suggest that the minimum number of cases should be between two and four with the accepted maximum to be between ten and twelve. Single case studies are
only justified if they represent rare and extreme events or are critical to meet all the conditions of the theory (Yin, 1994). This study has adopted to examine three cases in line with Miles and Huberman (1994) assertion.

3.6.2 Number of Interviews
Experience of some researchers and anecdotal evidence may suggest that thirty interviews represent a satisfactory size to provide a credible picture in a reasonable size research (Carson et al., 2001). However, Perry (1998) gives a rule of thumb that for PhD research at least four to five interviews in four to five case studies should deliver enough information to produce a satisfactory conclusion. The current study satisfies the views of both these authors.

3.7 Development of Research Instrument
To develop an appropriate research instrument the additional literature had to be reviewed. The first goal was to expand the conceptual model, which is made of three separate factors namely: cognition, culture and motivation. The conceptual model had to be examined in detail in order to ascertain the contribution and link to the innovation perspectives. The second aim during the development of the research instrument was to search for suitable models describing cognition, culture and motivation by means of validated, reliable and well-established sources. The third objective was to use the instrument to structure the interview process.

3.7.1 Cultural Model Framework Selection
The investigation of many available models used to assess organisational culture includes:

- Schein’s (1992) three elements framework made of: technological outputs of organisation, written and spoken language, and overt behaviour of members.
- Van der Post et al. (1997) fifteen factors framework which contained: conflict resolution, culture management, customer orientation, disposition towards change, employee participation, goal clarity, human resource orientation, locus of authority, management style, organization focus, organization integration, performance orientation, reward orientation and task structure.
• O’Reilly et al. (1991) seven elements framework made of: innovation and risks taking, attention to detail, outcome orientation, people orientation, team orientation, aggressiveness and stability.
• Delobbe et al. (2002) ECO five factors instrument confined to: recognition-supportiveness, commitment-solidarity, innovation-productivity, control, and continuous learning.

Decision to select O’Reilly et al. (1991) seven elements framework of Organizational Culture Profile (OCP) for this study was made on the basis of strong emphasis in the model on assessing person-organisation fit and innovation attitudes of the employees. Detailed examination of OCP framework revealed factors of:

- innovation and risks taking - the degree to which employees are encouraged to be innovative and take risks,
- attention to detail - the degree to which employees are expected to exhibit precision, analysis and attention to detail,
- outcome orientation - the degree to which management focuses on results or outcomes, rather than on the techniques and processes used to achieve these outcomes,
- people orientation - the degree to which management decisions take into consideration the effect of outcomes on people within the organization,
- team orientation - the degree to which work activities are organised around teams rather than individuals,
- aggressiveness - the degree to which people are aggressive and competitive rather than easygoing,
- stability - the degree to which organisational activities emphasise maintaining the status quo in contrast to growth.

3.7.2 Cognition Model Framework Selection

The literature about cognition and knowledge in general is vast and consist of a large number of instruments and measuring techniques based on theoretical considerations. In view of the current study there are few important issues that cognition model should include the following: i) how individual's cognition is transformed into action or product in the organisation, i.e. what are measurable outcomes?, ii) how tacit knowledge
could transformed into explicit knowledge for the organization and incorporated into its practices?

During the selection process of the suitable framework one of the dilemmas was whether to look at cognition at individual level or social cognition at the organisational level. Shneider and Angelmar (1993) suggested that looking at individual level might have its limits to understand cognition at the group level. Larson and Christensen (1993) defined social cognition as: the social process that relates to the acquisition, storage, transmission, manipulation and use of information for the purpose of creating a group-level intellectual product. In their model there are 5 factors based on shared cognition for in-group problem-solving situation. A similar view in relation to cognitive interpretation is based on perception that may affect organisational performance (Daft and Weick, 1984; Milliken, 1990; Thomas et al., 1993). Main processes in this type of cognitive framework involve: scanning and interpretation, and action and performance. According to Fiske and Taylor (1984) social cognition theory considers that individuals operate only within 2 pairs of factors: i) cognition and motivation, ii) person and situation. Personal effectiveness in this type of model is optimised within knowledge structures in a given situation. Mitchell et al. (2002) brings to the attention the use of terminology ‘entrepreneurial cognition’. This theory could be referred to the work of Jelinek and Litterer (1995) who suggested that understanding entrepreneurial activity at organizational level requires a cognitive paradigm, which focuses on individual sense-making and collective decision process. Shepherd and Krueger (2002) proposed an Intention-Based Model of Entrepreneurial Teams Social Cognition, according to which the average score of the individuals responding on behalf of the team is the most appropriate measure of team social cognition.

Many cognition instruments were developed from Myers-Briggs Instrument, looking at 2 out of 4 factors: sensing versus intuition and thinking versus feeling. Tagart and Valenzi (1990) proposed to assess the organizational cognition by two factors: reason (rational style) and passion (intuitive style). Hodgkinson and Sadler-Smith (2003) provided very thorough analysis of Cognitive Style Index (CSI) developed by Allinson and Hayes (1996). Though this instrument was constructed from thirty-eight items, only single dimension from that instrument, the intuition-analysis is sufficient to measure
organizational cognition at individual or team level (Hodgkinson and Sadler-Smith, 2003).

A novel approach towards the knowledge-creating company is presented by Nonaka and Hirotaka (1995) and is supported by the type of organizational structure and the way communications are happening within the organization. This framework includes:

- **bottom-up model**, characterised by independent employees, preferring to work on their own and where only certain individuals interact with each other, creating knowledge,
- **top-down model**, characterised by existence and controlling of the explicit knowledge at the top and thereby reducing the possibility to create tacit knowledge in the front line of an organization,
- **middle-up-down model** promotes cross levelling along with the creation and exchange of knowledge.

According to Nonaka and Hirotaka (1995) model, knowledge is created and expanded through social interaction between tacit and explicit knowledge. There are four types of possible interaction factors: socialization (tacit to tacit), explication (tacit to explicit), combination (explicit to explicit), internalization (explicit to tacit).

In line with Milliken (1990), in the knowledge based environment the following three factors form the basis of the cognitive framework:

- **scanning**, to identify key trends, changes and events in the organization’s environment that might affect the organization’s functioning and performance,
- **interpretation**, to identify key environmental threats and opportunities that an organization faces, and requires the individual to assess the meaning and significance of each change and trends that they may have noticed in the scanning phase,
- **responding and taking action** in response to environmental changes, characterised by the strategy and the decision process of scanning and interpretation.

Milliken (1990) framework for knowledge based environment is most suited for the purpose of this study as it may represent innovation as the possible outcome from the cognition process.
Motivation Model Framework Selection

Motivations theories propose that individuals are motivated to the extent that their behaviour is expected to lead to desirable outcomes (Robbins et al., 2000). Various aspects and configurations of motivation frameworks often relate to two elements: effort and reward. The assessment of availability of various frameworks for the purpose of this research includes:

- Alderfer’s (1969) ERG theory build around 3 factors and developed on the basis of Maslow's (1954) hierarchy of needs theory and consists of: existence which provides basic material requirements, relatedness as desire to maintain important interpersonal relationships, and growth as an intrinsic desire for personal development,
- Deci’s (1975) Cognitive Evaluation Theory is based on the process, by which intrinsic motivation is affected by extrinsic rewards,
- Locke's (1968) Goal-Setting Theory explains intensions to work towards a goal, which are a major source of work motivation,
- McClelland's (1961) Needs Theory focuses on three need factors: need for achievement, need for power and need for affiliation,
- Vroom's (1964) Expectancy Theory is focused on motivation factors and their relationship present between: effort and performance, satisfactory performance and desired reward, reward and need, desire to satisfy the need and effort.

It is commonly understood that individuals believe that their effort to accomplish a goal will lead to a reward. Model proposed by Vroom (1964) represents perception of organisational systems that support innovation as an important component of individual’s motivation to engage in the organisational activities. Vroom’s framework contains relationship among four factors:

- effort - performance relationship describing the probability perceived by the individual that exerting a given amount of effort will lead to performance,
- performance - reward relationship looking at the degree to which the individual believes that performing at a certain level will lead to the attainment of a desired outcome,
- reward - personal goals relationship showing the degree to which organizational rewards satisfy an individual’s personal goals or need and the attractiveness of those potential rewards to the individual.
Vroom (1964) model representing perception of organisational systems supporting innovation is most suited for this study because it promotes individual’s engagement with an organisation.

3.8 Research Instrument

Selection of the appropriate models of cognition, culture and motivation provided the impetus to further develop the research instrument and the interview protocol. The aim was to structure the research protocol in a form that allows asking as many as practically possible open-ended questions to address each factor’s elements. At the same time questions had to be precise in leading all themes discretely to the framework elements while permitting as much freedom for the individual expression as possible. Following Dick’s (1990) recommendation to create a relaxed atmosphere, general questions were asked first to allow the participants to present their views freely about the subject. Dick also emphasises that the conduct of the interviews should ensure maximum participant’s involvement. He suggested consistency and adaptation of some of the following patterns in the protocol:

- establishing and maintaining eye contact,
- displaying interest and listening closely to what participant is saying,
- smiling occasionally if the participant pauses,
- encouraging the participant by occasional use of expressions such as 'yes' or 'really',
- use of non-directive questions such as 'could you please elaborate further' to encourage development of the participant's answer,
- referring back to the comments previously made by the participant.

It is also important that the interviews were concluded in an appropriate manner, therefore each of the participants were asked if they had any issues that they may wish to discuss before the interview was concluded. If there were no additional issues, than the interview was concluded. Each participant was thanked for their time and their participation in the research. At this point participants were once again assured of their anonymity and confidentiality of their responses. On a few occasions researcher made the request if participants could recommend somebody from their organisation that
would also be willing to be involved in the research. Sometimes this request led the
author to other people who were willing to participate in the study.

Researcher’s aim was to conduct each interview in the same manner therefore questions
for each factor were written down on A4 sheets and filed appropriately under various
headings for better control of the protocol and consistency. In some cases a few
questions were asked in a block to allow participant to understand the subject clearly
and to express their views without interruption from the researcher. All interviews
started with the questions about culture, followed by cognition and finally with
motivation. Asking a final question how in their view these three elements may
influence innovation concluded the interviews.

Questions about culture included:

- What in your opinion is CRC organisation about?
- What constitutes the organisation’s culture and what sort of culture the
  organisation has?
- What do the organisational activities emphasise and revolve around?
- Could you describe how staff behaves / interact with each other? What sort of
  approach is common?
- What does management expects from the staff? What style of work behaviour is
  preferred?
- What are the circumstances, conditions or work climate in which you operate?
- What internal factors determine the future of your organisation? What should
  the organisation do to stay in business in the future?
- What should staff do to make sure that the organisation would stay in business
  in the future?
- What are the outcomes of your organisational culture?

Cognition questions involved the following:

- What is the process of acquiring knowledge in the organization and how is this
  knowledge used?
- What do you personally do to understand what is happening in organization? In
  short, how do you know what is going on?
• What do you do with the information and facts that you gathered and how do you assign value to these pieces of information?
• How do you use acquired information and what are the tangible outcomes from that knowledge? In other words, what you could turn your knowledge into?
• How do you think other people use knowledge in the organization, and are there any ways to learn what they know about certain things?
• How do you think other people could learn from your knowledge / experience?
• What are the priorities in filtering your knowledge?

Questions about motivation included:
• What do you think the role of motivation is in CRC organization?
• What do you do to achieve your personal goals and how that is done?
• Do you perceive any relationship between effort and performance?
• Can you comment on the relationship between performance and reward?
• Do you think there is a relationship between rewards and personal goals?
  Do people have satisfaction from the rewards given by the organisation?

Concluding question at the end of the interview was: In your opinion, which one of these three factors: culture, cognition or motivation has the strongest influence on innovation?

3. 9 Pilot Interviews
The next stage after formulating the research instrument was to test it in the field in order to examine: i) the interview protocol, ii) to assess the clarity of questions, iii) to consider any technical issues with setting up audio recording and iv) generally to examine the management of the interview process so that it could provide realistic and precise data for the study. Thus two interviews were conducted in October 2003 with engineers working in the R&D organisation, with whom the researcher has had previous association. After the interviews were finished, participants were asked to state their views on the clarity of questions, the sequencing, and any difficulties they may have experienced in answering the questions. The following day the recorded material was evaluated by the researcher in order to assess the quality and flow of answers. The next step included transcription of both interviews into the computer using Microsoft Word
software and printed versions of interviews were produced. Following the transcription of interviews the trial analysis of collected data was performed in order to identify the existence of common themes. Preliminary results looked very promising and thus the study followed the assigned protocol and research actions. Minor changes were adopted to address different cultural environment where interview protocol and sequence was adjusted. Additional questions were also created to reflect more precisely the meaning of the framework elements.

3.10 Sources of Data
In order to address this study objectives a sample of three organisations from Cooperative Research Centres of Manufacturing Technology Sector have been selected to provide primary data for the research. This exploratory multiple-case study is based on three different sources of evidence: interviews, survey based quantitative data obtained during the interviews and the organisation’s annual reports related to each organisational unit of analysis. The interviews were an essential source of case study evidence, which in the current research was conducted by obtaining prior permission from each organisation CEO to interview the organisation’s staff. Interviews were held between November 2003 and April 2004 and at that time annual reports were obtained from each organisation. These reports represented the latest publicly available data about each organisation and its performance.

3.11 Research Assumptions
One of the main assumptions drawn form the literature review was that organisations whose business is R&D activities would naturally be inclined to produce innovative outcomes and therefore could be classified as being innovative. Otherwise it would be difficult to engage with any organisation and start discussions about objectives of this research. Counting innovations in the organisations to classify their innovative credentials was also not the purpose of this research. The presence of R&D activities supported by the existing research programs satisfied the main selection criteria. Author shares an opinion with many engineers in Australia that CRC organisations are one of the best examples in the world where innovative activities originate. This assumption was an important part in the decision-making process prior to conducting case study research and the data collection.
3.12 Potential Research Sites

Once the conceptual framework was developed, suitable organisations were identified that were involved in research and development activities leading to the creation of intellectual property, which could be commercialised through innovation. The first preference in the selection was given to the organizations involved in the government program for Import Replacement. The aim of the program is to give the opportunity to the local organisations to create innovative products or manufacturing processes that could provide the replacement of currently imported goods with superior products made in Australia. This program also provides assistance to organisations and encourages them to get involved in exports of new products to the international markets.

The initial correspondence with Industrial Supplies Office (Victoria) Limited responsible for the Import Replacement program at the beginning of year 2003 and a few follow up meetings stumble on the simple issue of obtaining an access to organisations involved in the program. Due to new confidentiality agreement created in 2002 by Industrial Supplies Office the information about participating organisations was no longer available to the public.

The second option considered in selection of suitable organisations was the research and development type of organisations, which are involved in the knowledge created new outcomes through innovation. After discussions with research colleagues, the best choice was to establish contacts with the Cooperative Research Centre (CRC) organisations in Australia.

3.13 Case Study Selection

One of the prime reasons for selection of CRC organisations for case studies was their makeup that integrates the Government or Government Agencies, Industry and Academia. These integrated identities of CRC’s represent three main ingredients of the research framework proposed by the author. Motivation of the Government to change culture of research in Australia and to encourage greater use of knowledge generated at universities by closer cooperation with industry partners matches the main factors of that framework. In addition, following Glaser and Strauss (1967) method of theoretical sampling that requires relevance and purpose, and is based on similarities as well as
differences, three organisations engaged in R&D and intellectual property development were selected and approached to provide the required data for the research. These three organisations were part of the current CRC Program and were engaged in different activities of the manufacturing technology sectors. It has been assumed that selection of three organisations belonging to the manufacturing technology sector could present cases of organisations that were vigorously driving towards commercialisation of innovative outcomes. On the other hand engineering and manufacturing environments that are familiar to the researcher could make communications and exploration of case study organisations relatively comfortable. The other criteria during the selection of organisations were: i) similarities of work type performed by participants and their organisational roles, and ii) organisations with similar number of members. Selected organisations were: i) Cooperative Research Centre for Intelligent Manufacturing Systems & Technologies (CRC IMST), ii) Cooperative Research Centre for Cast Metals Manufacturing (CRC CAST), and iii) Cooperative Research Center for Advanced Composite Structures (CRC ACS). Detailed description of each organisation is presented in chapters six, seven and eight.

3.14 Methods of Data Collection

The data collection process for case studies is more complex than the processes used in survey type research design (Yin, 2003). The current study employed interviews as the main source of data collection in order to enquire into people’s minds for their perception and interpretation of activities that could lead to successful organisational outcomes. One of the important aspects of interview approach is the attitude of acceptance from researcher that the information is valuable and useful and at the same time a realisation that interview participants may have some reasons not to be truthful while responding to the questions (Marshall and Rossman, 1989).

Prior to conducting interviews with the selected organisations, researcher had no personal affiliation or contact with any of the employees. Researcher established contacts with the organisations by sending an introduction letters, which explained the purpose of the research and the field of enquiry, and ask the management for a voluntarily participation in the research by making themselves available for interviewing. Only one of the originally selected organisations declined to participate
due to the heavy workload and some administrative restructuring processes happening at that time. In its place another organisation was selected that expressed interest in participating in the study. The aim of the research was to obtain a cross-sectional view of the organisation and therefore personnel requested for the interviews was involved with various activities. Author specified that for the purpose of the interview, the participants should be involved with research, managing research, managing the organisation or be an industry participants or users.

The CEO of each organisation drew the initial list of people interested to participate in the interviews, however in many cases work commitments did not permit everybody to take part as originally planned. Thus additional personnel were acquired during the course of data collection as needed. A total number of ten people were interviewed from each organisation, which included: four researchers, two research/project leaders, two industry users/participants and two members of the Board of Directors. The protocol with semi-structured interview framework was used to keep consistency during a whole data collection process. Prior to each interview a short briefing was made where: researcher introduced himself, explained the purpose of the research, method of conducting the interview (tape recording), the issue of privacy, confidentiality and the voluntary nature of answers presented to the questions. Framework of interview (build on elements of cognition, culture and motivation) was also explained before the interview process and participant were asked to complete a short one-page survey data sheet. Researcher finished each interview by thanking the participants for sharing their opinions, giving their free time and the willingness to help in the process of data creation. A total of 30 interviews within three CRC organisations were conducted. On average, each interview was about one hour duration. Majority of interviews were conducted face to face, however due to availability of some local and interstate participants few interviews were conducted by phone and recorded using special telephone-microphone attachments. In this instance author had to fill up the data sheets, based on information provided by the participant. To maintain full confidentiality, no name of the participant was ever recorded on the data sheets or mentioned during the recording of the interviews. The only evidence of participant names was recorded in the private diaries of researcher in order to keep times for appointments. Names of participants or their organisation is not disclosed and data is codified in order to provide absolute confidentiality.
3.15 Data Management

Data administration and interviews were transcribed by the author to ensure consistency and credibility of the findings. As mentioned earlier in this chapter, data collection interviews took place between November 2003 and April 2004, but the process of interview transcriptions to text has been happening in parallel and continually from the beginning of interviews, whenever there was time available between appointments. On average each interview lasted for about an hour and 90 minutes tapes where used for that purpose to have one interview per site and two interviews per tape. Tapes were marked with the Case Study number as CRC 1, CRC 2 and CRC 3 and corresponding number of participants from P1 to P10 for first organisation, P11 to P20 for second organisation and P21 to P30 for third organisation. Transcribed text was marked accordingly to keep the uniform identification system for analysis. Computer data analysis software NVivo version 2 was used for text analysis. The data text files were converted to .txt format from .doc format as required input to NVivo. For security and safety reasons a backup files of all transcribed interviews were created prior to commencement of the analysis and they were stored in a secure place.

3.16 Data Analysis

Data analysis of case study evidence is one of the most difficult aspects in this type of research (Yin, 1994). One of major unknowns that faces researcher conducting the interviews is what to make from the available data and what truth does it reveal. Tesch (1990) claims that analysis is an intellectual and demanding task, while Coffey and Atkinson (1996) believe there is no single right way to analyse qualitative data and that the analysis process should be integrated with data collection. Miles and Huberman (1994) referred to data analysis as the process of data reduction, display, conclusion and verification. Qualitative data needs to be classified in order to reveal the meaning. Coding, which is the process of identifying and recording a distinct passage of text data is the most essential and important part of the qualitative analysis (Gibbs, 2002). Coding can capture themes, which allow to analyse patterns, relations and connections. Process of analysis needs to be imaginative, flexible and reflexive, while maintaining good method that encompasses scholarly and intellectual rigour (Coffey and Atkinson, 1996). Thinking about the representation of data can increase researcher’s desire to find understanding and its meaning. Coffey and Atkinson argue that the purpose of the
research is to go beyond the collected data in order to develop a theory that may be generalised. Wolcott (1990) calls for questioning the data to extract a meaning. The role of the researcher is to bring the meaning in the context of the world, according to their observation (Dey, 1993). Data analysis process seems to be a bit irrational as a whole, as small parts are undertaken to find the meaning with a final goal of consolidation that truly reflect a larger picture (Tesch, 1990).

Among many other dilemmas that researchers face, one is about adopting an approach when coding the data. Gibbs (2002) proposes two distinct ways, which could be used either exclusively or in combination that may reflect on personal inclination, knowledge and theoretical sophistication of the researcher. The first way of coding can be based on the existing concepts or framework with some ideas about potential categories of codes that reflect the framework elements. The second way is data-driven approach to coding where open mind type approach is adopted. Researcher reads text very thoroughly and tries to make sense of what is happening in the context. This approach is in a sense the ‘true’ grounded theory method proposed by Glaser and Strauss (1967), and Strauss and Corbin (1990). However Gibbs (2002) argues that the ideal approach is unrealistic and researcher should try to pull out from data what is happening without imposing any interpretation from the pre-existing theory. Ideal data coding in his opinion often requires researcher reading the text line by line with a very clear thinking and asking many questions. In comparison Strauss and Corbin (1990) classify analysis for grounded theory as made of three consequent stages or separate types of coding, with borders either formally nonexistent or artificial, depending on approach of researcher as follows:

• open coding which reflects without bias existing categories in the text,
• axial coding with refined categories that are related and interconnected,
• selective coding which identifies core of the theory and which relates other codes to it.

While open and selective coding methods may not need more explanation, there are numbers of options available to organise thinking about axial coding before conducting analysis. The explanation to these options is presented in Table 3.1 on the next page.
On the other hand, coding could vary according to the different nature of projects or structure of data that may dictate a specific approach to analysis (Bazeley and Richards, 2002). According to Bazeley and Richards three methods of coding could be used:

- broad-brushed coding to identify temporarily a general topic, themes, or issues,
- concept coding to explore the ideas in detail and other related concepts,
- pragmatic approach which is good for a novice to identify interesting passages in the text.

The overall strategy adopted for the data analysis was to reduce the volume of data and to extract the essence of the statement from it in a logical and efficient way. Before conducting data analysis for the current study, transcribed interviews were assessed for uniformity and inclusion of all questions, themes and answers. This research adopted the broad-brushed and concept coding as the main ways to approach data analysis process. The details of the elementary coding process will be discussed further in chapter four.

<table>
<thead>
<tr>
<th>MODEL ELEMENTS</th>
<th>EXPLANATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Causal conditions</td>
<td>What influences the central phenomenon, events, incidences and happenings</td>
</tr>
<tr>
<td>Phenomenon</td>
<td>The central idea, event, happening, incident which a set of actions or interactions is directed at managing or handling, or to which the set of actions is related</td>
</tr>
<tr>
<td>Strategies</td>
<td>Addressing the phenomenon; Purposeful, goal-oriented</td>
</tr>
<tr>
<td>Context</td>
<td>Locations of events</td>
</tr>
<tr>
<td>Intervening conditions</td>
<td>Shaping, facilitating or constraining the strategies that take place within a specific context</td>
</tr>
<tr>
<td>Action/interaction</td>
<td>Strategies devised to manage, handle, carry out, respond to a phenomenon under a set of perceived conditions</td>
</tr>
<tr>
<td>Consequences</td>
<td>Outcomes or results of action or interaction, result from the strategies</td>
</tr>
</tbody>
</table>

Table 3.1 Elements of the axial coding model (Adopted from: Gibbs, GR 2002, Qualitative Data Analysis Explorations with NVivo, Open University Press, Buckingham)
Data from the interviews represented multidisciplinary (cognition, culture and motivation) views as previously explained and the cross-sectional sample of organisation’s opinions from management to researchers. As for the final reduction of the bulk of data, the intersection method recommended in the Nvivo software (Richards, 1999) was used between maximum scored codes from three major factor elements in order to focus on the main picture extracted from a highly dense referenced text. This study adopted the mode of intersection offered by NVivo to reduce the volume of prime data and to initiate the process of theory building. The triangulation of three types of data used for this research and obtained by using three different collection methods helped to test consistency of the research findings. The strategy of this research was to use intersection method in a manner identical to triangulation process of data interpretation proposed by Eisenhardt (1989) and Yin (2002). They stated that it is much easier to define the reality imbedded in the research material when triangulating parts of available data instead of using a single point of view. The later stage of qualitative data exploration and analysis involves interpretation and generalisation of findings, which are described in detail in chapter ten.

3.17 Use of Computer Software

The use and availability of computer software applications for qualitative data analysis is gaining a growing popularity among researchers. It eliminates traditional ways of photocopying, filling cards, stacking, sorting or color pen coding. Sociological Research Online (1998, vol. 3, no. 3,) provides many attributes for two of the most popular software packages available today namely: Nudist and Atlas/ti. Since 2002 later version of Nudist software is available as NVivo version from the same software company. The use of specialised software is not restricting the researchers to conduct analysis using other simpler computer assisted methods. For example, Microsoft Word provides such an option for text search and colour coding, and many simple linguistic programs such as Word Frequency and Word Counters provide basic tools for analytical assessment of text data (Tesch, 1990). However, for the greater analysis flexibility and convenience, this research utilises the NVivo software. Detailed information about some of the major features of this software is presented in chapter five. Availability of Nvivo and a provision of basic training in use of this software at the university created the opportunity to utilise this medium for greater research efficiency in this study.
3.18 Data Interpretation Methods

This research employs the variety of different methods to interpret the available data in order to arrive with the credible theory. The role of the researcher and his ability is at the core of this process. While the data analysis procedure follows previously described research protocol to ensure scientific accuracy, the aspect of the researcher being ‘immersed in the data’ is one that has the most significant impact on research results (Glaser & Strauss 1967; Strauss & Corbin, 1998; Yin 1994). The other important part of the interpretation is to understand the situated nature of participants in order to bring their voice (Ezzy, 2002) and to use many intellectual tools (Punch, 1998). The author did not have such a problem with this aspect of the research interpretation as for the number of years he worked as the industrial engineer and the researcher, and could comprehend and relate to new examined activities and their meanings. Chapter four covers the issues of data analysis process in greater detail.

3.19 Building Theory from Case Studies

One of the advantages of qualitative research is that it allows building of emerging theory by viewing it from different perspectives, while at the same time it intimately links with the evidence (Eisenhardt, 1989). From this viewpoint the process itself is highly empirically valid. Eisenhardt stresses that this approach gives likelihood of building a novel theory. She goes further by arguing that new theory is likely testable, verifiable and empirically valid because it is generated from direct evidence. In addition to many positives about qualitative research Eisenhardt confirms that the use of multiple studies with both, theory building and theory testing could add up to its credibility. Among several criteria for assessing theory building she endorses that good theory should be parsimonious, testable and logically coherent.

Yin (1994) on the other hand declares that whether theoretical propositions or basic framework drive new theory, researcher should ‘play with data’ in the preliminary sense to assess what is emerging and worth to analyze. He acknowledges pattern matching and explanation building from nodes as one of the best approaches for creating a new theory.
Other researchers propose the use of factor theory as one of the common ways to explain theories in the social science, whether using individual behaviour or social phenomenon. Down and More (1976) for example, recommended that in this approach a dependant variable must be established and other highly correlated variables must be related to it in the analysis. Strauss and Corbin (1990) go further by saying that a central category from analysis must appear frequently in the data with some indicators pointing to it. This explanation needs to be consistent and logical without data being forced into it. Central category should have sufficiently abstract name to allow for greater generalisations and the explanation of variations in the data or conditions, which could permit the theory to hold its ground even under contradictory conditions.

According to some researchers, most of the qualitative analysis can be changed in a simple way to the quantitative coding allowing interaction between theory and data (Eisenhardt, 1989; Trochim, 2004). It is often the later stage of qualitative data exploration and analysis that reveals whether there is a common meaning and connections between the elements of the examined framework. Method of intersection using NVivo software may improve efficiency to find some of those commonalities in the text data (Richards, 1999). Among several available ways to analyse the data Tesch (1990) proposes a few common methods such as:

- analysing language of cognitive structures and processes of interaction,
- describing regularities in elements, categories, connections or patterns,
- discovering meaning of action or interpretation of text, and
- reflecting analysis from constant comparing (grounded theory).

Tesch (1990) especially points out to the phenomenological approach that can give the understanding of current developments based on the objective examination of the worldview presented by the interview participants.

It is expected that in this study the synthesis of the qualitative and quantitative results could reinforce the current status of innovation research. It may also have some implications for the organisations, and provide suggestions for future research directions. Thus some attention will be given to quantitative data analysis. It should be noted that quantitative analysis in this research may not be rigorous in a statistical sense, however this approach may assist in structuring the analysis to provide more depth in
comparativeness, and may also help to visually represent the information as recommended by Glaser and Strauss (1967).

3.20 Quality of Research

Many discussions about qualitative research tend to focus on accuracy and acceptance of findings. Interpretation is a key aspect of the qualitative data analysis. The issues of biased transcription and interpretation, the overemphasis on positive cases, ignoring negative cases, vague definitions of concepts or unwarranted generalizations can be common and should be avoided (Gibbs, 2002). Some researchers may tend to pay more attention to the evidence that confirms to their beliefs, rather than to facts, which contradict them (Dey, 1993). This issue is especially sensitive in the qualitative research that examines voluminous and complex data, while relying on the imagination, insight or intuition of the researcher, who may arrive to the wrong conclusions (Dey, 1993). In addition to the quality issues related to the qualitative research, Salner (1999) describes that self-deception is observed in the inability of the researcher to fully explore the given data and constitute one of the major validity problems. Salner relates self-deception to the kind of blind spot psychological anxiety exhibited by most researchers when they are faced with the implication of the facts from the data.

Matters like those mentioned above originate much from the debate about the quality of qualitative research when compared to the quantitative research methods. The true causes of the observed effects in quantitative research can be assured by the emphasis on the validity, reliability and generalizability of results (Gibbs, 2002). Validity is concerned with the theories or explanations derived from the research data, which should be true and correctly capture the actual data. Results are reliable if they are consistent across repeated investigations in different circumstances. Generalizability of results is achieved if they are true for a wider range of circumstances beyond those studied in the research. Techniques such as experimental design or random sampling often guarantee quality, validity, and reliability of general results. In fact, the ongoing discussions about the quality of qualitative research may lead to the establishment of the alternative techniques that could be applicable to qualitative researchers to help ensure the quality of their analysis (Gibbs, 2002). For example, Yin (1994) goes beyond validity and reliability and supports the common view among qualitative researchers
that case studies represent a set of logical statements, thus the quality of research can be assessed by using four major criteria:

- construct validity, which establishes correct operational measures for the concepts being studied,
- internal validity, which establishes a casual relationship for certain conditions and leads to the other conditions,
- external validity describing the domain to which findings can be generalised,
- reliability, which demonstrates that the research can be repeated to achieve the same results.

In a similar way Lincoln and Guba (1985) presented the issues of qualitative research evaluation with the emphasis on more traditionally oriented internal and external validity, reliability and objectivity, pointing out that researchers must first pose some questions about the ‘truth value’, applicability, consistency or neutrality to themselves before they look at defending the quality of their work. Guba and Lincoln (1989) on the other hand offered alternative approach to judge the soundness of qualitative research based on factors such as credibility, transferability, dependability and conformability, which may be contrasted with commonly accepted measures for quantitative assessment such as internal and external validity, reliability and objectivity. According to Guba and Lincoln details of these new quality assessment factors could be described as:

- credibility of the criteria involves establishing the results of qualitative research that are believable and matching the constructed realities of the participants with those realities represented by the researcher,
- transferability refers to the degree to which the results of qualitative research can be generalized or transferred to other contexts or settings,
- dependability concerns the stability and the awareness of the researcher of ever-changing context during the time of data collection, and
- confirmability refers to the degree to which the results could be confirmed by others.

Trochim, (2004) supports Guba and Lincoln (1989) arguments and emphasises the need for external sources to reach objective judgement. He makes a few claims about the evaluation process such as:
• the interview participants are be the only ones who can legitimately judge the credibility of the results;
• it is up to the person who wishes to transfer the results to a different context to make the judgment of how well they match new environment;
• by definition, if we are measuring twice the same thing, we are measuring two different things and it is the researcher responsibility to describe the changes that occur in the setting and how they may affected the research;
• the researcher can actively search for and describe any negative instances that may contradict prior observations;
• after the research is completed the independent data audit can be conducted in order to examine the data collection and analysis procedures and make judgements about the potential for bias or any distortion.

Trochim, (2004) endorses the view that it is difficult to escape the issue of validity, which is applicable to the idealist-realist debate and cannot be separated from it. He thinks that this view may depend entirely on the philosophical perspectives of the researcher. Trochim argues that validity does not make sense to those who take an extreme idealist or constructivist position, as for them there is no reality against which to check the analysis except by using multiple views. In general, Trochim believes that the issues of quality in qualitative research may be addressed appropriately, if the researchers pay more attention to how they write about their data and how they present their findings.

Far simpler measures of good research are proposed by Glaser and Strauss (1967) who provide guidance for evaluating the empirical grounding of a theory on the basis of:
• theory fit to the substantive area in which it will be used,
• understandability of theory to non-professionals with the substantive area,
• generalisability of the theory applied to a wide range of situations in the substantive area, and
• degree by which the user could control a theory over the structure and process of daily situations as they change through time.

As far as classical measures of credibility, validity and rigour are concerned it should be observed that grounded theory is based on a systematic and formal process of data
collection, analysis and theory generation, and therefore could be guarded against some inaccuracies or misleading interpretations through comparative analysis, separate investigation of different parts of data or the integration of theoretical concepts (Glaser and Strauss, 1967).

The whole argument in the qualitative versus quantitative research is about the irrelevance of traditional quantitative criteria to assess the quality of qualitative research (Trochim, 2004). He argues that no one yet has adequately explained how the operational procedures used to assess validity and reliability in quantitative research can be translated into legitimate corresponding operations for qualitative research. For example how external validity in a qualitative study is judged without formalized sampling methods? Similarly how the reliability of qualitative data without any true score could be judged? The matters of quality judgement in qualitative research can be very sensitive as they assess the role of the qualitative researcher, who brings the unique perspective to the study. In the case of this research these matters are assured by the quality of analysis and the research results.

It is also appropriate to mention about a few telephone interruptions and people entering the interview area that may break the process of data collection, but these occurrences did not resulted in any data gaps.

On the other hand, it may be argued that the approach to collect mixed type data within a multidisciplinary research environment could contribute to the development of alternative methods. The use of three verified and empirically tested research frameworks may give this study a reasonably high guaranty. Reliability concerns about the study and results in terms of replication can be also strengthened by the use of mixed types of data and verified research instruments. Validity issues will be evaluated by reviewing this research results in line with the published research to ensure that the probability of true finding is maintained.

In conclusion this research approach may not represent a radical shift, however the genuine effort is to be reflexive and innovative in the evaluation practice and at the same time to provide useful findings.
3.20.1 Limitations
This research is limited to provide a macro view of innovation in specifically oriented R&D organisations. Thus some general principles that emerge from the data analysis may not be applicable across a wider range of industries and different types of organisations. Situational and contingency factors may influence innovation as a context sensitive criterion and thus may be limited to specific organisation or industry. It is generally accepted that the limitations of research study are beyond the control of the researcher (Perry, 1998). For example, the researcher did not control the initial selection of interview participants. This should not present any major problems as through the process of investigation participants from cross-section of organizations were available for the study.

3.20.2 Delimitations
Delimitations are all those issues, which are within the control of the researcher when planning or running a research program (Perry, 1998). The focus of this study was on innovation process within an organisation. The research has been designed to reflect mainly societal and behavioral aspects, not for example economic domain of inquiry, which is usually drawing the greatest interest from a wider business society.

3.20.3 Ethical considerations
The issues of confidentiality, privacy of information and other associated matters were related before commencement of the data collection to the Ethics Committee of Swinburne University of Technology. The committee gave unconditional approval to proceed with the research at its meeting on 27 October 2003. The researcher followed closely Ethics Committee guidelines and undertook all ethical considerations into account when approaching the research participants by maintaining the confidentiality at all stages of the research.

The emphasis on ethics was especially important during data collection, which allowed the participants to freely share their insights without a fear or prejudice. High professionalism of the researcher allowed to obtain good quality interview material as per planned research protocol.
3.20.4 Bias

The identification of the ideology driving the qualitative research and researcher’s own believes may prevent some of the common biases that could affect the undertaking. Janesick (2003) insists that there is no value-free or bias-free research. In his opinion a critical reflection on oneself often allows to eliminate some of those potential biases. In comparison Sadler (2002) states that most of the common failings come from person’s intuitive thinking and the judgmental processes employed during the research. He classified potential sources of bias into three main categories:

- ethical compromises or distortions due to possible payoffs and penalties,
- background experience researcher brings to the task,
- limitations in human information processing abilities.

The above biases may pose threats to the quality and integrity of the research. Although it is impossible to completely eliminate those biases, researcher needs to be aware of them throughout the course of the study. The efforts to eliminate them during data source selection, the process of collecting data or analysis, can add to the overall improvement of the project quality and its credibility.

3.21 Summary

The focus of this research is to examine the opinion of the selected personnel from the case study organisations to discover what factors tend to enhance innovation. The aim of this research was not to answer specific questions or to prove any hypothesis. The qualitative approach to data collection was selected for greater exploration and insight of organisational life. Computer-assisted analysis has been adopted for efficiency of the process and the transparency of findings. The next chapter deals with the analysis of the data.
CHAPTER FOUR
Research Data Analysis Process

4.1 Introduction
This chapter presents detail description of processes used to examine the data collected for this research. The need for the separate chapter describing methods used in the analysis and the reasoning derives from the complexity of the analysis process and the variety of available sources. The analysis follows the earlier formulated research protocol and the search for patterns in a single case study organisation and then seeks a confirmation by conducting cross-case pattern analysis. The prime source of data comes from the interviews with personnel from the selected organisations. This information has been supplemented by the data obtained from surveys of all participating members of case study organisations. The independently created and publicly available data about each organisation’s performance has been used to verify the research findings. The content of this chapter provides the detail information about database, data coding techniques, methods of data interpretation and data analysis process that is common to all three case study organisations.

4.2 Research Database
The database used in this study comprises of three components: i) interview material, ii) survey data, and iii) annual reports from case study organisations. Data collected through interviews represents primary research evidence. The interview material derived from the multidisciplinary structure of the research framework. The data content of each case study comes out of ten cross-section interviews with organisations members. Each interview corresponded to about ten pages of single-spaced text resulting in about ninety thousand words of readable text of primary data. The primary qualitative data was supplemented by the information from a short survey, which included characteristics of all participants. The third important piece of the evidence comes from case study organisations, which details a host of performance measures in their annual reports. The information include: general information on the organisation and details about various activities characterising its performance. At the time of
writing this thesis the annual reports issued for the financial year 2002/2003 had the latest publicly available information about organisational activities. Annual reports were only used as they were directly comparable with the other sources of data. The information about performance of examined organisations was extracted from the annual reports and represents only common indicators. The variety of listed performance indicators and the lack of uniform annual reporting system throughout CRC organisations implied for the creation of one general Total Performance Indicator (TPI) that could summarize the performance outcomes. The incompatibility of CRC organisations reporting results from the specific industry sector activities and their expected outcomes.

4.3 Process of Coding Interviews

The major part of data analysis in this research involved the process of coding text from interviews using NVivo software. The first analysis had been conducted in the first week of data collection after completing first text transcription. Understanding of various methods for data analysis had to be aligned with the commitment to use NVivo software for qualitative data analysis. Author belief was reinforced by Coffey and Atkinson (1996) statement that there is no single right way to analyse qualitative data and the personal philosophical approach shared by Gibbs (2002), and Miles and Huberman (1994) that in the end it is all about reduction of huge volume of data to manageable size. The preparation for the process of analysis started with the transcription of all interviews into Microsoft Word documents and the subsequent change of file format into ‘.txt’ in order to import them into NVivo software. All interviews had distinct file numbers representing case study and the corresponding participant’s number for the purpose of identification. The process of data analysis was in the large part the monotonous coding process of text. Coding, which is the process of identifying and recording a distinct passages of text from available data gives qualitative research the necessary meaning. Though analysis reduces the volume of data, it brings to the focus a much larger picture (Tesch, 1990).

The strategy during analysis of interviews text data was to follow the recommendation of Bazeley and Richards (2002), who suggested to use as a first step the broad-brushed coding to identify temporarily a general topic and then to use specific concept coding to
extract ideas and themes. This approach is similar to Yin’s (1994) advice to code available text into simple patterns, with the aim to progress in the next stage of analysis into more detailed coding of meanings. It has been also assumed that this multidisciplinary framework of cognition, culture and motivation could produce in its final analysis some common meanings applicable to all major elements. The process of intersection within NVivo software was applied to find common overlapping text passages that could produce the desire results for the final step in the analysis.

Data coding required line-by-line reading of text from individual documents with very clear thinking about broad description of meaning for three major factors, selecting and placing highlighted text passages into appropriate nodes called cognition, culture and motivation that represent proposed framework factors. Meanings that were captured in these nodes by the multidisciplinary data made possible to intersect (triangulate) the evidence. The general interpretation of meanings for cognition, culture and motivation used in this study came from the different sources and are listed in Table 4.1.

After the preliminary sorting of data into three main factors, the confirmatory check for the existence of common data themes was performed for each case study using intersecting operation provided by the computer software NVivo. The evidence of common text passages gave the author reassurance that the further analysis of main nodes into detailed elementary nodes could continue with the possibility of finding common meanings from intersection process.

<table>
<thead>
<tr>
<th>COGNITION</th>
<th>CULTURE</th>
<th>MOTIVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge from personal view or an experience (New Webster’s Dictionary, 1992)</td>
<td>System of shared meanings, values, held by members of a group (Schein, 1992)</td>
<td>Process accounting for individual’s intensity, direction and the persistence of effort towards attaining a goal (Vroom, 1964)</td>
</tr>
</tbody>
</table>

Table 4.1 Description of the proposed research framework factors (Author).

At this point of time research analysis could take two different approaches. The first simplified approach could involve follow up analysis after the intersection of major factors and this would contain the larger chunk of text data to seek some commonalities between major factors. The second approach followed by the author of this thesis was the gradual, though much longer process of coding data into the fine elementary nodes.
and then conducting the intersection analysis. The advantage presented by the second option was to obtain the additional categories of high ranking elementary nodes with the data of maximum importance. The potential disadvantage in the second method could be that at the time of intersecting only selected data, some interesting information might slip through the system and the attention of the researcher.

The continuation of the research was progressing according to the earlier proposed research analysis process with the next stage that involved coding the segregated text data grouped by major nodes into detailed and elementary nodes. This step in the analysis was setting the stage for search of patterns in the data. Results of detailed coding of major factors uncovered emerging trends and patterns. However, to broaden the field of inquiry some minor additions and changes to the content of major factor elements were made to achieve the wider ranging coverage of analysis. The elementary nodes for cognition remained unchanged, however nodes for culture have expanded and included: process orientation, easy going, growth and innovation hindering whereby the broader categorisation of innovation enhanced instead of innovation and risk taking as the originally selected framework. Nodes for motivation have been expanded with new elements of goal and satisfaction. The details about the elementary nodes and their meanings are described in Table 4.2. The next stage of coding involved elementary coding of the selected text from major nodes of cognition, culture and motivation that represented the proposed research framework. Similar to broad coding process, line-by-line reading of the selected text from specific nodes involved more detailed categorisation of selected meanings into elementary nodes of cognition, culture and motivation according to selected individual descriptions in Table 4.2 on the next page.

The examination of elementary node density from each case study organisation could show nodes from each major factor that had the highest score (number of collected text passages per case study). The next operation involved identification of the highest score elementary nodes from each major factor of the proposed framework and the intersection process of them in order to produce the common meaning of text known as common theme nodes. In the case of this study the highest value elementary nodes were all from the same indicators recorded for each case study namely: i) sensemaking from cognition, ii) innovation enhancing from culture, and iii) effort from motivation.
<table>
<thead>
<tr>
<th>BASIC NODE</th>
<th>ELEMENTARY NODE</th>
<th>ELEMENTARY NODE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>COGNITION</td>
<td>Scanning</td>
<td>Identifying trends, changes and events</td>
</tr>
<tr>
<td></td>
<td>Sensemaking</td>
<td>Interpretation of scanned information</td>
</tr>
<tr>
<td></td>
<td>Action from learning</td>
<td>Taking action after interpretation</td>
</tr>
<tr>
<td>CULTURE</td>
<td>Innovation enhancing</td>
<td>Conditions, activities and elements that enhance innovation</td>
</tr>
<tr>
<td></td>
<td>Innovation hindering</td>
<td>Conditions, activities and elements that obstruct innovation</td>
</tr>
<tr>
<td></td>
<td>Attention to detail</td>
<td>Paying attention to precision and details</td>
</tr>
<tr>
<td></td>
<td>Outcome orientation</td>
<td>Focusing on outcomes/results in activities</td>
</tr>
<tr>
<td></td>
<td>Process orientation</td>
<td>Focusing on methods in activities</td>
</tr>
<tr>
<td></td>
<td>Individual orientation</td>
<td>Emphasis on individual and his activities</td>
</tr>
<tr>
<td></td>
<td>Team orientation</td>
<td>Emphasis on team activities</td>
</tr>
<tr>
<td></td>
<td>Competitiveness</td>
<td>Rivalry and competition</td>
</tr>
<tr>
<td></td>
<td>Easy going</td>
<td>No stress and easy going attitudes</td>
</tr>
<tr>
<td></td>
<td>Stability</td>
<td>Effort to maintain stability and status quo</td>
</tr>
<tr>
<td></td>
<td>Growth</td>
<td>Effort on growth and performance</td>
</tr>
<tr>
<td>MOTIVATION</td>
<td>Effort</td>
<td>Will, commitment to do something</td>
</tr>
<tr>
<td></td>
<td>Performance</td>
<td>Degree of accomplishment</td>
</tr>
<tr>
<td></td>
<td>Reward</td>
<td>Form of recognition for effort</td>
</tr>
<tr>
<td></td>
<td>Goal</td>
<td>Target or aim to get/achieve something</td>
</tr>
<tr>
<td></td>
<td>Satisfaction</td>
<td>Approval and fulfilment from reward</td>
</tr>
</tbody>
</table>

Table 4.2  Meanings of the elementary nodes (Author).

The major phase of analysis involved the intersection of the highest value elementary nodes from each case study in order to find the most probable common meanings in the primary data. Result of this operation could produce very refined data, which might be interpreted and sorted into the final categories (nodes). This process could allow for final assessment and the generalisation of the undertaken research results that may lead into the development of new concept of innovation.

4.4 Interviews Data Analysis

While the most of this research analysis is associated to the process of coding text of interviews, the final process of triangulating data from three main factors allowed it to capture the core of the significantly dense and relevant (grounded) data for the conclusive interpretation. This research supports Eisenhardt’s (1989) idea that triangulation of data that captures perceptions of different people allows for much easier defining of the reality and the theory, than using a single measure. Using the technique of intersection in the NVivo software, common text data was extracted from the highest value elementary nodes belonging to cognition, culture and motivation factors from each case study organisation. The generalisation of findings took place on the basis of data.
extracted from the first case study organisation. The subsequent results of the analysis conducted exactly in the same manner as for case study organisation one had to confirm or disprove originally proposed theory concept for case study organisation two and three. The consistency in the highest ranking elementary nodes and their corresponding relative values allowed for the use of the generalised meaning applicable to all examined case study organisations. The strength of the new concept of the theory was built on the credibility of those values for final indicators. The schematic of prime data analysis leading towards formulation of concept theory is presented in Figure 4.1.

Figure 4.1  Schematic of prime data analysis (Author).

The first set of the results came from a broad-brush coding of all interviews and due to the different number of questions present in the interview instrument had to be evaluated on the weighted scale for proportionate comparison. As the number of questions varied for each major factor, the corresponding number of nodes in each case study had to be calculated. The relation of the total number of broad-brush nodes (B-BN) to the number of questions asked during the interviews about each major factor and the number of words in each case study interview delivered the Node Density
Indicator (NDI) that allowed for fair assessing the significance of each major factor in the organisation. Cognition factor had seven related questions, culture nine and motivation five. For simplicity NDI’s were rounded up to the nearest single number.

The make up of the research instrument allowed also conducting at the end of interviews the quick assessment of the opinion held by interview participants about the major influence of one of the key research framework factors on innovation. Results of this additional assessment gave the opportunity to examine the results of broad-brush coding process with the survey data obtained form the interview participants.

The next set of results came after the lengthy analysis and coding of major research factors into the elementary nodes according to chosen frameworks for cognition, culture and motivation that were described in chapter three. One of the rules established during analysis of data was that only those elementary nodes that have at least three occurrences in each case study organisation or come from three independent sources would be taken up for the further examination. The significance of all nodes has been assessed accordingly to the prescribed rule and resulted in disqualification of some nodes as not significant to the further research.

The highest-ranking elementary nodes from cognition were situated in the node of ‘sensemaking’, among culture they were present in ‘innovation enhancing’ and those representing motivation had been grounded in the node of ‘effort’. Detail examination of the composition and the distribution of all elementary nodes from each case study have been conducted in order to gain the knowledge about the density of findings. Information obtained from node profiles provided by NVivo software in conjunction with the supplementary data from interviews surveys were put forward for the final conclusions from this research. The available elementary nodes provided also the opportunity to assess their groundedness and density. Groundedness can be referred to the number of participants who used a particular meaning during the interviews, with the node density showing the number of times the examined node was assigned to a participant in the particular case study text. At the same time it is recognised that using the numerical values is not truly within the interpretive tradition of qualitative research, but this is the most effective way to bring up the importance of the examined nodes.
Density and groundedness of the elementary nodes for each organisation allowed grouping them into four categories, which could reflect the importance of the issues existing in each case study according to the presented research framework. Those four categories are established as: i) insignificant, for nodes below density or groundedness number 3, ii) minor, for nodes below average number 5, iii) major, for nodes with the number between 5 and 9, and iv) fully supported, with maximum occurrence of 10.

On the basis of the established rule, all elementary nodes from each case study were sorted into the appropriate categories. The intersection between the highest grounded elementary nodes gave outputs to common and dense theme factors for the concluding analysis and generalisation of research findings.

Instead of taking the major elementary nodes for further analysis as it happened, there was also another option available at this stage of processing data. The alternative could involve the selection of nodes to the next stage, which would satisfy the Pareto 20/80 rule. This rule states that 20% of elementary input could resolve in the 80% of the desired outcome. According to the Pareto rule, instead of three top ranking factors for further data analysis, those factors which represented at least 20% of all total nodes for each major factor could be taken into consideration. That would provide more text data and increased number of the elementary nodes for final analysis from three to six.

As mentioned before, even after the elementary nodes intersection analysis has been performed, those common theme indicators had not been reduced to the single meaning units and still had some short text passages worth to be explored further. The final interpretation of this short text data allowed creation of a few uniform nodes that could represent indicators of the new concept theory. This generalisation of meanings resulted in formulation of three basic indicators (nodes) for each case study final analysis. The interpretations of those indicators lead to naming them as: aptitude to perceive (in short as perception), predisposition to participate (in short as participation), and the clarity of objective (in short as objective). Node profiling within NVivo software allowed for the extraction of detailed information about each node property from three case studies to help determine their final indicator value. The creation of the single relative value for each of the elementary nodes involved extraction of groundedness and density values.
and calculation of their square root to obtain the final value for analysis. The formula
for final value is:

i) perception relative value = \sqrt{\text{groundedness}^2 + \text{density}^2}
ii) participation relative value = \sqrt{\text{groundedness}^2 + \text{density}^2}
iii) objective relative value = \sqrt{\text{groundedness}^2 + \text{density}^2}

The aim of the final analysis of the prime text data was to lock together three
independent indicators of perception, participation and objective into a single meaning
that could describe organisational activities leading towards innovation. Though this
research final result has more complex multidiscipline outcome than originally
anticipated, author’s idea was to transform the final meaning of three indicators into one
focused theme and value that could represent it. That information about final indicator
could provide better understanding of the emerging phenomenon. This process is
described in detail in chapter ten.

4.5 Surveys Data Analysis

Another important aspect in the analysis of data was the availability of additional
quantitative data and attributes collected from the interview participants. That
information allowed for greater depth of analysis before final structuring of the
phenomenon and creating the concept of the theory about innovation determinants in
the organisations. As Huberman and Miles (2002) pointed out that the qualitative and
quantitative inquiry could support and inform each other. It is with this intention in
mind that major qualitative analysis in this research is seeking support from the
additional survey data collected.

Social science often refers to factor theory that bases its findings on the analysis of one
selected variable and other correlated to it in the relationships that could be easily
established between qualitative and quantitative data (Down and More, 1976; Trochim,
2002). Those relationships between qualitative and quantitative data could be
established from analysis of language, regular events, and interpretation of text or
constant comparing of data from both sources (Tesch, 1990).
Two surveys were conducted for this research during the interviews process. The first survey contained the answer to the question, which of the major factors of cognition, culture and motivation may have the most significant influence on the innovation in the organisation? The second survey includes the attributes data collected from each of the interviews participants and was more of the personal nature. The information included: i) position/function member performs within CRC organisation, ii) member’s formal qualification, iii) gender, iv) age group, v) number of years worked for CRC, vi) cultural background/sensitivity, vii) types of two previously held jobs, viii) number of people in personal network related to CRC, and ix) number of formal and informal meetings per month.

The attributes indicating: number of years of experience, network size, number of formal and informal monthly meetings and the total number of people involved during the year in any activity of an organisation that could be expressed by a single value representing connectivity within an organisation. This Connectivity Indicator (CI) could express the ability of members to make contacts with others or ease of organisational communications. CI was constructed by multiplying the average years of experience of interviewed participants, by average network size, by the average ratio of informal monthly meetings to formal monthly meetings, and dividing this number by the total number of people involved during a year in the activities of an organisation. The second surveys data had been tabulated for the clarity of analysis and is presented with each case study organisation’s overall research data in chapters six, seven and eight.

4.6 Organisational Performance Data Analysis

Each CRC organisation has unique type of activities that are often characterised by mission statement, objectives and strategic plan. The distinctive profile of individual CRC influences the selection of the most appropriate measures to report on their performance. The variety of listed performance indicators from each organisation and the lack of uniform annual reporting system throughout CRC organisations motivated the author of this thesis to create one single performance indicator that could show the total performance outcome. Creation of Total Performance Indicator (TPI) uses common performance indicators present in each examined organisation and therefore allows for effective comparison of multidimensional performance data. The TPI
formula captures the diverse organisational activities containing many existing CRC performance indicators such as: i) total money available to the organisation, ii) money received from the government, iii) the economic benefits to the organisation, iv) number of publications, v) number of postgraduates who completed study, vi) number of obtained patents, vii) number of external collaborations, viii) resources available for research. In addition, this formula captures the number of full time equivalent staff and the total number of people involved in the CRC during a year.

At this stage to present a clear view about the selected factors some additional explanation to their meanings needs to be established. The economic benefit to CRC organisations is reflected by the return provided from the total operational money available. The Federal Government provides a fixed amount of funds to each of the organization on the annual basis. However as part of the arrangement they must show initiative and secure partnerships with the industry including the ability to attract additional funds. Therefore the total money available for each organization represents the important indicator of their performance and effort. The number of published journals and papers with the number of obtained patents indicates how much of the new knowledge is generated by the organizational research activities, with various rewards representing the external recognition for the quality of research work. The number of the postgraduate students who completed their study sponsored by the organisation, including full time research staff or the total number of organisation’s members that supported them is a further sign of their effort to create meaningful outcomes. The number of active external collaborations with the industry or other institutions provides advanced indicator of the usefulness of work produced by the organization, as well as their ability to negotiate, attract and maintain those relations.

The numbers of coefficient indicators (numbers without the units of measure) were created to condense many specific activities into one numerical value according to the established formula: \( TPI = (C2 + C3 + C4 + C5 + C6) * C1*C7/C8 \)

New formula for the total organisational performance represents all the listed factors and proposed coefficient indicators of:
C1 = Leverage (as Total Money/Government Money),
C2 = Economic benefit to Centre/Government Money,
C3 = Journal and Conference Papers/Total CRC Members,
C4 = Postgraduates completed/Total CRC Members,
C5 = Patents/Total CRC Members,
C6 = External Collaborations/Total CRC Members),
C7 = Staff Time Commitment as (Full Time Equivalent Staff/Total CRC Members),
C8 = Research program resources/Total Money.

The results of TPI from each organisation will be used in chapter nine for comparison of performance between organisations and also to verify the evidence of the proposed innovation concept in the final discussion of research results in chapter eleven.

4.7 Interpretation of Primary Data

The interpretation of interviews data and the creation of concepts or research theory depend on the skills and abilities of the researcher. The main part and one that was most time consuming in the process of analysis was the interpretation of the substance of the transcribed interviews text and the coding process of the data. First stage of coding involved interpretation of the whole available text into text passages with the broader meaning of data about cognition, culture and motivation. The second stage was focused on the specific activity to define the elementary nodes and to establish the highest occurring once for dominant themes. Though the intersecting process reduced significantly the data volume from a few hundreds for each elementary node to less than ten percent of the common content, it still had considerable amount of text context to be analysed further. This common data of high density to all major factors of the framework was finally examined and coded into the single word meaning nodes as the indicators for the final generalisation process and creation of the research theory. The final stage of these single node indicators interpretations will be discussed subsequently in detail in chapters six, seven and eight. Generalising the meaning of research findings is most effective when both, abstracting and comparing could be used (Punch, 1999). It is the intention of the author of this thesis to adopt this approach in the final analysis. Chapter nine will include comparison of results across the three case study organisations.
4.8 Making Sense of Research Data

To gain reassurance and greater confidence from the final research finding for each case study, the additional complementary measure had been performed to assess it in the light of the organisational survey and performance indicators. The comparison of final research findings for the emerged concept of innovation theory was necessary to verify research results and gain confidence that the new theory concept could be generally used as an applicable tool. Though the process of coding data and subsequent reduction of analysed text often strip it from the significant meaning, it condenses data to a more generalised description as an indicator. The experience of conducting the qualitative research data collection such as interviews and the opportunity to share many rare moments with the interview participants are unique. Often the discussions before interviews or after official closure revealed more interesting material for each case organisation than that had been recorded and presented by the author in subsequent chapters describing individual case studies. Coffey and Atkinson (1996) support this approach arguing that processes integrated with data collection enrich analysis of qualitative data. This study relies on triangulation methods and adopted the exploratory multiple-case study approach recommended by Eisenhardt (1989) to assess it from different perspectives and to reaffirm its credibility. Three different sources of evidence such as interviews, surveys and the organisations annual reports guarantied sufficient data to test, verify and validate the final research findings. Qualitative data often needs to be supplemented by quantitative evidence to add credibility to research findings (Yin, 2003). One of the likelihood presented by Dey (1993) and followed by the author was to be open to the findings emerging from the analysis of interviews data by not confirming to ones own beliefs but honestly reporting the results as they are. The final ‘play with data’ as Yin (1994) describes it was left till the last moment of analysis when the generalisation of findings could be conducted. The interpretation of emerging theory concept is presented in chapter ten.

4.9 Summary of Research Data Analysis

This chapter presented the processes of data analysis that allowed to evaluate the primary data and to compare it with the qualitative evidence for the verification. As the primary source of information, the data from interviews was used and has been supplemented by the surveyed information obtained from each organisation. The
independently published data in annual reports about each case study organisational performance was also used to verify this research finding. Next chapters present NVivo software and its application to this research study.
CHAPTER FIVE

NVivo Software

This chapter describes the NVivo, one of the most popular computer softwares. This software is used in the study to assist with qualitative text data analysis. The information presented in this chapter is not a guide about how to conduct analysis using NVivo, but an introduction to the capabilities offered by the software.

5.1 Introduction

NVivo software was developed and is marketed by the Australian company QSR International. This software is a powerful, flexible and a user-friendly product that could be used for qualitative analysis by novice and experienced researchers. The main advantage of NVivo is the assistance in efficient management and retrieval of analysed text. QSR software can be applied in variety of research fields and to research tasks ranging from detailed interpretation of documents to the discovery of patterns within the examined text. NVivo can even provide linkages to other statistical softwares. Capability of NVivo software ranges from handling small to very large size projects. This research used the current version of QSR’s NVivo 2.0. Extended descriptions of software with all capabilities and options are available from the Internet, QSR International or book references such as Bazeley and Richards (2002), Gibbs (2002) and Richards (1999; 2002). This chapter provides only a brief description of general software capabilities and some functions that were used to analyse the research data.

5.2 Overview of NVivo Capabilities

NVivo provides opportunity to import and code text data in .txt or .rtf computer file format. All available tools within the software are interconnected and can be saved in NVivo. Major functions of NVivo software allows: i) edit the text, ii) retrieve the text, iii) review and recode previously coded data, iv) search for combinations of words in the text or patterns in coding, and v) import or export data from other quantitative analysis softwares. The central task in qualitative research is usually to develop ideas, concepts or categories from the data by means of coding. However, the role of the
researcher in the process of data analysis and coding is indispensable as no softwares in the world performs the task of text interpretation automatically. After basic coding is finished, more refined search for ideas and themes could be continued within a selected group of text by reading it or utilising software search capability. Boolean and proximity are two basic types of search that could be used during text analysis process where single words or phrases of interest to researcher could be allocated automatically and placed in specifically created files within the software. The selected text can be viewed and grouped into sets, structures or associations utilising data attributes such as age, gender or profession of interviewed people. NVivo software is very versatile and allows also to create graphic models of emerging research concepts that can assist in providing the clarity of the emerging phenomenon.

5.3 Choices within Software and Analysis Options

NVivo software provides a range of options in selecting the most appropriate method for data analysis. They may include: i) discovering and developing categories by making nodes, exploring their content, making memos and using the Modeler, ii) recording the links between data and ideas by means of coding, using DataLinks and modelling, iii) bringing data together with the aim of parting and differentiating it, iv) coding at nodes, giving values to the attributes and placing documents or nodes into sets, v) ordering and organising data by sets, trees and modelling, vi) finding and showing relations in data by use of tools of show, filter and assay, vii) viewing and finding patterns by use of options in Browsers, Explorers, profiles and special matrix tools, viii) linking of statistical data by importing and exporting matrices, profiles and reports.

5.4 Software Modes

There are two basic options available to work within NVivo software. The first includes analysis of the available documents. The second option relies on created codes categorised within the software as ‘nodes’. The basic functions within the software for both, documents and nodes are identical and are displayed in the opening screen of NVivo in Figure 5.1.
5.5 Coding and Nodes

NVivo like word processing has provision for text browsing, alteration and text marking. Files can be viewed unaltered while text is marked for ideas and concepts. Process of marking examined text is known as coding. Coding of an examined text can be done by either highlighting selected text using common drag and drop process used within Windows environment that allows placement of text into the designated nodes or after selecting a text passage a specific description/name could be given to the chosen text. Single selected words or text passages are known as ‘nodes’. Process of coding that includes text passages grouped into nodes can than be refined for each node through further stages of analysis resulting in advance data reduction. Possibility also exists within software to group nodes into sets when they may not have hierarchical relation but some related meanings. One of the advanced methods of narrowing data analysis is the process of intersection where software can find common words or text passages among specified nodes within a coded document. The probability for intersected data increases with the larger number of created nodes, which may contain overlapping text. Selected text from a document can represent ideas, concepts, processes, places or any other required categories. Several ways of approaching data
analysis are available depending on the methodological aspects, research goals, research style, researcher priorities, and available time (Richards, 2002). As the alternative approach to coding, Gibbs (2002) highlights the possibilities of efficient text coding for advanced researchers using available text search and inclusion of nearby information text to create nodes. At any time during the coding process, the numbers of text passages contained in nodes are available for viewing in the software counter. Computer techniques in general, allow for greater efficiency in data exploration and data manipulation, and include Boolean and Proximity search. Results of those searches by default are automatically stored in new created nodes.

### 5.6 Boolean Search

This search technique allows for search of more than one word or phrase within documents, nodes or attributes. Boolean operators such as ‘and’, ‘or’ and ‘not’ give opportunity for the search process to be combined into one group of data. Description of Boolean search options is presented in Table 5.1. This search method does not cover all ways in which text passages (nodes) could relate to each other and therefore Proximity search supplements the full NVivo software capability.

<table>
<thead>
<tr>
<th>OPERATOR</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intersection (And)</td>
<td>Find text referenced by all of these items</td>
</tr>
<tr>
<td>Union (Or)</td>
<td>Find text referenced by any of these items</td>
</tr>
<tr>
<td>Negation (Not)</td>
<td>Find text referenced by none of these items</td>
</tr>
<tr>
<td>Difference (Less)</td>
<td>Find text referenced by any of these items</td>
</tr>
<tr>
<td>Matrix Intersection</td>
<td>Find text referenced by each of these items</td>
</tr>
<tr>
<td>Matrix Difference</td>
<td>Find text referenced by each of these items</td>
</tr>
</tbody>
</table>

### 5.7 Proximity Search

Proximity search adds to the variety of options available for complex search within the text data. For example ‘near’ or ‘preceding’ passages of text could be identified. The range of alternative search methods is presented in Table 5.2.

<table>
<thead>
<tr>
<th>OPERATOR</th>
<th>UPPER PANEL</th>
<th>LOWER PANEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-occurrence (Near)</td>
<td>Find places where text is referenced by this item</td>
<td>Find places where text is near text referenced by this item</td>
</tr>
<tr>
<td>Sequence (Preceding)</td>
<td>Find places where text is referenced by this item</td>
<td>Find places where text starts before text referenced by this item</td>
</tr>
<tr>
<td>Inclusion (Surrounding)</td>
<td>Find places where text is referenced try this item</td>
<td>Find places where text surrounds text referenced by this item</td>
</tr>
<tr>
<td>Matrix Co-occurrence</td>
<td>Find places where text is referenced by each of these items</td>
<td>Find places where text is pairwise near text referenced by each of these items</td>
</tr>
<tr>
<td>Matrix Sequence</td>
<td>Find places where text is referenced by each of these items</td>
<td>Find places where text pairwise precedes text referenced by each of these items</td>
</tr>
<tr>
<td>Matrix Inclusion</td>
<td>Find places where text is referenced by each of these items</td>
<td>Find places where text pairwise surrounds text referenced by each of these items</td>
</tr>
</tbody>
</table>


### 5.8 Organising Data

Three tools within NVivo software specifically allow to organise examined data into sets, trees representative models. While sets could be a collection that may represent a way to organise the large number of associated documents or nodes in the research project, trees denote hierarchical relations among the selected nodes. Modeling on the other hand helps to visualise created relationships between documents or nodes in the form of flow charts or diagrams. Created models can have many versions, which can be distinguished by model layers. While diagrams are preferred to show relationships, flow charts for example may be excellent to illustrate the decision-making process. The
ability to use NVivo modeling can effectively improve the conceptualisation process and record creation of new ideas.

5.9 Monitoring Process of Analysis

NVivo provides the option of continuous profile monitoring of the target data. Profiles can show variety of information about documents, nodes, sets or attributes. Their identity can be created from the search tool using standard matrix search operation. Profiles show the tabulated information displaying numerical values of each type of node occurrence and their spread throughout various documents. This information helps to identify density and groundedness of the created nodes that may be significant in finding emerging patterns and formulation of new concepts or theories.

5.10 Data Synthesis

One of the creative ways of examining and searching documents and nodes is to look for patterns among data that contain the same attributes. There are three principal ways of bringing data together. Two methods include coding and giving values to attributes while the third relies on placing documents or nodes into sets. Nodes can not only be used to gather information on a topic but also to point the occurrences of themes. Nodes that have attributes for a theme, organisation, or person allow to store a specific information representing examined identity. Values of selected attributes could be used as an indicators pointing to all the documents with particular characteristics, or to all the material coded by a node representing something with similar characteristics. Set editors within the NVivo software allow differentiating nodes within ranges of attribute values, by gathering them in one place as a new default node for conclusions. For example, there could be items with age greater than a particular number or dates before a particular time. The same documents or nodes can go together into sets for various reasons and as many times, as may be necessary. The use of sets is often beneficial for answers to brief or work in progress enquires, as well as major research questions.

5.11 Summary

Computer softwares such as NVivo greatly reduce the strain on the researcher and help to manage the process of qualitative data analysis in an organised way. Coding allows reducing the volume of data and extracting the meaning from documents in an
organised and efficient way and therefore controls the process. However, despite the user-friendly NVivo format, the ease of final process of sense making depends largely on the choices of methods that have been selected along the way.
CHAPTER SIX
Case Study One – CRC IMST

6.1 Introduction
This chapter describes the first case study organisation, the Cooperative Research Centre for Intelligent Manufacturing Systems & Technologies (CRC IMST) and deals with the issues of organisation’s settings, human dimensions and performance outcomes. There are also some quotes from the participants of interviews presented in this chapter, which could be identified by the abbreviation ‘P’ with the corresponding number from 1 to 10. Description of the case study organisation contains results from data analysis according to the process described in chapter four.

6.2 Overview of Case Study One Organisation
CRC IMST is a company established by five universities, thirteen manufacturing companies and the Commonwealth Scientific and Industrial Research Organisation for Manufacturing Science and Technology (CSIRO-MS&T). The organisation has the status of company limited by guarantee and without share capital. The organisation commenced its activities in 1993 after the successful approval of its business proposals and subsequent Government funding for the first seven years of operation. At the time of collecting data it had completed four years in a seven years cycle of operational period. During the financial year 2002-2003 the total money available to the organisation was $9.6 M.

The focus of CRC IMST is on research that addresses the needs of the Australian machine tool industry, plastics processing and machining, aerospace design and assembly, metal cutting and forming, developing specifications for new generation machines, design, and controls. Sensor Technology is an emerging area of science and technology with significant industrial and commercial potential. The importance of sensor technology in a manufacturing environment is strongly related to the process control. The research ranges from product assessment, through re-design of products and manufacturing processes, to recycling and re-use strategies. Wear and corrosion
resistance, higher thermal strength and toughness, lighter weight, and environmental friendliness demand new approach to manufacturing and often lead to innovative products and solutions. The state of the art technologies associated with: high speed machining and grinding of materials, future cutting technologies, and next generation of plastics processing simulation are being advanced through IMST research. The main research focus of IMST is on five programs: i) future generation machines and equipment, ii) real time sensing and machine control, iii) sustainable and environmentally friendly manufacturing, iv) information systems in manufacturing, v) advanced processing of materials.

The areas of research expertise include: i) manufacturing information systems, ii) concurrent engineering, iii) design for manufacture, iv) production simulation and control, v) sensor fusion, vi) signal processing, v) cutting, grinding and polishing, vi) metal and plastics manufacture, modelling, and rapid prototyping.

6.2.1 Mission Statement
IMST motto is to be a world-class Centre for the development and application of intelligent manufacturing systems and supporting technologies for the economic benefit of Australian industry and society. In addition, the organisation aims to better utilise Australia’s research capability and foster a culture change in both academia and industry through collaborative activities.

6.2.2 Objectives
Main objectives of this organisation are: i) to become an internationally recognised centre of excellence in research, development and education in the field of intelligent manufacturing systems and technologies, ii) in association with Australian industry to identify areas of intelligent manufacturing systems and technologies that could provide opportunities for further basic and/or applied research that is important for Australia, Australian manufacturing industry and the community, iii) to conduct research and development in collaboration with appropriate Australian industries and research establishments, iv) to enhance the international performance of individual companies and of the manufacturing industry sector that could evolve into the development of new high value products and processes as exports or import replacements, v) to raise the
standard of education and training in manufacturing and management in Australia and to establish and maintain programs for undergraduate and postgraduate education in manufacturing and management within Australia, vi) to raise the status of manufacturing engineering, vii) to ensure that the participating organisations in CRC IMST could add value to greater enhance the performance of the Centre.

6.2.3 Strategy
The CRC IMST is committed to continue operating as a virtual enterprise model. The preference is to engage with larger companies that have an involvement in research and are looking to build new long-term partnerships. The important characteristics that are thought of partners are: i) an existing research culture, ii) Australian based organisation, iii) vision of a product based on understanding of the market trends, iv) export interests. However, the recent trend encouraged by the board of directors is to support smaller projects within new start up Small to Medium Enterprises (SME). The other important approach is to ensure that research students from the Centre gain a comprehensive experience in conducting industry oriented research that expose them to timeline pressures and useful outcomes. The organisation continues to ensure that the research outcomes delivered by the academic providers will be relevant to industry partners. The Centre's cooperative efforts continue to ensure were possible that CRC IMST researchers are co-located on one site to work on appropriate modules of individual research projects. This ensures researchers maintain direct contact with the industry and the industry researchers keep up with the latest developments emerging from academic institutions. There are also a close working relationships developed amongst the participants through regular project management committees. Project management committees require to have a senior representative from each of the cooperating partner together with the Executive Director of the Centre. This mechanism has enabled an understanding of project problems and priorities leading to optimum solutions through sharing of information and project commitment. In general, the Centre encourages three or more partners for each project. This can either be made of multiple industry or academic membership, in addition to an industry participant. Such an approach encourages a broadening of the research skills applied to a particular research effort. However some smaller projects can be approved on one to one basis, usually when the industrial partner is immature in research and wants to gain experience in the process.
In exceptional circumstances the arrangements could be made with other industrial companies and institutes described as ‘associates’, that act as test sites and advisers in order to broaden the input to research projects.

The Centre's approach is to achieve excellent level of cooperation between researchers in specific projects. However, with the majority of the project research work being conducted at Industrial Partner sites across Australia, the sharing of information across projects poses unique problems. To overcome this special attention is given to planning and execution of the annual reviews. The approach is to find a neutral location, off campus, where all researchers gather for several days of research interaction. The core objective is to share knowledge and experience, and more importantly to gain an understanding of the ever increasing broad range of expertise available within the IMST.

### 6.2.4 Members, Customers, Industry Partners and Associates

The members of the CRC IMST are categorised as class ‘A’ and ‘B’ members. ‘A’ members pledge to the organisation each year a cash contribution of $20,000 and no less than three persons year of research related activities, while ‘B’ members contribute only $5,000 and no less than one person year of research related commitment. There were two ‘A’ and six ‘B’ members companies during the year under review. Most of the organisation’s customers and partners come from industry, however strong relationships are also maintained with many universities to expand the research and educational base. During the year 2002-2003 there were fifteen member organisations involved with the CRC IMST Centre such as: Commonwealth Scientific and Industrial Research Organisation, The University of New South Wales, Swinburne University of Technology, University of Wollongong, Royal Melbourne Institute of Technology, University of South Australia, ANCA Pty Ltd, Hawker De Havilland Pty Ltd, Moldflow Pty Ltd, Technical Components Pty Ltd, Sola International Holdings Ltd, Mitsubishi Motors Australia Ltd, Philmac Pty Ltd, Dynek Pty Ltd and Godfrey Office Equipment Pty Ltd.

A strong interest in CRC IMST activities was also shown from the fourteen ‘associated companies’, with the agreement for limited cooperation under the condition that the
researchers could maintain general industry focus and have access to experienced industry practitioners. These organisations were used in some sense as a vehicle to publicise the CRC research work, and to create stronger relationships later. This is an important aspect of the Centre's overall strategy for technology transfer in order to find additional industry partners. Experience has shown that it takes considerable time to build a relationship before new participants are willing to involve themselves in research within the Centre.

Over the years a number of leading Australian companies benefited from such collaborative programmes. ANCA, Moldflow or Hawker de Havilland are good examples of CRC IMST members, who have been key enterprise players in Australia's development of high-tech machines, products and manufacturing processes that have placed them at the forefront of their respective markets in the world. All CRC IMST partners have demonstrated their capability to work in cooperative arrangements to develop world-class concepts, products and manufacturing processes with opportunity to share the benefits from the success.

6.2.5 Projects and Arrangements

Each project run by CRC has a planned commercialisation strategy that incorporates the method of exploiting the research project results, the failure modes, and plans to overcome these problems. These plans also include the forecast of the likely financial returns and how it will be shared by the project participants and the Centre. During the project formulation stages, commercialisation strategies are sufficiently developed in order to proceed with the project and to identify areas where more in depth work may be needed. The standard review for project commercialisation planning stages reflects the findings from the preliminary research activities. That review helps to justify major approval of the project budgets, research activities, and development milestones. During the business year 2002-2003, CRC IMST had twenty active research projects.

6.2.6 Intellectual Property Protection and Commercialisation

The Centre has in place comprehensive and effective confidentiality systems to protect any project’s Intellectual Property (IP). Very often researchers work background can also be incorporated in the research projects and licensed under normal commercial
terms. Projects carried out by the partners in the Centre have IP sharing in proportion to the value of their contributions to project. The Centre is a large contributor of cash to each project that could eventually become an income stream from royalties and licences. This income may be used for further research work and development of new facilities. Such processes have been established with the approval from the government in order to ensure expeditious research progress.

The Centre maintains the services of Patent and Trademark Attorneys to provide professional advice on IP protection. Each research project is reviewed to determine the best strategy to protect project IP. Part of this activity is devoted to identify what is patentable and what could be protected by copyright. Appropriate advice often follows to the Board for decision on what resources are needed for project protection. The Centre exercises strict control over all IP associated with the research projects. They may include: i) patentable inventions/discoveries, ii) copyright material, including designs & computer software.

Every approved research project includes a commercialisation strategy, which ensures that the research activities conducted by CRC will be directed towards the achievement of a successful application of the Project IP by the industry. Whilst the Centre does not engage in the direct commercialisation activities, it may be involved in negotiating the appropriate licences and agreements on behalf of the project partners. The Board places great emphasis on the projected commercialisation results and the establishment of a sound strategy to achieve this outcome, before approval of any project proposal is granted. When products development reach a stage where they can be well defined, the Centre initiates a market survey to find the size and segmentation of the market, competing products, barriers to entry, threats, specific end users requirements, and the development of a strategy for entering each of the identified market.

6.2.7 Business Environment

Many organisations face ongoing increased competition from overseas manufacturers and suppliers. CRC IMST plays an important role in research and development supporting local industry to become globally competitive by helping them to develop new products that may enhance export effort. Despite general economic trends showing decline of the manufacturing base in Australia with the balance of trade deficit not in
our favour, the efforts put by CRC IMST to help Australian industry are recognised and appreciated. However, in many instances as participant P5 pointed, IMST shouldn’t be interested only in solving the immediate problems but to be able to look far enough in front of their immediate problem to sustain more in-depth work to provide them with longer term benefits. Although, it may be beneficial for the organisation to find the other strategy and not do something which is totally irrelevant or may turn into benefits in 10 years time rather than to have shorter term goals. From the academic site they need to be real goals and objectives, but from the business perspective those strategies may have to look towards a 3 year period. As most of the companies look at next 3 month and not at next 3 years, thus getting the balance in the objectives for CRC is difficult (P4). The feeling among the Board members is that CRC ISTM has to especially demonstrate a way of operating that enables it to overcome the natural failures of academic-industry interfaces (P8). The pressures of the competitive market and general work environment do not relieve the organisation from constant problems and dilemmas about operational funding that are often out of their control. Participant P5 thinks that the fundamental determinant of CRC future will be its ability to obtain resources, because it is clearly demonstrated that the kind of research that it does, whilst specifically beneficial to certain enterprises and whilst generally beneficial to manufacturing, has not generated returns and revenues from royalties or from product sales. Only substantial external funding from the Commonwealth can sustain that kind of CRC research model. It is believed that neither the research enterprises nor universities have got resources to sustain this kind of operations. It is also unlikely that, the original Government’s intention in starting the CRC program was to have organizations self-funded. It may never happen that an R&D organization can earn enough money to support itself, so it really comes down to whether the government is interested in supporting such organizations. The government will normally support the organization, if the industry also supports the organization, however there is no industry that the government is likely to put any direct cash input (P7).

6.3 Organisational Setting

6.3.1 CRC IMST Organisation

The Centre office is located at CSIRO Manufacturing Science & Technology in Preston, Victoria. This registered office of the company provides central facilities for
the administration of the Centre. The office is located in a very modern building equipped with modest computing and support facilities that could be upgraded for future research needs. The location has good access for the partners and is close to the airport. The office can provide convenient facilities for seminars, conferences and project meetings on a regular basis. The Executive Director, Financial Controller, Research Manager and Office Manager all work from this location. The only exception is the newly appointed Business Development Manager who operates primarily from an office at Tytronics in Adelaide.

6.3.2 Structure of Organisation

The structure of the organisation is relatively uncomplicated and reflects project orientation for research and development that are its major activities (Figure 6.1).


**Legend:** PMC SP – Project Management Committee Structure Program

**The Board of Directors**

The controlling body for the Centre activities is the Board of Directors. The Board’s prime focus has been on policy, strategy and maintaining the regular governance responsibilities. The content of seven members comprised: i) External Director appointed by resolution of the Members to act as Chairperson, ii) Executive Director appointed by the Board, iii) External Director appointed by the ‘A’ Members, iv)
Internal Director appointed by and drawn from Members which are either Universities or CSIRO, v) two Internal Directors appointed by and drawn from ‘A’ Members that do not include Universities or CSIRO, and vi) Internal Director appointed by and drawn from ‘B’ Members which do not include Universities. The Board met on five occasions during the financial year 2002-2003.

**Executive Director**

The Executive Director provides the leadership and direction for the Centre and is responsible for the management of the research, education and commercialisation programs. The work of the Executive Director involves considerable liaison with the researchers and the industry partners. A Research Manager, six Program Leaders and the Research Committee assist him as required. Although project management continues to be a major activity for the Executive Director, some emphasis is placed on strategic planning for the future as recommended by the Government. Project management and strategic development are always an important function that often requires extensive travel to the research locations in the other states. The Executive Director works very closely with the Board of Directors to establish the budgets and to obtain project approvals. He also reports on the Centre's operations at the end of each year quarter. Current director has extensive industrial background and substantial experience in the successful introduction of new technology.

**Research Committee**

The research committee is a permanent advisory body at the Centre. It expands the research base of the program leaders by adding required expertise in particular research areas. This ensures that each research project can have a suitably qualified member on the research committee who is able to assess the quality of the project research and development. All research provider members are represented on the committee to ensure a balance of the research effort. During the year 2002-2003 there were seven formal members of the research committee. Committee members monitor specific projects and are asked to take responsibility for their technical content progress and research innovation. The day-to-day managing of the projects remains vested in the project leaders with responsibility including items such as: progress to milestones, budget performance, quarterly reports, and general progress towards planning goals.
The Committee has particular responsibility for advising the Executive Director and the Board on: i) research content and innovation of existing projects, ii) recommended changes in direction of effort on current projects, iii) formulating and recommending new projects to the Board, iv) resolution of research problems encountered in projects, and setting appropriate direction in association with the project leader, v) advice on intellectual property developments and protection, vi) specialist advice on content and desirability of publishing research papers, vii) advice to business development manager on protection and commercialisation of IP, and viii) assistance in evaluation of potential new research staff. The research committee role in 2002-2003 has continued to be focussed on formulating and evaluating new research projects and providing input to the strategic planning process.

Education Committee
The education committee is responsible for advising the Executive Director on: i) education content of each education project, ii) recommended changes to the direction of education projects, iii) formation of new education project proposals, iv) resolution of problems encountered in education projects, v) advice on intellectual property developments, vi) specialist advice on the content and desirability of published papers, and vii) evaluation of potential new research staff. There were five active members of this committee during the period of research.

Project Management Committee
Project management committee and the program leaders form an integrated part of each individual project that is regarded as the main management tool for project control.

6.3.3 Business Administration
The management of administration activities of CRC IMST is in the hands of a few people only. They are: financial controller, office manager, research manager and business development manager. The financial controller is employed on a flexible part-time basis to focus on budgetary control and protection of Intellectual Property. The office manager is responsible for bookkeeping, office correspondence and records, cash expenditure and project costing, as well as providing the secretarial assistance to the executive director and management team in the organisation. Research manager assists
in project management and development of new relations with the industry. Business development manager works with other members of management team to secure new industry participation and looks after commercial returns from Intellectual Property.

**Staff and Work Time Commitment**

At the time of this study the organisation operated with 66 full-time equivalent staff and 18 postgraduate students. During the financial year 2002-2003 about 144 people operated within CRC IMST system, only 8 were women. The Executive Director worked full time for the Centre. There were 17 participants including industry and academia who committed 100% or more of their time, while 16 people dedicated 50% or over that. Those under 50% of obligation represented about 111 people.

**6.3.4 Communications**

At the program level, the Centre under the Commonwealth Agreement is responsible for the reporting requirements to the Government. In practice, both the Board and the Commonwealth expect the Executive Director to be responsible for all research programs. The Executive Director supervises the program leaders who are in charge of each of six programs. The Board also expects the program leaders and other research committee members to carry the major responsibility for research quality and outcomes. At the project level, the Centre operates as a matrix organisational structure. The other task of project management committee is to ensure that a control of the project, for taxation reasons be vested in the project participants. The management of each project is delegated via the project agreements with the project management committee (PMC), which reports directly to the Board of the CRC IMST. The Centre tends to be structured and operate as a ‘virtual’ enterprise with the research work being conducted at industry and academic sites. However, from the pragmatic viewpoint the ‘virtual’ model is rather impossible for modern research organisations that cannot afford not to have some fixed structures and may not be able to operate efficiently without the minimum of bureaucracy and administration (Sundbo, 2001). Therefore to maintain contact and ownership of the Centre, regular travel to these locations is undertaken by the Executive Director. Project Management Committee meetings are also held on site, with presentations by selected researchers to maintain the integrity. Additionally, each year, all researchers are gathered off site for two days internal conference to share their
experience and to have a complete update on their research progress and to enable researchers to share the insight on each individual projects. Common daily contacts with the outside are maintained by emails or phone conversations but seem to be limited because of the commercial nature of the projects (P7). The main reason for the limited communications is to maintain the high degree of IP protection to only those researchers who are involved with the specific project and have the opportunity for open exchange of opinions. In this sort of environment sharing ideas and knowledge is quite difficult (P4). Industrial partners publish and share knowledge within their organization much easier compared to CRC, what tends to open up new project avenues (P4). Location of projects at various sites and work pressure restrict some researchers face to face communications. Regular meetings are than becoming more of the rarity (P9). However, the Board encourages some sort of informal interactions with the independent work style to support the decision making at the project level (P10). Although this may not suit everybody’s preference the formal meeting allow for everybody to get together with a discussions taking place that encourages ‘bouncing ideas of each other’(P3). Part of official annual gathering event is also social in order to provide the opportunity for networking among organisation’s members. During this annual gathering all matters affecting the Centre and its operations are discussed openly in detail. To summarise this part of case organisation review, it is important to note that CRC objectives are achieved with the recognition from industry partners and by not just doing the research and development together, but also by building relationship in the interaction and the communication of results (P10).

6.3.5 Organisational Culture and Attitudes

Given the fact that all CRC organisations have slightly different structural configurations, even though their makeup integrates academic, industry and government cultural backgrounds, it is fair to expect that each organisation could develop individual social interactive context for delivery of specific outcomes (Mintzberg, 1979a). The cooperative approach adopted by the CRC IMST organisation has demonstrated the ability to bring together entire Australian key manufacturing research institutions related to its activities. This CRC by its nature provides the glue between the industry and the research organizations (P1). The ability to cooperate comes easier when parties understand each others demands. A lot of academics are going into research, because
they like doing their favourite research, where as companies which are in the CRC need to work together to develop common outcomes. The ability to find a common ground allows for different individual motivations to be driven by common outcomes (P4). The personal closeness of the objective and the personal chemistry between people in the team often cement this common ground” (P5). On the other hand, from time to time old sentiments linger where as industry wants to have all the problems solved as soon as possible (P4) while academic researchers are interested to get stuck into long-term blue sky research (P9). It was also articulated that among many other things that Board expects from its members are: i) openness, ii) predisposition towards cooperation, and iii) commitment to achieving the result. The Board claims to create this organisation’s culture by spending a lot time ‘breaking down chimneys culture’ and ‘massaging individuals to make them work better in teams’, as the culture they came from is dominated by a ego (P8).

One of the recognised success factors in CRC practices which ensures a multi-disciplinary contribution to the research is co-location of researchers and the inclusion of industry driven projects with general avoidance of one researcher to any one project. This attitude helped to establish a great system of networking with large number of people (P7). With the exception of some smaller projects that are frequently approved, limited personal participation is required to establish a new research culture. International cooperation is also happening and there are three projects which are being conducted with overseas research institutes. The existence of CRC brings together educational institutions to work with the industry which in many cases would not happen otherwise due to lack of will or resource to conduct the research. On several occasions the success of past relationships has led to a range of additional new projects. Interaction amongst industry partners, both at Board level and outside is a highlight of the CRC process with shared ideas and discussion on successes and failures.

The evaluation of CRC progress is based on formal CRC evaluation criteria applied on a project-by-project basis. The results are discussed during project management committee meetings and all issues and progress are reported to the Board. Late in 2002 a business development manager has been appointed to spearhead evaluation of the potential commercial value of research and possible ways to market outcomes.
Continuation to use patent attorney to assess the merits of projects IP has an advantage particularly where niche technologies being developed are protected by best IP strategies. This has resulted in an increased number of patent applications. Additional links that were developed with the international institutes resulted in several projects being approved with United Kingdom and Germany.

Focussed travel is always encouraged and supported by the Centre to maintain a close association with the other international Intelligent Manufacturing Systems research organisations. The Centre is also an associate member of International Institution for Production Engineering Research. This exposure and the relationships created access to world-class researchers and are available to all CRC partners and is being used for the benefit of Australia. Continual cooperation with external organisations such as Advanced Centre for Manufacturing and Industrial Research Institute Swinburne has resulted in technology diffusion and training that have enhanced members specialist knowledge. Project involvement with the CRC CAST and continual dialogue with the other CRC’s helped to develop new attitudes and research culture within Australia. Opportunities of new business and contacts with companies that aren’t members of the CRC are often explored in search of more industry participation in cooperative research.

However, even if there are occasional frustrations within IMST related to dealing with many different partners and at times setting too many different objectives, this helps organisation to achieve research goals. Very often those frequent interactions are happening by the attraction to CRC capabilities (P10).

Though in the past there were ‘politics’ involved and some CRC members especially from academia may not be particularly interested to cooperate with the Centre, the adequate financial compensations, personal recognition, and a change of universities attitudes towards research conducted at CRC contributed to reasonable engagement and good outcomes benefiting all parties. However, occasional conflicts of interests happen because people involved in research do not only represent CRC, but they represent their own organizations and own cultures (P3; P10). On the other hand, the compromise is reached understanding that successful projects allow organisation to continue into the better future, especially when everybody gets the positive outcome (P3).
It would be difficult to argue the point and bring views of all members about CRC IMST culture, but it is undeniable that it is shaped by cooperation and integration.

6.4 Human Dimensions

People working for CRC IMST are selected during the preliminary interviews based on some criteria’s such as independent conducting of research, ability to lead others or ability to work in teams. Involvement of project leaders and senior researcher’s in interviews process guaranty better assessment of candidates’ knowledge (P8).

Many CRC IMST members especially from academia are either PhD qualified or their work is related to research projects that are subjects of PhD thesis. All postgraduate students at the Centre have CRC IMST founded study. With one exception of Doctoral program leader, Professors run five major research programs.

It is generally accepted that people have to cognate to be able to create new products (P1). CRC IMST is in the strange position, because does not have a core staff that could retain knowledge from previous projects. Instead this knowledge stays within universities and it can be easily lost for the Centre. Keeping a knowledge or moving it around between projects is difficult because the organisational project arrangements, IP agreements and relying on people for their openness to share it and not be selfish (P2).

The Board recognises the problems that organisation faces about creation and sharing of knowledge and therefore organises the annual reviews to encourage free flows of information and exchange of ideas, and presentations of each project to give researchers opportunities for interactions (P10). On the other hand, some members think that the annual report gives such opportunity to the rest of the organization to find out what is happening within, and about the progress on each of the projects (P6). It may not be everybody’s way of dealing or learning but some researchers are very motivated after talking to others when ideas can be ‘bounced around’ and information from many sources could be brought together to develop into something new (P3). The attraction of this approach may be in the fact that the annual review is the only chance for all researchers to meet officially and informally during the coffee brakes. As there are no golden rules how to get good information or be inspired, even reading a science
magazine can be inspiring when one sentence about somebody’s idea could totally change the direction of the research or improve it. The similar results could be achieved after reading 50 or 100 scientific papers to get the same outcome (P3). It may not be very common, but it is through the research and intuition that knowledge about new products or a new idea is sometimes gained. On the other hand it may be the combination of all things put together that tells researcher which is the right direction to go (P4).

Not many people would argue that CRC is driven by gaining knowledge and getting outcomes (P4). CRC is the very good home for PhD students, where they carry through significant research and see the practical application of their work in the industry and become familiar with the sorts of pressure that are on enterprises in the research (P5). Therefore everybody plays certain role in the organisation. The Board decides whether to change direction or take particular actions and through chief executive carries those through (P5). The same applies if people at all levels communicate with one another frequently and clearly to understand what others are doing. This allows reacting when they have a piece of knowledge that might be relevant to others and pass it on (P5). Sharing the knowledge within the Centre tends to be by verbal engagement in formal and informal meetings (P8). However, the common opinion is that learning about things at CRC exposes researchers to realise how much more could be learned (P6). It is also important for CRC organisations to continue remain the relevant, to understand what the business conditions are, to understand what leading edge research is and how that can be reasonably applied to the business needs (P8). As an organisation, CRC also needs to disseminate operating procedures by regular reviewing to ease sharing of knowledge. The possibility exists in the organisation for common understanding that researchers could use knowledge in two ways. One way to better work with the Centre because it is in their private interest to use knowledge to modify their behaviour. The other way is to use research knowledge to advance their careers and their understanding of the particular project (P8).

In the times when many things in research have attached price and ought to be commercialised, some researchers still believe that the organisation has to be open minded to innovative ideas even without the commercial return to start up some sort of
blue sky research (P9). Motivation as well as capability to imagine new things and getting them to the final conclusion could be for some people a ticket to stay at CRC IMST or a matter of personal and organisational survival (P1). Some sort of basis by which different universities, or people from different fields can be inspired must be establish through interactions (P10). Although, motivating people to work for interests of CRC may involve the degree of conflicting values and frustration as many researchers come from different cultures and environment and some may prefer getting the ARC grant, which is much more prestigious for researchers than cooperation with CRC. However, the reward of working for CRC in the long run is in interactions and relationships that are build with the university partner and industry partners and the possibility for spin-off businesses outside of the CRC system (P10). Generally, the innovative work or organisational culture inclined to innovation attracts people who are inclined that way as well as it provides more motivation for people already working there. Over the years CRC IMST learned to be very responsive to industry partner’s needs, but on the other hand some times it could be more serious with the quality of response (P2). This often ensures whether more work is granted from industry to CRC. The IMST organisation puts a lot of effort to ensure that their culture must be able to give new opportunities the best chance of success and in the effort to do so facilitate the best people in Australia for a job (P2). From the personal viewpoint of all CRC staff it may be wise that organisation looks at system of compensating researchers for extra efforts in the form of different rewards, but this is not well spelled out and presented for example in the organisational strategy (P2). What researchers are often left with may not be what they expect from their effort. Many of them have own objectives that they are interested to fulfil, for example own work satisfaction and just being able to see that they are performing well (P3). The fact of acknowledgement by the success of the project may not go well with everybody (P2). There seems to be always expectation from individuals that they will do the best and make the effort towards the goals by working long hours, but there is very little assurance of fairness when it comes to rewards (P3). Like for CRC to be rewarded by the consequent projects from the industry it is equally important to find similar recognition for individuals (P2).

The success of CRC may depend on search and matching the right people from the outside of own circles for the specific projects. For example most people in universities
are personally very interested to work in the area of own expertise and would welcome such opportunities (P2). However self motivation for PhD candidates at CRC is often required to persevere with research ‘nutting through problems’ and trying to solve them as whole experience can be quite draining and otherwise may not happen (P3). Therefore social interactions seem to be perfect and very motivating occasions to talk about ideas.

From time to time it happens that there are some blind players on both sides of CRC cooperation and they decide for their own reason that they are not going to be involved. The assumption is that their motivation may be culturally effected what in turn influences the outcomes. However, the organisation puts a lot of effort on the cooperative team arrangement and hopes to develop a new culture where the expectation is that working together will bring outcomes together (P4). Generally, many people in the organisation share the view that they want to see the Australian industry survive and grow and they get satisfaction out of seeing Australian business doing well, but that may not be what drives everybody. It is also truth that maybe personal drive to achieve projects, to get the personal satisfaction out of it is what drives many researchers. “We are all ‘getting a kick’ out of an outcome, out of each of the projects” (P4). In the fact everybody is motivated by different things and “money plays an important role, but only if there is a big differentiation to what you can get out in other places” (P4). In the opinion another participant (P5), the great majority of people working in CRC are motivated by the fun of solving the problems and they get the buzz out of achieving results that are meaningful.

In the type of work environment CRC is, enterprises or the individuals from the universities who do not enjoy the team work tend to self select themselves out. It is pretty prosaic and everybody knows that people should communicate with one another frequently and clearly, share their knowledge, but somehow “we are not very good at doing it” (P5).

The attitude of the Board is to be an example in how the organisation should work by keeping in touch with other members of the organization and have good knowledge of what their interests are. The expectation of good communications is in both directions
between top and bottom of CRC. Board tries to give as much opportunity, space, remove the blockages from people to get on with what is interesting them in order to help them in what they are seeking to achieve (P5). The Board’s attitude is to compensate adequately for what people are doing and at least pay them what their reasonable expectations are, because adequate rewards can be transformed into the intellectual stimulation and innovation (P8). It is also probably without much of controversy to say that successful organisations “are typically run by people who are very interested in what they do anyway, that is how they build business in the first place” and success does not come without the effort or may not be achieved with effort only. Therefore those people who are making a good effort and are successful, CRC cannot miss to recognise and reward. (P5).

The amount of the evidence supporting good intentions of management is coming from many interviews with IMST. The organisation puts a lot of effort to attract researchers, make them familiar with the rest of the team, to seek their opinions, and to encourage them in knowledge sharing, but how those individuals would behave is probably beyond anybody’s imagination (P6). Some organisation members have the opinion that whether they committed to the CRC or not, at the end of the day it is a job, so they treat it like anything else (P7).

The work pressure on researchers at CRC IMST reflects a different environment that they have to manage individually. Research has limits and things that don’t work are stopped and “not just research of to the never-never in the terms of hope” It is often a matter of using your own intelligence to target the right areas, to go and work out in some kind of priority order based on the experience (P8).

It is difficult to generalise about such issue as human motivation, but like in any profession, researchers are a unique category of people and most are probably motivated just by research work they do. Some of them are even happy when they get good publications out of these projects (P9).
6.5 Performance Outcomes

In general terms functioning and performance of an organisation depends on inputs, process and outcomes. As inputs CRC IMST recognised: i) extent of participation by each partner in research and support programs, ii) degree of direct industry involvement in research projects, and iii) industry personnel involvement in training initiatives. The active processes in the organisation involve: i) the number and frequency of interchange of personnel between participating organisations, ii) degree of consultation between education providers and industry, and iii) number of industry test sites for the Centre. Expected outputs could be classified as: i) the number and significance of collaborative activities, and the level of industry involvement, ii) adoption, by industry of products and processes based on Centre results, iii) commercial returns to those utilising the Centre's research, iv) extent to which the Centre's research has been used as the basis of new extended projects, v) recruitment and retention of quality staff, and vi) achievement of milestones within projects. Performance outcomes may differ for various people working in organisation depending on functions they have to perform. However, for the majority of members the emphasis would be on projects with good industrial solutions.

It is always within the policy of this CRC organisation to make cooperative efforts to get the outcomes which are relevant and acceptable to the industry partners, but at the same time to keep the balance looking after CRC interests as well (P10). This balance is difficult to maintain as most of projects are driven by industry with the inclination towards commercialisation (P10). It is worth to know that the interests of CRC members are maintained by a certain percentages of financial gains that flow to the team and than to the individuals (P7). The focus on outcomes such as patents, new products, new processes for the industry that can be sold or licensed could become part of the strategic direction of the organisation (P7). The possibilities of spin-off companies from CRC research are real but the numbers of cases in the history of CRC program are few (P10). There is also an opinion that outcomes like publications and obtaining more external grants could highlight the organisations research potential but the ultimate success comes down to having tangible projects and industry players that actually will get benefit out of CRC (P3). It is rare but some individuals have their own personal goals in terms of research and development at CRC, for example, to become a research leader (P3). Those working in industry ‘get kick out of the organization’
because they like to be on the edge, they like driving a new ‘staff’, and ‘they do not do it for the money evil’ (P4). Quite often it is difficult for CRC to understand what market place demands from industry partners and this may be a result of conflicting outcomes or conflicting objectives (P4). The accepted opinion in industry is that CRC should be working with the right goals and directions which ought to have practical application in order to achieve their objectives (P4; P5). In the opinion of industry quarterly, 6 monthly or annual reports which every CRC puts out are not the measure of their performance (P7). Industry has rather low appreciation of such outcomes as PhD thesis (P4). On the other hand, CRC see industry as only interested in solving the immediate problems and not being capable to look far enough in to the future beyond their immediate problem. This tends to leave them in the open when competition gets tough or new products start to undercut their market (P5). In cases when CRC outcomes are set by the industry the specifications are based on a specific time frame that reflects the best return for the research dollar invested in the research outcome.

It is important to note that in all pursuits CRC organisation has to rely on teamwork in order to produce outcomes and the only true reward despite the rhetoric from the Board is basically the outcome of project to the organisation and industry users (P9). In 2002-2003 CRC IMST openly published for the last time the annual report with Key Performance Indicators. These indicators will be discussed further in this chapter.

6.6 Results from Case Study Data Analysis
The outcomes from data analysis for the CRC IMST case study include the results from interviews, surveys and key organisational performance indicators.

6.6.1 Interviews
The process of coding was conducted using NVivo software. The first analysis of interviews data using broad-brush coding method revealed in total over eight hundred codes related to three major factors which made research framework. They were all broad-brush nodes (B-BN). The detail evaluation of node profiles from NVivo showed the information displaying numerical values of each type of node, but their relevant value had to be recalculated as there were different numbers of questions present in the research instrument for each major factor. The text from each case study also varied in
size. The approximate number of all words from case study one interviews was 25430. At this stage of the analysis creation of Node Density Indicator (NDI) allowed for adequate assessment of the significance of each major factor in the organisation (Table 6.1). Listed NDI’s represent the numbers of nodes per 10000 words of text data from interviews.

<table>
<thead>
<tr>
<th>FACTORS</th>
<th>NUMBER of QUESTIONS</th>
<th>B-BN</th>
<th>NDI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognition</td>
<td>7</td>
<td>142</td>
<td>7</td>
</tr>
<tr>
<td>Culture</td>
<td>9</td>
<td>367</td>
<td>16</td>
</tr>
<tr>
<td>Motivation</td>
<td>5</td>
<td>309</td>
<td>24</td>
</tr>
</tbody>
</table>

Table 6.1   Major factors nodes distribution from CRC IMST interviews (Author).

Based on the preliminary results from the first level of data analysis, it could be stated that the majority of attention in organisational affairs is concentrated on issues of motivation. Cultural significance presents about thirty percent less concerns, with cognition least significant.

The next set of results came from the detail analysis of each of the major factors. This second stage of coding from the initially coded broad brush data involved specific coding into elementary nodes according to the descriptions of the preselected frameworks and elementary nodes as described in chapter three. Results of the break down of major factors into elementary nodes are presented in Table 6.2.

<table>
<thead>
<tr>
<th>FACTORS</th>
<th>ELEMENTARY NODES</th>
<th>NUMBER of NODES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scanning</td>
<td></td>
<td>77</td>
</tr>
</tbody>
</table>

The summary of all nodes significance and distribution for groundedness and density is shown in Table 6.3.
<table>
<thead>
<tr>
<th>Cognition</th>
<th>Sensemaking</th>
<th>116</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Action from learning</td>
<td>105</td>
</tr>
<tr>
<td>Total Cognition elements</td>
<td>298</td>
<td></td>
</tr>
<tr>
<td>Innovation enhancing</td>
<td>287</td>
<td></td>
</tr>
<tr>
<td>Innovation hindering</td>
<td>87</td>
<td></td>
</tr>
<tr>
<td>Attention to detail</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Outcome orientation</td>
<td>154</td>
<td></td>
</tr>
<tr>
<td>Process orientation</td>
<td>219</td>
<td></td>
</tr>
<tr>
<td>Culture</td>
<td>Individual orientation</td>
<td>46</td>
</tr>
<tr>
<td>Team orientation</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Competitiveness</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Easy going</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Stability</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Growth</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Total Culture elements</td>
<td>908</td>
<td></td>
</tr>
<tr>
<td>Effort</td>
<td>225</td>
<td></td>
</tr>
<tr>
<td>Performance</td>
<td>101</td>
<td></td>
</tr>
<tr>
<td>Motivation</td>
<td>Reward</td>
<td>68</td>
</tr>
<tr>
<td>Goal</td>
<td>218</td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>102</td>
<td></td>
</tr>
<tr>
<td>Total Motivation elements</td>
<td>714</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ELEMENTARY NODES (EN)</th>
<th>TOTAL NUMBER OF EN</th>
<th>ELEMENTARY NODES DISTRIBUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scanning</td>
<td>77</td>
<td>1</td>
</tr>
<tr>
<td>Sensemaking</td>
<td>116</td>
<td>6</td>
</tr>
<tr>
<td>Action from learning</td>
<td>105</td>
<td>5</td>
</tr>
<tr>
<td>Innovation enhancing</td>
<td>287</td>
<td>14</td>
</tr>
<tr>
<td>Innovation hindering</td>
<td>87</td>
<td>11</td>
</tr>
<tr>
<td>Attention to detail</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Outcome orientation</td>
<td>154</td>
<td>11</td>
</tr>
<tr>
<td>Process orientation</td>
<td>219</td>
<td>15</td>
</tr>
<tr>
<td>Individual orientation</td>
<td>46</td>
<td>1</td>
</tr>
<tr>
<td>Team orientation</td>
<td>60</td>
<td>5</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>24</td>
<td>4</td>
</tr>
<tr>
<td>Easy going</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>Stability</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Growth</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Effort</td>
<td>225</td>
<td>12</td>
</tr>
<tr>
<td>Performance</td>
<td>101</td>
<td>8</td>
</tr>
<tr>
<td>Reward</td>
<td>68</td>
<td>3</td>
</tr>
<tr>
<td>Goal</td>
<td>218</td>
<td>28</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>102</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 6.2 Elementary nodes values for CRC IMST (Author).

Table 6.3 Elementary nodes distribution for CRC IMST (Author).
Analysis of elementary nodes is on the basis of their profile value for groundedness and density based on priori set rule stating that only those elementary nodes that have at least three occurrences in each case study organisation or come from three independent sources would be taken up for further examination. This resulted in rejecting some of the nodes as not significant for further research. The summary of all elementary nodes significance is presented in Table 6.4. Node ‘attention to detail’ will not be considered in the next stage of analysis due to its of low relative value to research.

The next stage of the analysis process involved sorting nodes into four classes: i) insignificant, ii) minor, iii) major, and iv) fully supported, accordingly to their occurrences in the case study data (Table 6.5).

<table>
<thead>
<tr>
<th>ELEMENTARY NODES</th>
<th>DENSITY and GROUNDEDNESS of ELEMENTARY NODES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scanning</td>
<td>77 (10)</td>
</tr>
<tr>
<td>Sensemaking</td>
<td>116 (10)</td>
</tr>
<tr>
<td>Action from learning</td>
<td>105 (10)</td>
</tr>
<tr>
<td>Innovation enhancing</td>
<td>287 (10)</td>
</tr>
<tr>
<td>Innovation hindering</td>
<td>87 (10)</td>
</tr>
<tr>
<td>Attention to detail</td>
<td>2 (2)</td>
</tr>
<tr>
<td>Outcome orientation</td>
<td>154 (10)</td>
</tr>
<tr>
<td>Process orientation</td>
<td>219 (10)</td>
</tr>
<tr>
<td>Individual orientation</td>
<td>46 (10)</td>
</tr>
<tr>
<td>Team orientation</td>
<td>60 (10)</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>24 (8)</td>
</tr>
<tr>
<td>Easy going</td>
<td>13 (8)</td>
</tr>
<tr>
<td>Stability</td>
<td>9 (5)</td>
</tr>
<tr>
<td>Growth</td>
<td>7 (4)</td>
</tr>
<tr>
<td>Effort</td>
<td>225 (10)</td>
</tr>
<tr>
<td>Performance</td>
<td>101 (10)</td>
</tr>
<tr>
<td>Reward</td>
<td>68 (10)</td>
</tr>
<tr>
<td>Goal</td>
<td>218 (10)</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>102 (10)</td>
</tr>
</tbody>
</table>

Table 6.4 Significance of the elementary nodes for CRC IMST case study (Author).
It could be observed that the ‘fully supported’ nodes formed the group of themes majority that seem to be of concern to everybody in the organisation, though ‘competitiveness’, ‘easy going’ and ‘stability’ should not be discarded either as not important as they create the nascent conditions for innovation. ‘Growth’ had only minor interest among organisation members, while ‘attention to detail’ had the lowest score.

Further analysis of the significantly condensed data involved selection of only one elementary node from each of the major factors of cognition, culture and motivation with the highest ranked relative value and subsequent intersection process of those nodes content text available from NVivo. These nodes were: i) ‘sensemaking’ from cognition, ii) ‘innovation enhancing’ from culture, and iii) ‘effort’ from motivation. After this step, the data was further reduced to manageable smaller size of twenty common text passages. The final interpretation of this short dense data allowed creation of few new uniform nodes (Table 6.6). The generalised nodes with their occurrence values represent the final indicators of the new concept theory. The generalised, short meaning of final indicators was established to be perception, participation and objective.

**Table 6.5 Categories of nodes from CRC IMST case study (Author).**

<table>
<thead>
<tr>
<th>FULLY SUPPORTED</th>
<th>MAJOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scanning</td>
<td>Competitiveness</td>
</tr>
<tr>
<td>Sensemaking</td>
<td>Easy going</td>
</tr>
<tr>
<td>Action from learning</td>
<td>Stability</td>
</tr>
<tr>
<td>Innovation enhancing</td>
<td></td>
</tr>
<tr>
<td>Innovation hindering</td>
<td></td>
</tr>
<tr>
<td>Outcome orientation</td>
<td></td>
</tr>
<tr>
<td>Process orientation</td>
<td></td>
</tr>
<tr>
<td>Individual orientation</td>
<td></td>
</tr>
<tr>
<td>Team orientation</td>
<td></td>
</tr>
<tr>
<td>Effort</td>
<td></td>
</tr>
<tr>
<td>Performance</td>
<td></td>
</tr>
<tr>
<td>Reward</td>
<td></td>
</tr>
<tr>
<td>Goal</td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td></td>
</tr>
<tr>
<td>MINOR</td>
<td>INSIGNIFICANT</td>
</tr>
<tr>
<td>Growth</td>
<td>Attention to detail</td>
</tr>
</tbody>
</table>

148
The analysis of final indicators distribution from Table 6.7 was conducted by the assessment of their properties of groundedness and density that allowed establishing their relative values which would be more meaningful in the analysis of concluding results (Table 6.8). The calculation method for the relative indicator numbers is described in chapter ten.

<table>
<thead>
<tr>
<th>COMMON THEME NODES</th>
<th>GENERALISED INTERPRETATION of COMMON TEXT DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perception</td>
<td>Participation</td>
</tr>
<tr>
<td>20</td>
<td>13</td>
</tr>
</tbody>
</table>

Table 6.6  Results of generalised interpretation of data for CRC IMST (Author).

<table>
<thead>
<tr>
<th>FINAL INDICATORS</th>
<th>NUMBER of INDICATORS</th>
<th>FINAL INDICATOR DISTRIBUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARTICIPANTS</td>
<td>P1</td>
<td>P2</td>
</tr>
<tr>
<td>Perception</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>Participation</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>Objective</td>
<td>6</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 6.7  Final indicator distribution for CRC IMST organisation (Author).

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>Perception</th>
<th>Participation</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>DENSITY and GROUNDEDNESS</td>
<td>13 (6)</td>
<td>11 (6)</td>
<td>6 (3)</td>
</tr>
<tr>
<td>RELATIVE VALUE</td>
<td>14.32</td>
<td>12.53</td>
<td>6.71</td>
</tr>
</tbody>
</table>

Table 6.8  Final values of primary data indicators (Author).
6.6.2 Surveys

Surveys could be an additional mean to qualitative research to verify its meaning and to provide attributes that give more credibility to research evidence. The research instrument used in this study allowed conducting at the end of interviews quick and preliminary assessment of interview participants opinions about the major influence of the key research framework factors on innovation. Results of this additional assessment for CRC IMST are listed in the Table 6.9 and demonstrate that immediate opinion of participants about the influence of culture and motivation on innovation was equally important without giving any consideration for the role of cognition.

<table>
<thead>
<tr>
<th>PARTICIPANT</th>
<th>MAJOR FRAMEWORK FACTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>COGNITION</td>
</tr>
<tr>
<td>P1</td>
<td></td>
</tr>
<tr>
<td>P2</td>
<td></td>
</tr>
<tr>
<td>P3</td>
<td></td>
</tr>
<tr>
<td>P4</td>
<td></td>
</tr>
<tr>
<td>P5</td>
<td></td>
</tr>
<tr>
<td>P6</td>
<td></td>
</tr>
<tr>
<td>P7</td>
<td></td>
</tr>
<tr>
<td>P8</td>
<td></td>
</tr>
<tr>
<td>P9</td>
<td></td>
</tr>
<tr>
<td>P10</td>
<td></td>
</tr>
</tbody>
</table>

Table 6.9 Opinion survey about the importance of major factors on innovation in CRC IMST (Author).

The more comprehensive survey of interviews participants resulted in the tabulation of the attributes and data that permitted greater in depth analysis to understand the case study (Table 6.10).
<table>
<thead>
<tr>
<th>PARTICIPANT</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>P5</th>
<th>P6</th>
<th>P7</th>
<th>P8</th>
<th>P9</th>
<th>P10</th>
</tr>
</thead>
<tbody>
<tr>
<td>POSITION at CRC</td>
<td>RES</td>
<td>IND</td>
<td>RES</td>
<td>IND</td>
<td>BD</td>
<td>RES</td>
<td>PL</td>
<td>BD</td>
<td>PL</td>
<td>PL</td>
</tr>
<tr>
<td>QUALIFICATION</td>
<td>B</td>
<td>P</td>
<td>P</td>
<td>B</td>
<td>P</td>
<td>M</td>
<td>P</td>
<td>B</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>GENDER</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>AGE GROUP</td>
<td>25-34</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>#</td>
<td>34-45</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
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<td></td>
<td></td>
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<td>#</td>
<td>45-60</td>
<td>X</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>#</td>
<td>60+</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YEARS of CRC EXPERIENCE</td>
<td>10</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>3.5</td>
<td>5</td>
<td>9</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>CULTURAL SENSITIVITY</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>TWO PREVIOUS JOBS</td>
<td>1st</td>
<td>IND</td>
<td>ST</td>
<td>ST</td>
<td>RES</td>
<td>AC</td>
<td>IND</td>
<td>RES</td>
<td>IN</td>
<td>D</td>
</tr>
<tr>
<td>2nd</td>
<td>AC</td>
<td>RES</td>
<td>RES</td>
<td>IND</td>
<td>AC</td>
<td>IND</td>
<td>RES</td>
<td>IN</td>
<td>D</td>
<td>IN</td>
</tr>
<tr>
<td>PEOPLE in NETWORK</td>
<td>50</td>
<td>80</td>
<td>2</td>
<td>20</td>
<td>10</td>
<td>15</td>
<td>17</td>
<td>120</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>MEETINGS</td>
<td>FORMAL</td>
<td>1</td>
<td>40</td>
<td>2</td>
<td>60</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>#</td>
<td>INFORMAL</td>
<td>50</td>
<td>80</td>
<td>8</td>
<td>200</td>
<td>1</td>
<td>15</td>
<td>5</td>
<td>40</td>
<td>20</td>
</tr>
</tbody>
</table>

Table 6.10 Survey data about CRC IMST interviews participants (Author).

Legend: Positions at CRC have following meaning: RES = researcher, IND = industry participant, BD = member of board of directors, PL = project leader.
Qualification codes represent: B = bachelor, P = PhD, M = masters.
Gender: M = male, F = female
Sign '#' = means the same description as above.
Cultural Sensitivity = knowledge of other language than English that increases the probability of greater cultural awareness than that of single culture.
People in Network = the number of people in personal network related to work at CRC.
Meetings Formal and Informal = the number of arranged meeting per month.
Meetings Informal = the number of unplanned and spontaneous meeting/discussions per month.
The survey results reflect the unique composition of the CRC IMST organisation. By coincidence, all interviewed members were male and half of them were PhD qualified. Majority of participants were between 45 and 60 years of age with an average of 6.6 years of experience within the CRC organisation. Fifty percent of interviewed CRC members had two last jobs of the same type, five had industry experience, four worked previously in research and other four had academic experience. It appears that four out of ten participants could be classified as more sensitive to cultural aspects of life/work because of their exposure to other language/culture. The knowledge of another language and type of work experience signified to the author the possibility of deeper awareness of the cultural values that could be described as personal, national or organisational and which may have the influence on members work attitudes.

Many people work for CRC organisations on part-time basis. The total contribution of all people time represents the equivalent of organisations personnel size calculated as ‘full time equivalent research staff’. Taking into consideration the total number of 144 people who worked during the year for the organisation and the average size of the network calculated from People in Network in Table 6.9 as 36 people, it gives reader the picture that each member may operate or know the quarter of all organisational staff.

The additional analysis of data about average number of informal meetings for each type of work/function within organisation and corresponding size of the network related to that function extracted from Table 6.10 are presented in Table 6.11.

<table>
<thead>
<tr>
<th>ATTRIBUTES</th>
<th>TYPE of WORK at CRC IMST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RES</td>
</tr>
<tr>
<td>Average of Informal Meetings</td>
<td>24</td>
</tr>
<tr>
<td>Average of Network Size</td>
<td>22</td>
</tr>
</tbody>
</table>

Table 6.11  Network size and intensity of networking at CRC IMST (Author).
It seems evident from the survey data that on average the number of informal meetings for industry partners is nearly three times larger than the size of their network, while for board members it is opposite. The network size for board is three times larger than the number of informal meetings they may have during the month. It is also that researchers and industry partners have more informal meetings than the size of their networks which may suggest larger frequency and need for personal exchanges of information with certain people in network. Network sizes for industry partners and board members are more than twice as large than those of researchers and project leaders which may indicate that it is part of their function to see ‘nearly everybody’. A conclusion can be drawn that the network size and the networking intensity seem to be showing slight growth trend with increasing years of experience for members of CRC IMST organisation (Figure 6.2).

![Figure 6.2 Attributes of CRC IMST networks (Author).](image)

The other conclusion that emerges from the survey is that the ratio for the average number of informal to formal monthly meetings at CRC, could suggest the need or
intensity of communications of its members. For CRC IMST organisation this ratio is three and a half, which could mean that people interact with each other about three times more often than the opportunities presented by the formally arranged meetings.

Data about years of experience, network size, networking intensity and total number of people engaged in the Centre was extracted from Table 6.10 to express the Connectivity Indicator (CI) for the organisation members according to the formula described in the chapter. Value of contributing attributes and final CI indicator are in Table 6.12. Richness of connectivity has no real value, however when compared with the other case study organisations may lead to some relevant conclusions. This analysis is presented in chapter nine.

<table>
<thead>
<tr>
<th>ATTRIBUTES</th>
<th>VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Years of Experience</td>
<td>6.6</td>
</tr>
<tr>
<td>Average Network Size</td>
<td>36</td>
</tr>
<tr>
<td>Average Networking Intensity</td>
<td>3.5</td>
</tr>
<tr>
<td>Total Number of People Involved</td>
<td>144</td>
</tr>
<tr>
<td><strong>CONNECTIVITY INDICATOR</strong></td>
<td><strong>8.3</strong></td>
</tr>
</tbody>
</table>

Table 6.12  Connectivity at CRC IMST (Author).

### 6.6.3 Organisational Performance

The information about organisational performance has been extracted from the CRC IMST annual report 2002-2003. This data represents only those indicators that are common to all three case study organisations. It is beyond the scope of this study and practically impossible to present all organisational performance indicators and to conduct some meaningful comparison and analysis. As an example one of the indicators in the report is “Partners revenue to increase from $500M to $900M”. This statement may represent sincere organisational intention, but does not have much value for analysis. Perhaps this is the traditional tendency required by the government reporting requirements that is generally more focused on the compliance to CRC program goals, rather than to tangible research outcomes. The combined data used for the purpose of analysis of the organisation is presented in the Table 6.13.
<table>
<thead>
<tr>
<th>ATTRIBUTES</th>
<th>PERFORMANCE INDICATOR</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTCOME</td>
<td>Economic benefit to Centre ($1M)</td>
<td>0.127</td>
</tr>
<tr>
<td>INPUT</td>
<td>Government money p.a. ($1M)</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>Total money p.a. ($1M)</td>
<td>9.6</td>
</tr>
<tr>
<td>OUTPUT</td>
<td>Journal papers</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>Conference papers</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Postgraduates completed</td>
<td>0</td>
</tr>
<tr>
<td>RELEVANCE OF R&amp;D</td>
<td>Awards</td>
<td>3</td>
</tr>
<tr>
<td>INPUT</td>
<td>Research programs resources ($1M)</td>
<td>8.9</td>
</tr>
<tr>
<td>MEMBERS</td>
<td>Full Time Equivalent staff</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>Postgraduate students</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Total members</td>
<td>144</td>
</tr>
<tr>
<td>OUTPUTS</td>
<td>Patents</td>
<td>1</td>
</tr>
<tr>
<td>COOPERATIVE</td>
<td>External Collaborations</td>
<td>3</td>
</tr>
<tr>
<td>ARRENGEMENTS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6.13  Key Performance Indicators for CRC IMST organisation (Author).

It is commonly accepted that one of the most important indicators of organisations business activities is profit. The economic benefit to the Centre is represented by the organisation earnings in the financial year. In general, the issue of CRC profitability in the strict business sense tends to be very sensitive to the Government. The other important indicator of CRC IMST activities is the total money they used during the financial year. The role of partners as contributors of funds is crucial to the existence of the CRC programs and demonstrates CRC ability to attract interest and money from outside. The size of the available fund could be linked to many factors, for example entrepreneurial skills of the Board or the demand for certain type of services and products on the market. From the research viewpoint it is unique to this type of culture, the number of publications from the organisation and the rewards achieved for its
activities often give more pride to members than economic profits. The other similar measure of the organisation’s success could be in number of successful patents and postgraduate students completing their study sponsored by the Centre. For relevance and credibility of analysis, these outcomes are compared to the effort put by the number of people engaged during a year 2002-2003 with the CRC IMST. However, the true value of all organisational performance outcomes can only be realised if compared to the performance of other similar organisations. In order to make comparison between each case study organisations easier, data from Table 6.12 has been compiled into Major Performance Indicators (from C1 to C8) and than calculated into one single Total Performance Indicator (TPI) as explained in chapter four. Value of TPI for CRC IMST is presented in Table 6.14.

<table>
<thead>
<tr>
<th>MAJOR PERFORMANCE INDICATORS</th>
<th>INDICATOR VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>5.1</td>
</tr>
<tr>
<td>C2</td>
<td>0.013</td>
</tr>
<tr>
<td>C3</td>
<td>0.24</td>
</tr>
<tr>
<td>C4</td>
<td>0</td>
</tr>
<tr>
<td>C5</td>
<td>0.007</td>
</tr>
<tr>
<td>C6</td>
<td>0.021</td>
</tr>
<tr>
<td>C7</td>
<td>0.33</td>
</tr>
<tr>
<td>C8</td>
<td>0.9</td>
</tr>
<tr>
<td>TPI</td>
<td><strong>0.52</strong></td>
</tr>
</tbody>
</table>

Table 6.14 Major Performance Indicators CRC IMST (Author).

Legend:
C1 = Leverage (Total Money/Government Money)
C2 = Economic benefit to Centre/Government Money
C3 = Journal and Conference Papers/Total CRC Members
C4 = Postgraduates completed/Total CRC Members
C5 = Patents/Total CRC Members
C6 = External Collaborations/Total CRC Members
C7 = Staff Time Commitment (Full Time Equivalent Staff/Total CRC Members)
C8 = Research program resources/Total Money
Full comparison of performance results for all case study organisations is presented in chapter nine.
CHAPTER SEVEN
Case Study Two – CRC CAST

7.1 Introduction
This chapter examines in some detail the second case study organisation, the Cooperative Research Centre for Cast Metals Manufacturing (CRC CAST) and deals with the issues of organisation’s settings, human dimensions and organisation’s performance outcomes. In addition, there are some quotes presented from the interview participants in this chapter, which could be identified by the abbreviation ‘P’ with the corresponding number from 11 to 20. The description of the case study organisation supplements results from data analysis according to the process described in chapter four.

7.2 Overview of Case Study Two Organisation
CRC CAST is an unincorporated joint venture involving nineteen core participating organisations. This includes four universities, eight manufacturing companies, CSIRO, the States of Queensland and Victoria and other organisations supporting casting industry. CAST is recognised as a strategic asset to the Light Metals Industry in Australia through partnerships developed between complementary research groups within Australia's industry, education and government sectors. The organisation was established as part of the Australian Commonwealth Government's Cooperative Research Center Program and commenced operations in July 1999. The Centre continues and extends research related activities on light metals previously carried out under the name CRC for Alloy and Solidification Technology, which operated between 1993 and 1999. At the time of collecting data, it had completed four years in the second round of seven years cycle of operational period. During the financial year 2002-2003 the total money available to the organisation was $22.1 M.

CAST focuses its expertise on the issues related to light metals processing and manufacturing for die casting industries. Australia has a large aluminium industry, which is fifth largest in the world and produces approximately 1.5 million tones of
aluminium annually. One of the current issues related to light metals in Australia is also to become one of the major producers of magnesium based products based on extensive magnetite mineral deposits. Worldwide growth in demand for light metals is mainly driven by the automotive industry where it is used to decrease vehicle weights and fuel consumption along with lower emissions. This among other factors creates an opportunity for Australian light metals production, processing and manufacturing industries. CAST operates globally and works with partners around the world. Through such partnerships, new opportunities are increasingly created for Australian companies to provide innovative solutions and commercialization of new technologies. The specific areas of organisation’s research expertise include: solidification technology, physical metallurgy of light alloys, casting processes, tooling technology, manufacturing systems, design and prototyping of light alloy castings.

7.2.1 Mission Statement
CAST mission is to be a partner of choice for creation of innovative light metals technology that benefits Australia. It aim is to help companies to adopt innovative solutions through cooperation.

7.2.2 Objectives
Some of the main objectives of the organisation are: i) to promote a corporate culture that reinforces effective communications, ii) to maintain diversity of research providers while encouraging face-to-face interactions between the management team, research teams and stakeholders, iii) to position the organisation as a global partner of choice for the creation of innovative light metals technology, iv) to maximise the benefits of research through an enhanced process of utilisation, commercialisation and technology transfer, v) provision of improved services to partners that could support marketing credibility, vi) to managed commercialisation effectively, vii) to promote professional development of staff, viii) to share organisational culture and values for the benefit of Australian nation.

7.2.3 Strategy
Organisation’s strategy is to achieve results through the cooperation of other research providers and industry partners. It is believed that by bringing together world-class
people, facilities and many new ideas, innovations could be materialised effectively. Providing training across Australian light metal industry may be beneficial to long-term survival of the industry and could benefit the Centre in the longer run. There seems to be no preference for business engagement with any companies as long as their core business and involvement is in light metals. That resulted in the successful cooperation with many of SME's through ongoing Die Casting Best Practice project. The project was established in conjunction with the Australian Die Casting Association (ADCA) to transfer technology to small die casting companies and to develop their knowledge and skills in order to improve manufacturing performance. CAST has developed its technology and expertise by undertaking a large number of projects with its industry partners. The Best Practice project was the mechanism by which SME's could share the outcomes of some of the latest research through the development of innovative solutions to everyday manufacturing problems. Many projects with the other companies focus on addressing problems or opportunities encountered by them and ensuring that the outcomes could result in improved company performance. The approach provided visible proof of the value of CAST research and educational support activities in identifying and implementing technologies appropriate to industry needs. Partnerships with SME die casting companies provide valuable support for benchmarking company specific improvement projects, energy use audits and training programs. In addition, the Best Practice program facilitates organisational learning through a process of concurrent human resource development. The Best Practice project is valuable in improving the performance and competitiveness of the participating companies and is a very successful CAST initiative. This program also offers an opportunity for die casting companies to participate in CAST as associate members and to access diverse network of resources at CSIRO, Deakin University, Monash University, the Industrial Research Institute at Swinburne University of Technology and the University of Queensland.

7.2.4 Members, Customers, Industry Partners and Alliances

Most of the organisation’s customers and partners come from an industry, but strong relationships are maintained with four universities to expand research and educational base. During the year 2002-2003 CAST core participants included: Australian Die Casting Association Limited, Australian Magnesium Corporation Pty Ltd, CAST Centre Pty Ltd, Comalco Aluminium Limited, CSIRO, Deakin University, Ferra Engineering
Apart from core participants in CRC CAST activities a strong interest was also shown from the eighteen ‘associated members’, who have agreed to have limited cooperation under special conditions. Centre's attitude has always been to attract even limited interest from outside organisations that could in longer-term change towards more committed core partners.

Over the years a number of leading Australian Companies such as Ford, Nissan casting or Holden benefited from the collaborative programmes. All of CAST partners have learned to work and benefited from the cooperative arrangements to develop products or manufacturing processes with opportunity to share knowledge, experience and resources. Some organisations form alliances with CAST to directly benefit from tailored business developments according to their needs. Two such partners are: Australian Magnesium Corporation Pty Ltd and Shandong Bohai Piston Group.

7.2.5 Projects and Arrangements
One of the emphases in each project run by CAST is to explore the opportunity to commercialise outcomes of the research. During the early project development stages decisions are made to identify areas where more in depth work needs to be carried out in order to produce unique intellectual property. These early stage reviews help to justify the project budgets and the necessary research activities for the anticipated outcomes. During the business year 2002-2003, CRC CAST had twenty research projects implemented by industry and seven continuing international collaborations. Most of the projects involve new production processes or improvements, for example, CASTcoat improves life of dies for low and gravity casting. However, some outcomes resulted in new product such as CASTvac low cost vacuum valve for the high pressure casting.
7.2.6  Intellectual Property Protection and Commercialisation

One of CAST objectives is to ensure that the research and development efforts are utilised and implemented by the industry. The industry participants provide the most effective route to market for many new technologies. Several of CAST patent protected technologies have been licensed to industry partners who either used it or take it to the end users. When the opportunities for these technologies are identified by the industry CAST undertake research with a direct input from the end users. In some instances, the industry participants may require non-exclusive access to CAST technology and therefore different licensing arrangements may have to be established. In this context, CAST needs to manage the creation, protection and commercialisation of intellectual property for the Centre, its participants and Australia. As a research organisation, one of CAST core activities is the creation of intellectual property (IP). IP represents one of the key assets of the organisation, therefore its management is critical to ensure industry adoption of technology. At the same time, CAST ensures that maximum returns on IP could be achieved. CAST strategy for managing IP includes four steps: i) to identify IP created within the project, ii) to establish the most appropriate means of protecting the IP, iii) to determine and implement a strategy for the technology to be accessed and adopted by the industry, and iv) actively manage IP on a portfolio basis in order to establish maximum value that can be created and delivered.

Protection and management of IP at CAST is in the interest of the whole organisation and this culture has been nurtured. Research staff has been provided with training and support to help them implement, protect, commercialise and transfer the technologies developed within CAST. IP could be identified through the project review process and direct interaction with sector leaders and project teams. Every IP is recorded in CAST proprietary IP database. CAST has engaged the Strategic Technology Evaluation and Management (STEM) Partnership to provide an independent valuation of its IP portfolio. At a project level, STEM can identify benefits of the technology to CRC as well as the industry participants and quantify the financial values of the portfolio. STEM can also identify and quantify the risks associated with developing, commercialising and implementing new technologies. The licensing ability of CAST patent protected technologies for industry partners results in significantly improved
performance of their manufacturing operations with decreasing cost reducing and improved productivity.

7.2.7 Business Environment

CRC CAST faces strong competition from overseas manufacturers and suppliers. Subsidised production of aluminium or magnesium from some countries may put at risk some new investments in Australia. The efforts put by CAST to protect and help Australian industry are well understood and appreciated. However, in some instances such as development of pilot magnesium plant in Queensland, different strategies may need to be applied. CAST recognised the reality that it would be difficult to compete with overseas suppliers on price, but at the same time it recognises the opportunity to become superior in innovative processes and their application. Close working relations with most light metal casting industry in Australia and major players overseas may prove to be the best strategy for the organisation, as CAST can provide the intellectual knowledge base (P14). Organisation position on the global casing scene is well recognised at major international conferences and in scientific publications. It may be paradox, but CAST is better known in Detroit US than at the Holden in Fishermen's Bend (P14).

Internal environment and work climate at CAST is important to create desired organisational outcomes. There is generally a good feeling about the organisation, because it creates opportunities to do new things in different ways. The CRC is not constrained in doing things that relate to the systems of particular university or research organisation. The organisation gives people the opportunity to work outside those boundaries without worrying about processes or the politics of the particular organization. The sense of freedom to some extend allows people almost to create their own jobs (P20).

7.3 Organisational Setting

7.3.1 CRC CAST Organisation

CAST maintains two offices in both Queensland and Victoria reflecting the spread of research activities between Brisbane, Geelong and Melbourne. The head office is
located at the University of Queensland's St Lucia campus, while the Victorian office is located at Swinburne University of Technology, Hawthorn.

### 7.3.2 Structure of Organisation

The structure of the organisation is very integrated and reflects actual programs and its major sectors of research and development activities (Figure 7.1).

The structure and management of CAST strengthen the Centre's success in taking research from ideas to providing solutions to the Australian light metals industry. Responsibility for the management of CAST lies primarily with the Board of CAST Centre Pty Ltd that is appointed with the agreement of the Governing Board. The Chief Executive Officer and the Management Team integrate the operational functions of the Centre, reporting to the CAST Centre Pty Ltd Board eight times a year on commercial and financial matters. The Governing Board meets four times a year to review research activities and sets long-term strategic directions for CAST.

![Figure 7.1 Structure of CRC CAST](Source: CRC CAST Annual Report 2002-2003).

Legend: Mg – magnesium, Al - aluminium
Governance
CAST has developed a two-tier Board structure that is similar to European board systems. The two tier CAST Board system has a research management board (CRC Governing Board) and a business policy board (Company Board), which provides a separation between management of research issues and commercial decisions that need to be made regarding research outcomes. Such structure reduces the potential for conflicts of interest. In addition, the smaller company board is able to focus on business activities of CRC, which could have more dynamic impacted than it is possible with a larger board. The smaller company board may provide CAST with flexibility to be proactive and to react rapidly to meet business requirements, especially on commercialisation matters. In such arrangements it can be sufficient for the Governing Board to meet four times a year, while the Company Board has eight to ten meetings a year depending on business imperatives. From a legal point of view, the CRC Board has delegated responsibilities for a range of activities to the Company Board, but maintains the right to appoint the Company Board and thus is in a position to monitor the competence of their business decisions. The Company Board has been appointed on the basis of competency rather than membership of CRC. The role of the Chair for both Boards is held by the same person providing a base for strong communication link.

The Board of Directors
The Board of Directors known at CRC CAST as Governing Board consists of representatives of core participants in CAST with an independent chair and a CEO. Under the Centre Agreement, the Queensland and Victorian State Governments, and CSIRO have appointed one director each. Research participants have right to appoint two directors, while the remaining seven directors come from industry participants. In total there were fifteen directors. During the year 2002-2003 the Governing Board delegated financial and commercial matters to the Company Board, but maintained power to its appointment. Company Board become the Board of CAST Centre Pty Ltd managing all resources in trust for the participants. Under the two-tier system, effective from 15 November 2002, the Governing Board represents the CRC partners setting strategic directions for research and resolving research management issues. The Governing Board met on four occasions during 2002-2003.
Executive Director

The Executive Director (CEO) is directly responsible for the management of the research, education and commercialisation programs at the Centre. He provides the leadership and direction for the organisation under the guidelines from the Government. The work of the Executive Director involves sizeable amount of work towards partners cooperation and market credibility. Current Director has a distinguished academic and corporate background in light metals research and is a charismatic person who enjoys interacting with others.

Management Committee

The Management Committee is composed of the CEO, Program and Research Sector Leaders and Business and Communications Managers. The Committee meets every four to six weeks to deal with planning issues and day-to-day decision making that influences the life of the Centre. The Committee has increased the number of meetings compared to previous year, by making extensive use of videoconference facilities. The regular informal contacts on the ‘as required basis’ with all individual members are kept via telephone and e-mails. During the year 2002-2003 there were nine formal members of the Management Committee. Management Committee oversee and supports the activities of Program and Sector Leaders. There are three major programs in the organisation: i) research, ii) commercialisation, iii) technology transfer and education. Current activities of CAST are based on two sectors and each of them with two programs: a) Magnesium: i) Magnesium production, ii) Magnesium application, b) Aluminium: i) Aluminium Casthouse, ii) Aluminium die casting.

7.3.3 Business Administration

The majority of administration work for CAST is done at the Brisbane Head Office. That includes tasks such as supporting the CEO, coordination of meetings, the management of finances, records and all statutory reporting requirements. The management of administration activities of CRC CAST is done by a few people including: business manager, accountant, office manager, communication manager, and commercialisation and IP manager. The office manager is responsible for providing the secretarial assistance to the executive director and management team in the organisation.
as well as for bookkeeping, office correspondence, records, cash expenditure and project costing.

**Staff and Work Time Commitment**

At the time of this research study with CRC CAST, it had 71 full-time equivalent staff and 25 postgraduate students. During a business year 2002-2003 about 175 people operated within CRC CAST system, of which 19 were women. The Executive Director worked full time for the organisation. There were 14 participants including industry and academia who committed 100% of their time, while 6 people dedicated 50% or more. Those who dedicated fewer than 50% of time represented about 155 people.

7.3.4 **Communications**

CAST is committed to the dissemination of knowledge within the Australian light metals industry and maintaining Australia's reputation as one of world leaders in light metals technology. There are a number of different ways in which CAST promotes its activities. The most important seems to be the presentations made by its personnel both within and outside the organisation. ‘CASTcommunications’ owns publishing media that produces a range of promotional material describing the research work conducted at each of CAST four sectors, as well as promoting some of the spin-off opportunities that have emerged from CAST projects. The organisation employs the communications manager who maintains good image of CAST. Press releases informing the wider community of CAST activities are distributed to the appropriate media outlets as a matter of company policy (P12; P14). The quality of internal communications with the clearer focus may reflect on the ability of the organisation to produce effectively its outcomes. Because organisation has many informal communications, it tends to operate more effective than formally endorsed (P11). For example, face-to-face communications are very important and cannot replace phone or email (P12). Some good scientists who had a problem and were not able to work and communicate in teams and with industry partners had to leave the organisation (P13).

The specific project orientation culture at CAST and protection of everything what is going on with projects may be restricting creativity and innovation in the organisation. Personal contacts/interactions could be broaden by providing more informal
opportunities for people to meet and talk more often than once a year during an annual meeting. Such occasions may be beneficial to expand interests and to share knowledge (P17). Members of CAST could help this organization to stay in business by not only focusing on good communication skills, but also working within the business budget to maintain high level of technical competence (P19).

7.3.5 Organisational Culture and Attitudes

Different structural configuration or the makeup of CAST that integrates unique academic, industry and government cultural backgrounds does not create automatically active and dynamic organisational culture. The persistent cooperative approach and teamwork adopted by the CAST has demonstrated that it takes time and ability to bring people together. Despite nearly ten years of working together, some divisions may still have place in the organisation that are unable to blend with all the members. At the beginning, there was attempt from the administration of CRC to impose on researchers the culture of total focus on scientific excellence. However, later on some common elements and interactions accommodated various people and allowed generating common values necessary to work together (P12). Anybody can talk to anybody and be heard in the organisation, as well as everybody's opinion is valued. Despite challenges and difficulties, some people working in research have fun (P12). Others think that CRC is more of the meeting of other cultures than the culture itself (P11). An attempt to portrait the organization as virtual is generally a trend everywhere and is not exceptional to CAST (P14). This organisation has first of all a culture of conducting research focused on getting outcomes” (P12). It is common that an organisational culture is associated with the management, though is often shaped by external forces. In the case of CRC the Government has certain desired outcomes to do with innovation and the commercialisation, which also drive the culture at CAST. The organisation has to meet them to survive in the end (P13). Over the years, CRC CAST organisation matured and has a high level of confidence to tackle big issues. The culture of ‘nothing is impossible’ has been build within the organization, which consists of the best people in the country in the field of casting and they should work together (P14). It comes down to culture of team environment, where things of interest are discussed openly (P14). CAST earned itself a good deal of respect in the industry, though there are still remnants of government style culture where everything seems to take very long time.
without any sense of urgency (P15). However, there is a feeling at CAST that everyone fits well into the organisation. This means people do not spend their time grizzling, instead actually spend their time doing the work (P16). Although on some occasions it may be necessary to have outcomes that are more specifically defined or people may need a special motivation to perform. Innovation often has to be demanded from the people, otherwise it will not happen naturally. It is rare to have individuals who cannot help themselves and are full of innovative ideas whilst majority seems to ‘plod along’ their research (P18). In this case, some cultural assistance is required to force their mind to what's new or novel or how to get there. Getting people together to talk about ideas and bounce them of each other maybe necessary for the larger group, but requires stronger motivation among smaller groups in order to innovate (P18).

Motivation and culture maybe linked in a peculiar way, but it is the culture that allows many things to happen in the organisation (P20). Although, culture and peoples attitudes often change, CAST success could be related to the adaptation abilities to new business realities. New business conditions require involvement of industry and organisational culture has to accommodate it. The other aspect of that culture is to create the sense of enjoyment and reward for research achievements (P20). A whole issue of what is CRC Cast about and people activities could be describe as an integrated interaction. They ought to be exciting and intellectually constructive to bring people together in teams from the variety of discipline backgrounds and the variety of organizations so everybody could “see the statue from a slightly different view point, put together, it formes a better holistic view of the issue and possible solutions than one person could get by themselves” (P14).

7.4 Human Dimensions
Personnel mix of CRC CAST is diversified. Staff of the organisation is picked during interviews that examine candidates work credentials and abilities to work in a team environment. One of the criteria difficult to detect is attitudes at work. Members of CAST are generally open and keen to work together, but some IP issues seem to build the barriers (P13). Apart from postgraduate students, most of the researchers, program and sector leaders are PhD qualified. However, that gives no guarantee about someone’s greater ability to work in research organisation or effective use of knowledge. The issue
of organisational knowledge is also debatable, but it is assumed to be related to the capability of personnel. Organisational knowledge only exists while CAST is functioning (P11). Universities are probably better at developing and physically storing created knowledge, but CAST is good at making connections. Through these connections it is possible to find somebody who can unite all the pieces of research knowledge that may have practical application (P11). CAST organisational knowledge is without a doubt an integration of industry participants experience and own R&D work (P15). The attitude of research project leaders is to be honest with people and value their contribution (P12). It is often researcher’s knowledge that counts the most in creating innovation in the organisation. They know what technology is patentable, innovative and worth the investment (P12). When research may involve experimental work and hands on approach, it is the individual’s sense making ability that often determines the fate of a project. Another view is that to work in research may require not only special abilities but also personality (P13). For people to be successful in CRC they need the mindset with a combination of a strong desire to carry out the research work and the ability to see the big picture, while at the same time be aware of fine detail resulting in innovation (P14). To run such a fine line of balance it may require the organisation to pay more attention to the personal needs of its members. The attitudes and behaviour of people often dictate in the long-run how organisation could grow and develop innovation. Because transferring tacit knowledge is very difficult and there are no magic answers about how to do it (P15), personal rewards are the only way of motivating and confirming personal achievements (P12).

Experiences in relation to knowledge, as well as the amount of accumulated knowledge and the ability to identify it are difficult to measure. Often small bit of information may not solve the problem, but it might change the way of thinking. Many of these bits of information are intangible and difficult to write down with the same token the body of knowledge is forever increasing. Eventually certain bits of it may become useful, however we can't always predict when and how (P16).

“There is sort of a strange term that we've been using recently called a ‘brain dump’, which is you get all the information out that the person has, but that doesn't happen, as it's not just the knowledge, it's experience. You can give the same information to four
different people, but depending on their background, some would be able to use that information and some will not have a clue what to do with it. So I don't think that you can in any way accumulate all the knowledge in any one place” (P16). Ability to share with others not only material things but also the experience or knowledge is probably the greatest power to change things within the organisation. Some people may require additional encouragement to motivate them to share things with others (P17). This is the reasons that researchers work in teams at CAST to eliminate uncertainty of their skills in any one particular area. Organisations may seek help from different aspects and perspective to do business and to generate new things with an aim to develop a team culture that overcomes people’s willingness to share their knowledge (P17). The current expectations of the society are such that more outcomes of research should be applicable. For many researchers that may involve a radical shift in thinking and presentation of their work in a way that the industry can understand it (P18; P19). Openness and alertness to what is happening not only at CAST but also in the world may give additional advantage to the organisation (P20). The other important thing that is happening in the organisation is not only sharing project knowledge and experience, but also sharing of knowledge about networks. In the end, it is perhaps the combination of all factors, which make an organisation what it is (P20). Adding further, business may also require from individuals a dose of imagination to see what an organisation should be like in the future in order to produce desired outcomes. Routine standard processes and procedures may never reflect true operational realities of what people do or may want to do, therefore operational flexibility is required to let them control some formalities. This works fine with some people who have major role to play at CAST and may develop requirements for such a role for themselves to ‘fully own it’(P20). It seem that productive activities and interactions between partners are embedded by the cooperative statutory nature of CAST organisation, however it is always a bit of wishful thinking that knowledge transfer and creation of outcomes may happen spontaneously (P15). Many interactions have to take place to keep everything moving (P20). The unpredictable thing in the seven years of CAST life span is commitment from industry partners to cooperate fully. Therefore, the organisation has to be proactive to seek new partners and be open to conduct business as market may require. The stability of staff cannot be taken for granted either. Some researchers at CAST may be interested to get individual government research grants to pursue their own goals. The change in critical
mass in staff number may splinter and defuse some of the Centre activities, as well as the internal lack of planned succession for the CEO, may have occasionally destabilised the operations in the last 10 years (P18).

7.5 Performance Outcomes

It could be assumed that organisational outcomes are always specific to its activities profile. For example, university research organisations are interested in the basic or applied research and the publication of scientific papers, while the industry is often keen to apply new knowledge in the form of new production processes or products. The recent push from the markets for more consumer goods shifted the emphasis of some of the research organisations into the experimental research allowing for quicker delivery of innovations. CRC CAST is in the position where main outcomes are more related to customer production methods than to new products. This organisation also aims at scientific recognition with goal in the first 5 years of operation to dominate 2 or 3 sessions in biannual conferences around the world (P14).

The main objectives of the Centre includes: i) economic benefit to the Centre, ii) economic benefit to user’s core participants, iii) economic benefit to Australia, and iv) other economic benefits, for example, positive environment impact. It is in a sense a part of organisational culture that everybody is focused on getting outcomes (P12). Though there is a desire and an objective to do research which is relevant to the industry, some individuals focus on their area of expertise, ‘drill down’ and try to become the best in that particular area (P11). The other outcome for the organisation from the cooperative arrangements viewpoint is a constant contact and relationships between researchers and the industry people” (P12). It is especially towards the end of seven years of CRC life cycle that the feeling in the organisations is of working together to secure a better future (P11). However, for many individuals acknowledging their performance is equally important to organisational achievements. Rewards are important to confirm personal achievement, not only when some research has been commercialised” (P12). Cast recognises exceptional people for the variety of things, for example, as best scientist for the year or the best presentation at the annual conference. Some people go to key overseas conferences as the form of organisational reward (P14).
The ability of individuals to work towards common goals is well regarded at CAST. In essence all research work may be regarded as solving industry problems. Some people within the organisation are more commercially oriented than others and that is quite important in realising the goals. In the end, it is the industry partner’s satisfaction that keeps this organisation going (P13). The list of what is required from the individual in the organisation may vary depending who one talks to, but in a nutshell it could be the ability to work independently, to be creative when coming up with the solutions (P14). Researchers generally realise importance of their input to the organisational performance and the satisfaction of their customers (P16). Some staff members have an opinion that a lot of the work, which has been done in CRC is not highly valued by the industry. The reason for their disappointment could be that traditionally industry has always had more problems than can be solved and CAST is unable to deliver them in a short time or does not have the capacity to handle big number of such enquiries (P15).

The organisation does not want to lose the economic focus and makes sure that there are certain amounts of return on generated IP (P14). Managing organisational affairs is not easy with operational dilemma whether to attract larger number of industry partners or only those with bigger amounts of money for research (P16).

In the long run, for the organisation to successfully operate it ought to do research for the industry partners but with the mutual benefits for both parties (P17). At the same time CAST needs to accommodate expectations of the researchers that papers or reports may bring them a satisfaction, fame and recognition (P18) as it is not only important for the research but also for the people to feel rewarded for their achievements (P20).

7.6 Results from Case Study Data Analysis

Data analysis for the case study organisation CRC CAST includes the results from the interviews, surveys and key organisational performance indicators.

7.6.1 Interviews

The process of coding was identical as for previous case study organisation and was conducted using NVivo software. The analysis of interviews data started with the broad-brush coding method. This approach to coding revealed in total over nine
hundred and sixty codes related to three major factors of the proposed research framework. The detail evaluation of broad-brush nodes (B-BN) profiles with the assistance of NVivo showed the information about numerical values of each type of node. However, the significance of each node had to be calculated because different numbers of questions were present in the interview instrument for each examined major factor and the examined text for each case study varied in size. The approximate number of all words from case study two interviews was 31580. Creation of Node Density Indicator (NDI) allowed for correct assessment of the significance for each major factor in relation to CAST organisation (Table 7.1). NDI’s represent the number of nodes per 10000 of the examined words of text data.

<table>
<thead>
<tr>
<th>FACTORS</th>
<th>NUMBER of QUESTIONS</th>
<th>B-BN</th>
<th>NDI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognition</td>
<td>7</td>
<td>200</td>
<td>9</td>
</tr>
<tr>
<td>Culture</td>
<td>9</td>
<td>416</td>
<td>14</td>
</tr>
<tr>
<td>Motivation</td>
<td>5</td>
<td>348</td>
<td>22</td>
</tr>
</tbody>
</table>

Table 7.1 Major factors nodes distribution from CRC CAST interviews (Author).

Preliminary results from the primary data analysis show that the majority of attention to organisational affairs is concentrated on issues of motivation. Cultural significance takes second priority, while cognition seems to have the smallest attention.

The next set of results came from the detail analysis of each of the major nodes/factors. This second stage of coding involved specific coding of data into the elementary nodes according to the selected elementary nodes descriptions for the preselected frameworks of cognition, culture and motivation and described in detail in chapter three. Results of the brake down of major factors into elementary nodes are presented on the next page in Table 7.2. The significance of the Innovation Enhancing factor holding maximum number of nodes implies that CAST has a culture with many elements that could predispose it to innovation. The summary of all nodes significance and distribution for groundedness and density is shown on the following pages in Table 7.3.
<table>
<thead>
<tr>
<th>Cognition</th>
<th>Total Cognition elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scanning</td>
<td>101</td>
</tr>
<tr>
<td>Sensemaking</td>
<td>169</td>
</tr>
<tr>
<td>Action from learning</td>
<td>114</td>
</tr>
<tr>
<td>Innovation enhancing</td>
<td>415</td>
</tr>
<tr>
<td>Innovation hindering</td>
<td>67</td>
</tr>
<tr>
<td>Attention to detail</td>
<td>4</td>
</tr>
<tr>
<td>Outcome orientation</td>
<td>157</td>
</tr>
<tr>
<td>Process orientation</td>
<td>228</td>
</tr>
<tr>
<td><strong>Culture</strong></td>
<td></td>
</tr>
<tr>
<td>Individual orientation</td>
<td>61</td>
</tr>
<tr>
<td>Team orientation</td>
<td>87</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>22</td>
</tr>
<tr>
<td>Easy going</td>
<td>9</td>
</tr>
<tr>
<td>Stability</td>
<td>10</td>
</tr>
<tr>
<td>Growth</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total Culture elements</strong></td>
<td>1067</td>
</tr>
<tr>
<td>Effort</td>
<td>214</td>
</tr>
<tr>
<td>Performance</td>
<td>138</td>
</tr>
<tr>
<td><strong>Motivation</strong></td>
<td></td>
</tr>
<tr>
<td>Reward</td>
<td>70</td>
</tr>
<tr>
<td>Goal</td>
<td>204</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>73</td>
</tr>
<tr>
<td><strong>Total Motivation elements</strong></td>
<td>699</td>
</tr>
</tbody>
</table>

Table 7.2 Elementary nodes values for CRC CAST (Author).

<table>
<thead>
<tr>
<th>ELEMENTARY NODES (EN)</th>
<th>TOTAL NUMBER of EN</th>
<th>ELEMENTARY NODES DISTRIBUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scanning</td>
<td>101</td>
<td>P11 4 P12 4 P13 15 P14 12 P15 9 P16 8 P17 13 P18 8 P19 3 P20 25</td>
</tr>
<tr>
<td>Action from learning</td>
<td>114</td>
<td>P11 13 P12 14 P13 17 P14 20 P15 7 P16 4 P17 13 P18 9 P19 1 P20 16</td>
</tr>
<tr>
<td>Innovation enhancing</td>
<td>415</td>
<td>P11 60 P12 53 P13 44 P14 58 P15 33 P16 20 P17 40 P18 30 P19 18 P20 59</td>
</tr>
<tr>
<td>Innovation hindering</td>
<td>67</td>
<td>P11 8 P12 8 P13 8 P14 13 P15 3 P16 5 P17 14 P18 1 P20 3</td>
</tr>
<tr>
<td>Attention to detail</td>
<td>4</td>
<td>P11 2 P12 2 P13 0 P14 0 P15 0 P16 0 P17 0 P18 0 P19 0 P20 0</td>
</tr>
<tr>
<td>Outcome orientation</td>
<td>157</td>
<td>P11 21 P12 22 P13 23 P14 13 P15 11 P16 6 P17 21 P18 9 P19 5 P20 26</td>
</tr>
<tr>
<td>Process orientation</td>
<td>228</td>
<td>P11 22 P12 16 P13 13 P14 24 P15 19 P16 12 P17 26 P18 33 P19 13 P20 50</td>
</tr>
<tr>
<td>Individual orientation</td>
<td>61</td>
<td>P11 6 P12 3 P13 6 P14 12 P15 6 P16 2 P17 3 P18 5 P19 1 P20 17</td>
</tr>
<tr>
<td>Team orientation</td>
<td>87</td>
<td>P11 11 P12 11 P13 13 P14 14 P15 5 P16 2 P17 15 P18 4 P19 1 P20 11</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>22</td>
<td>P11 4 P12 3 P13 4 P14 1 P15 1 P16 3 P17 2 P18 2 P19 0 P20 2</td>
</tr>
<tr>
<td>Easy going</td>
<td>9</td>
<td>P11 0 P12 3 P13 2 P14 0 P15 2 P16 0 P17 0 P18 1 P19 1 P20 1</td>
</tr>
<tr>
<td>Stability</td>
<td>10</td>
<td>P11 4 P12 1 P13 2 P14 0 P15 1 P16 0 P17 0 P18 0 P19 2 P20 0</td>
</tr>
<tr>
<td>Growth</td>
<td>7</td>
<td>P11 0 P12 0 P13 1 P14 2 P15 3 P16 1 P17 0 P18 0 P19 0 P20 0</td>
</tr>
<tr>
<td>Effort</td>
<td>214</td>
<td>P11 23 P12 25 P13 23 P14 15 P15 34 P16 18 P17 20 P18 23 P19 1 P20 32</td>
</tr>
<tr>
<td>Reward</td>
<td>70</td>
<td>P11 10 P12 8 P13 6 P14 8 P15 11 P16 6 P17 5 P18 3 P19 4 P20 9</td>
</tr>
<tr>
<td>Goal</td>
<td>204</td>
<td>P11 21 P12 16 P13 26 P14 38 P15 27 P16 9 P17 19 P18 21 P19 1 P20 26</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>73</td>
<td>P11 7 P12 8 P13 4 P14 17 P15 9 P16 7 P17 4 P18 4 P19 0 P20 13</td>
</tr>
</tbody>
</table>

Table 7.3 Elementary nodes distribution for CRC CAST (Author).
The significance of elementary nodes is based on the analysis of their profiles for groundedness and density according to set rule that only those elementary nodes that have at least three occurrences in each case study organisation or come from three independent sources would be taken up for the further examination. The summary of the elementary nodes significance is presented on the following pages in Table 7.4. Node ‘attention to detail’ is omitted in the next stage of analysis because of its low relative value to this research.

<table>
<thead>
<tr>
<th>ELEMENTARY NODES</th>
<th>DENSITY and GROUNDEDNESS of ELEMENTARY NODES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scanning</td>
<td>101 (10)</td>
</tr>
<tr>
<td>Sensemaking</td>
<td>169 (10)</td>
</tr>
<tr>
<td>Action from learning</td>
<td>114 (10)</td>
</tr>
<tr>
<td>Innovation enhancing</td>
<td>415 (10)</td>
</tr>
<tr>
<td>Innovation hindering</td>
<td>67 (10)</td>
</tr>
<tr>
<td>Attention to detail</td>
<td>4 (2)</td>
</tr>
<tr>
<td>Outcome orientation</td>
<td>157 (10)</td>
</tr>
<tr>
<td>Process orientation</td>
<td>228 (10)</td>
</tr>
<tr>
<td>Individual orientation</td>
<td>61 (10)</td>
</tr>
<tr>
<td>Team orientation</td>
<td>87 (10)</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>22 (9)</td>
</tr>
<tr>
<td>Easy going</td>
<td>9 (5)</td>
</tr>
<tr>
<td>Stability</td>
<td>10 (5)</td>
</tr>
<tr>
<td>Growth</td>
<td>7 (4)</td>
</tr>
<tr>
<td>Effort</td>
<td>214 (10)</td>
</tr>
<tr>
<td>Performance</td>
<td>138 (10)</td>
</tr>
<tr>
<td>Reward</td>
<td>70 (10)</td>
</tr>
<tr>
<td>Goal</td>
<td>204 (10)</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>73 (9)</td>
</tr>
</tbody>
</table>

Table 7.4  Significance of the elementary nodes for CRC CAST case study (Author).

The next stage in the process of the analysis involved sorting nodes into four classes: i) insignificant, ii) minor, iii) major, and iv) fully supported, accordingly to their occurrences in the case study data shown in Table 7.5.
### Table 7.5 Categories of nodes from CRC CAST case study (Author).  

<table>
<thead>
<tr>
<th>FULLY SUPPORTED</th>
<th>MAJOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scanning</td>
<td>Competitiveness</td>
</tr>
<tr>
<td>Sensemaking</td>
<td>Easy going</td>
</tr>
<tr>
<td>Action from learning</td>
<td>Stability</td>
</tr>
<tr>
<td>Innovation enhancing</td>
<td>Outcome orientation</td>
</tr>
<tr>
<td>Innovation hindering</td>
<td>Process orientation</td>
</tr>
<tr>
<td>Outcome orientation</td>
<td>Individual orientation</td>
</tr>
<tr>
<td>Team orientation</td>
<td>Effort</td>
</tr>
<tr>
<td></td>
<td>Performance</td>
</tr>
<tr>
<td></td>
<td>Reward</td>
</tr>
<tr>
<td></td>
<td>Goal</td>
</tr>
<tr>
<td>MINOR</td>
<td>INSIGNIFICANT</td>
</tr>
<tr>
<td>Growth</td>
<td>Attention to detail</td>
</tr>
</tbody>
</table>

Results in Table 7.5 indicate that the ‘fully supported’ nodes represent all of themes that could be related to most people in the organisation. Although, ‘competitiveness’, ‘easy going’, ‘stability’ and ‘satisfaction’ have slightly lesser importance, these themes may be equally influential to research conclusion as being represented by the majority of opinion.

The further analysis of the data from the elementary nodes allowed selection of most dominant topic. The text contained in these nodes was cross-examined using the process of the intersection from NVivo. The selected nodes for intersection analysis were: i) ‘sensemaking’ from cognition, ii) ‘innovation enhancing’ from culture, and iii) ‘effort’ from motivation. The process of intersection produced the common data reduced to the convenient size of ten common text passages. The interpretation of these text passages allowed creating final nodes that could be generalised to represent the indicators of the new theory (Table 7.6). The generalised meaning of final indicators has been described as perception, participation and objective.
The analysis of final indicators distribution from Table 7.7 and the assessment of their relative values by using groundedness and density provided the set of numbers that could describe and relate indicators as one meaningful unit (Table 7.8). The calculation method for the relative indicator numbers is uniform to all case studies and was described in chapter four.

<table>
<thead>
<tr>
<th>FINAL INDICATORS</th>
<th>NUMBER of INDICATORS</th>
<th>FINAL INDICATOR DISTRIBUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARTICIPANTS</td>
<td>P11</td>
<td>P12</td>
</tr>
<tr>
<td>Perception</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Participation</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>Objective</td>
<td>6</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 7.7  Final indicator distribution for CRC CAST organisation (Author).

The follow up and calculation of the relative values for perception, participation and objective leading into the development of Innovation Framework are described in chapter ten.

### 6.6.2 Surveys
Surveys used in this research provide additional data to verify the findings coming from the qualitative data. The snap assessment of the opinions held by interview participants was the first survey that allowed quick assessing of the influence of major framework factors on innovation in the organisation. Results of this assessment for CRC CAST are listed in the Table 7.9. Judging by the results of this survey, the majority of organisational members may have the opinion that motivation has the greatest influence on innovation with other sizable group claiming the influence of culture and probably very small number (one instance) supporting the importance of cognition. Results of this survey are consistent with the results from broad-brushed coding of data for CRC CAST.

<table>
<thead>
<tr>
<th>PARTICIPANT</th>
<th>MAJOR FRAMEWORK FACTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>COGNITION</td>
</tr>
<tr>
<td>P11</td>
<td>X</td>
</tr>
<tr>
<td>P12</td>
<td></td>
</tr>
<tr>
<td>P13</td>
<td></td>
</tr>
<tr>
<td>P14</td>
<td></td>
</tr>
<tr>
<td>P15</td>
<td></td>
</tr>
<tr>
<td>P16</td>
<td></td>
</tr>
<tr>
<td>P17</td>
<td></td>
</tr>
<tr>
<td>P18</td>
<td></td>
</tr>
<tr>
<td>P19</td>
<td></td>
</tr>
<tr>
<td>P20</td>
<td></td>
</tr>
</tbody>
</table>

Table 7.9 Opinion survey about the importance of major factors on innovation in CRC CAST (Author).

The expanded second survey with interviews participants resulted in obtaining the data that permitted greater in depth analysis of the attributes to understand the examined case study. Survey results are compiled on the next page in Table 7.10.

These survey results reflect the unique composition of the examined CRC CAST organisation. With the exception of one interview participant, all of them were male. Seven of participants had PhD qualifications and four of them were in the age group between 34 and 45 years. The average experience of the member within CRC
organisation is 6.9 years. Half of interviewed CRC members had two last jobs of the same type, eight worked previously in research, five had industry and two had academic experiences. The knowledge of another language signify to the author that three out of ten participants could be more sensitive to cultural aspects of life/work, which may have the influence on members work attitudes. Many people work for CRC organisations on part-time basis. The total contribution of all people time represents the equivalent of organisations personnel size calculated as the ‘full time equivalent research staff’. During the year 2002-2003 the total number of people who worked for the organisation was 175. The average size of network within CRC CAST calculated from ‘People in Network’ in the Table 7.10 was 49 people. This gives indication that each member may conduct organisational activities knowing only one third of people from the total staff.

<table>
<thead>
<tr>
<th>PARTICIPANT</th>
<th>P11</th>
<th>P12</th>
<th>P13</th>
<th>P14</th>
<th>P15</th>
<th>P16</th>
<th>P17</th>
<th>P18</th>
<th>P19</th>
<th>P20</th>
</tr>
</thead>
<tbody>
<tr>
<td>POSITION at CRC</td>
<td>PL</td>
<td>PL</td>
<td>RES</td>
<td>BD</td>
<td>IND</td>
<td>RES</td>
<td>RES</td>
<td>IND</td>
<td>PL</td>
<td>BD</td>
</tr>
<tr>
<td>QUALIFICATION</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>T</td>
<td>P</td>
<td>M</td>
<td>P</td>
<td>B</td>
<td>P</td>
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<tr>
<td>GENDER</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>F</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>AGE GROUP</td>
<td>25-34</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>YEARS of CRC EXPERIENCE</td>
<td>4</td>
<td>6</td>
<td>10</td>
<td>4</td>
<td>10</td>
<td>6</td>
<td>4</td>
<td>10</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>CULTURAL SENSITIVITY</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
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<tr>
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<td>RES</td>
<td>RES</td>
<td>AC</td>
<td>IND</td>
<td>RES</td>
<td>RES</td>
<td>IND</td>
<td>RES</td>
</tr>
<tr>
<td></td>
<td>2nd</td>
<td>RES</td>
<td>RES</td>
<td>RES</td>
<td>IND</td>
<td>IND</td>
<td>IND</td>
<td>RES</td>
<td>IND</td>
<td>RES</td>
</tr>
<tr>
<td>PEOPLE in NETWORK</td>
<td>40</td>
<td>50</td>
<td>20</td>
<td>100</td>
<td>30</td>
<td>10</td>
<td>6</td>
<td>10</td>
<td>25</td>
<td>200</td>
</tr>
<tr>
<td>MEETINGS</td>
<td>FORMAL</td>
<td>3</td>
<td>6</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>40</td>
<td>3</td>
</tr>
<tr>
<td># INFORMAL</td>
<td>20</td>
<td>60</td>
<td>22</td>
<td>20</td>
<td>4</td>
<td>20</td>
<td>2</td>
<td>4</td>
<td>100</td>
<td>150</td>
</tr>
</tbody>
</table>

Table 7.10  Survey data about CRC CAST interviews participants (Author).

Legend for Table 7.10: Positions at CRC have following meaning: RES = researcher, IND = industry participant, BD = member of board of directors, PL = project leader.
Qualification codes represent: B = bachelor, P = PhD, M = masters, T = trade
Gender: M = male, F = female
Sign ‘#’ = means the same description as above.
Cultural Sensitivity = knowledge of other language than English that increases the probability of greater cultural awareness than that of single culture.
People in Network = the number of people in personal network related to work at CRC.
Meetings Formal and Informal = the number of arranged meeting per month.
Meetings Informal = the number of unplanned and spontaneous meeting/discussions per month.

The additional analysis of data extracted from ‘Informal Meetings’ and ‘People in Network’ from Table 7.10 shows average values of informal meetings and network size for various organisational roles at CRC CAST (Table 7.11).

<table>
<thead>
<tr>
<th>ATTRIBUTES</th>
<th>TYPE of WORK at CRC CAST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RES</td>
</tr>
<tr>
<td>Average of Informal Meetings</td>
<td>15</td>
</tr>
<tr>
<td>Average of Network Size</td>
<td>12</td>
</tr>
</tbody>
</table>

Table 7.11 Network size and intensity of networking at CRC CAST (Author).

It seems to be evident from this survey data, that on average the number of informal meetings for project leaders is one and half times larger and for researchers one and the quarter than the size of their network. On the other hand, the network size for industry partners is four times larger and for board members nearly two times larger than the number of informal meetings they may have during the month. This may indicate the need to have such a large number of contacts that gives the opportunity to interact when required. In addition, it is project leaders and board members that have the most of informal meetings as their role in the organisation may require this.

The other conclusion about networking emerges from the presented graph in Figure 7.2.
This graph was created on the basis of years of experience at CRC, network size and the intensity of networking. It shows that though the network size may grow slowly during the nine years spent at CRC CAST, it starts eventually to decline. However, the networking intensity, which is quite intense at the beginning, shows a drop around four years and picks up at nine years after which it shows a decline to values lower than that in the earlier years in the organisation. This finding about intensity may suggest that more frequent changes of staff might be required to keep the momentum of continuous learning.

The overall results from second survey also show that the average number of informal to formal meetings held per month at the Centre is over six times greater. This may suggest that members want to interact with each other more often than the opportunities presented by formally arranged meetings.

In addition, specific data extracted from survey Table 7.10 about years of experience, network size, networking intensity and total number of people engaged in the Centre may exhibit the evidence supporting behaviour of people in the organisation. It is
assumed that the Connectivity Indicator (CI) created according to the formula described in chapter four and for which attributes are listed in Table 7.10 could be the appropriate summary representing this survey. The final value of CI for CRC CAST is listed in Table 7.12. The value of this indicator has no real meaning on its own, however when compared with the other case study organisations it may lead to some conclusions. The analysis of CI indicators for all case study organisations are presented in chapter nine.

<table>
<thead>
<tr>
<th>ATTRIBUTES</th>
<th>VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Years of Experience</td>
<td>6.9</td>
</tr>
<tr>
<td>Average Network Size</td>
<td>49</td>
</tr>
<tr>
<td>Average Networking Intensity</td>
<td>6.2</td>
</tr>
<tr>
<td>Total Number of People Involved</td>
<td>175</td>
</tr>
<tr>
<td>CONNECTIVITY INDICATOR</td>
<td>12</td>
</tr>
</tbody>
</table>

Table 7.12  Connectivity at CRC CAST (Author).

### 7.6.3 Organisational Performance

The information used for the analysis of CRC CAST organisational performance has been extracted from their annual report 2002-2003. This data represents only those indicators that seem to be common to all analysed organisations in this thesis. Author believes that it would be impractical and without much benefit to this study to present and discuss all published organisational performance indicators from the annual report and to conduct some meaningful comparison and analysis. For example, one of the indicators is ‘Research cooperation within Centre’ stating that 48% of projects involved more than one research provider. This information maybe showing the complexity of the projects, but for the analysis is rather too vague to be considered. The combined data used for the purpose of the analysis of CRC CAST organisation is shown in the Table 7.13.
The economic benefit to the Centre represents the earnings that the organisation achieved in the financial year. The other important indicator of CRC CAST activities is the total money they had to operate during the financial year. The ability to attract partners and the contributions of their funds are crucial to the existence of the Centre and conducted programs. The size of the available funds could be linked to many business, organisational and industry aspects, but entrepreneurial skills of the Board may be what matters the most. However, for CAST researchers, the number of publications and the rewards achieved for organisational performance are probably the highlights of the activities. The number of patents received could be interpreted as the inclination towards innovation. The other measure of the organisational success could be the number of postgraduate students completing their study sponsored by the Centre.

To maintain the relevance of analysis and the credibility of data, some outcomes are compared to the effort contributed by the total number of people engaged during a year with the CRC CAST organisation. The Key Performance Indicators presented in CRC
CAST annual report have very limited values unless they can be compared to the performance of the other similar organisations. For the purpose of comparison between each of the case study organisations, data from Table 7.13 has been compiled into the Total Performance Indicator (TPI) as explained in chapter four, and is presented in Table 7.14.

<table>
<thead>
<tr>
<th>MAJOR PERFORMANCE INDICATORS</th>
<th>INDICATOR VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>6.5</td>
</tr>
<tr>
<td>C2</td>
<td>0.106</td>
</tr>
<tr>
<td>C3</td>
<td>0.63</td>
</tr>
<tr>
<td>C4</td>
<td>0.0051</td>
</tr>
<tr>
<td>C5</td>
<td>0.071</td>
</tr>
<tr>
<td>C6</td>
<td>0.1</td>
</tr>
<tr>
<td>C7</td>
<td>0.81</td>
</tr>
<tr>
<td>C8</td>
<td>0.7</td>
</tr>
<tr>
<td>TPI</td>
<td>7.25</td>
</tr>
</tbody>
</table>

Table 7.14  Major Performance Indicators CRC CAST (Author).

Legend:
C1 = Leverage (Total Money/Government Money)
C2 = Economic benefit to Centre/Government Money
C3 = Journal and Conference Papers/Total CRC Members
C4 = Postgraduates completed/Total CRC Members
C5 = Patents/Total CRC Members
C6 = External Collaborations/Total CRC Members
C7 = Staff Time Commitment (Full Time Equivalent Staff/Total CRC Members)
C8 = Research program resources/Total Money

The comparison of all results from this case study analysis to other organisations examined is fully presented in chapter nine.
CHAPTER EIGHT

Case Study Three – CRC ACS

8.1 Introduction

This thesis examines the third case study organisation, the Cooperative Research Center for Advanced Composite Structures (CRC ACS). The issues of organisational settings, human dimensions and performance outcomes are presented to set up the ground for comparative analysis with other two case study organisations. Description of this organisation is enhanced by various quotes from the interviews conducted at CRC ACS. These quotes could be identified by the abbreviation ‘P’ with the corresponding number from 21 to 30. The major part of presentation includes results from data analysis according to the process described in chapter four.

8.2 Overview of Case Study Three Organisation

CRC ACS is an incorporated joint venture that was founded in 1991 as the Cooperative Research Center for Aerospace Structures and has been restructured in 1997 with a broader participant base. This venture included in 2002-2003 five universities and six other industrial partners. The Centre was set up initially as the CRC for Aerospace Structures, to improve the competitiveness of the Australian Aerospace Industry, and has established itself as a key organisation in the development of that industry. At the time of collecting data with the organisation it had completed six years in the second round of seven years cycle of operational period. Further changes took place in 2003 as a restructured company was establish with new members, and the Australian Government committed to provide base funding support until June 2010. During the financial year 2002-2003 the total money available to the organisation was $10.15 M.

ACS primary aim is to provide support for the development of advanced technologies, which foster growth of efficient and globally competitive Australian composite industry. This is achieved by conducting research and development programs into the design, manufacture, testing, durability and supportability of advanced composite structures. ACS brings together the best skills in six of Australia's leading research providers to support its own core staff of thirty research engineers, scientists and
technicians. These experts work with the industry to develop new technologies to improve the cost-competitiveness and structural performance of composite materials in ever-expanding market place. The core organisational programs (approximately seventy percent) are aimed at the aerospace industry. The rest of the programs cover maritime and general composites research. Major programs had delivered a number of technological developments that have resulted in reduced costs to its industry participants in their manufacturing programs and have made major contributions to win new product contracts.

The areas of research expertise include: i) design, manufacture and performance of composite structures and materials, ii) aeronautical, materials and production engineering, iii) process modelling, iv) computer-aided design and manufacturing, v) stress analysis, structural and environmental testing, vi) resin chemistry, vii) fire performance and durability of materials.

ACS constantly seeks new opportunities to enhance and expand the scope and the quality of its contributions to composites industry in Australia, while continually exploiting new business opportunities and composite structures in a more competitive manner. CRC ACS has now completed 12 years of operation and is one of six CRC organisations renewed for the third term of operation.

8.2.1 Mission Statement
Cooperative Research Center for Advanced Composite Structures mission is to provide a comprehensive base of advanced engineering technology and expertise that will enable Australian industry to exploit composite structures in a more globally competitive manner.

8.2.2 Objectives
Main objectives of organisation are: i) to operate and to enhance the CRC ACS as an internationally recognised research and development centre with sufficient capability and resources to support the immediate and long-term needs of the Australian advanced composite structures industry, ii) to encourage strong involvement of post-graduate students in the CRC ACS research and educational program and to encourage strong
links between universities, research organisations and industry, iii) to develop local and international links that support collaborative research and profitable commercial exploitation of CRC ACS developments to the benefit of Australian enterprises, iv) to promote the CRC ACS Centre as the focal point of technology for advanced composite structures within Australia to provide support to the wider industry, v) to ensure the ongoing financial capacity of the CRC ACS to fulfil its mission, and vi) to provide a safe and stimulating environment that encourages equal opportunity, staff development and long-term career prospects for CRC ACS staff.

8.2.3 Strategy
The Centre preference is to engage with larger international companies from the aerospace sector that are involved in research and manufacturing. These contacts are aimed at building new partnerships for a long duration. The above-mentioned objectives are supported by organisational strategy that aims at fulfilling it and includes: i) the enhancement of centres of expertise at participating universities that could targeted needs of the associated research users, ii) fostering industry-university links that provide industry support for postgraduate studies and collaborative research additional to CRC ACS program of activities, iii) utilising university expertise in the delivery of specialist courses, seminars and workshops for CRC ACS, industry participants, and broader composites industry, iv) supporting student activities ranging from secondary schooling to post graduate studies aimed at attracting high calibre students into advanced composites research and application development, v) involving CRC ACS and industry participant staff in joint supervisory roles with post graduate students, vi) supporting the continuing professional development needs of industry and academic staff through the promotion and support of relevant workshops and conferences, vii) close involvement of industry staff in demonstration programs, viii) to attract participants whose interests either align with, or complement the existing core programs, and ix) to secure contracts from international clients.

Though the majority of research in the organisation is aerospace related, very recent cooperation with the Composites Institute of Australia (CIA), which comprises 200 company members aims to engage a broader interest from the composite sector by identifying growth opportunities and emerging market trends. For example by June
2003, the Centre established its first manufacturing license with a non-participant after secured IP protection of a unique manufacturing process for the production of lightweight, fire-resistant, foam-filled sandwich panels, and an second opportunity successfully negotiated an exclusive manufacturing license with Australian Urethane and Styrene Pty Ltd to fully commercialise the technology.

The other important strategy is to ensure that research outcomes are relevant to the industry partners and give students from the Centre a comprehensive experience in the related industry. For example, links with Airbus Deutschland facilitated in placement of one postgraduate student and three research staff. This gives opportunity to establish closer relations and better chance for CRC ACS to participate in future projects. As much as possible the Centre encourages two or more partners for each project which must always include the industry participant. It has been also realised that one of the ways the future growth of organisation is realised is by putting more efforts on broadening the Centre's linkages with wider composites industry that provide opportunities for commercialisation and/or technology transfers.

8.2.4 Members, Customers and Industry Partners
The Centre has four categories of membership: i) Participant Member with Board membership, full voting rights, full access to Intellectual Property and full rights to participation in all research programs, ii) Contributory Member with access to IP and participation in defined research programs and a commitment to move to Full Participant, iii) Supporting Member with involvement in selected core programs only, and iv) Associate Member with access to non-restricted reports and consultation advice.

For the financial year to 30th June 2003 there were eight participants involved in the activities of CRC ACS: AeroSpace Technologies of Australia Ltd, DSTO-Platforms Sciences Laboratory, Hawker de Havilland Pty Ltd, Monash University, RMIT University, University of New South Wales, University of Sydney, and University of Newcastle. Holden Ltd is the only company that had the working relations as a contributory member. Three other organisations namely: Pacific Engineering Systems International Pty Ltd, CSIRO-Molecular Science Division and MSC Software Australia Pty Ltd had the status of supporting members. Over the years, a number of companies
benefited from the collaborative programmes with CRC ACS, but mostly those involved with the aerospace industry. In line with the organisations principles those benefits of cooperative arrangements were shared equally according to the participants commitments.

8.2.5 Projects and Arrangements
CRC ACS activities are organised into six programs including education. During each year of operation there could be a number of projects that are long term or new to each of the programs. These programs concentrate on: i) material science that is dedicated mainly to the development of new aerospace epoxy resins with improved fire performance, ii) improved manufacturing concentrating on process modelling using computer softwares or development of new process, iii) improved structural performance that includes optimisation of structures and structural details and certification of these structures, iv) improved operations aiming at evaluation of defects and their effects on structural integrity, methods of repair and recycling of composite materials, and v) technology demonstration that reduces the risk to industry in adopting new technology by producing demonstrator parts that incorporate new technology. CRC ACS had eighteen active research projects during the business year 2002-2003.

8.2.6 Intellectual Property Protection and Commercialisation
Intellectual property generated during the research programs is held beneficially by CRC ACS on behalf of the participants. At the conclusion of 2002-2003 year, the Centre produced commercial-in-confidence intellectual property register. This data base details all patents worth a total of $ 80M. These were developed by the organisation during its twelve-year history. Most of them have been transferred to participants and were successfully commercialised. Commercialisation of research outcomes takes usually the form of technology transfer for the manufacturing process including IP.

8.2.7 Business Environment
There is no competition in Australia to activities of CRC ACS. In the global market the organisation is one of the minor players in the composite sector. The majority of competition comes from USA and Europe. This organisation survives mainly because of continual support from the Australian Government and some long-term arrangements
with selected countries. However, the member’s capability to innovate may be restricted by financial strain and therefore involvement in the Centre may be beneficial to all members. Although business environment in Australia is good but it is still undeveloped for locally used composite products in other fields than aerospace (P30). There are more opportunities to move into the other markets than aerospace, but maybe more effort and work is required in breaking barriers to achieve required goals (P28). The existence of CRC ACS gives an excellent prospect for growth of composite industry in Australia, but the results may also depend on the other factors such as entrepreneurial skills (P29).

8.3 Organisational Setting

8.3.1 Location of CRC ACS Organisation
The CRC ACS maintains four offices, two located in Melbourne, one in Sydney and one with limited use in Newcastle. The head office is located in Fishermans Bend, Melbourne on Defence Science and Technology Organisation (DSTO) grounds. Location of head office is within very convenient distance from Hawker de Havilland Pty Ltd, one of the major Australian participant, but being on the DSTO grounds is subject to restricted access from outside due to the high military type security arrangements. The Executive Director and most of administrative staff are located there.

8.3.2 Structure of Organisation
The CRC ACS operates as the incorporated company limited by guarantee. It manages joint research programs between all the members of the organisation according to the accepted structure in Figure 8.1. In addition structure consists Liaison Committees chaired by the Deputy CEO. This body have been established with each industry participant to facilitate the transfer of technologies developed during research programs into commercial application. The management structure aims to support a number of goals, foremost of which are: i) commitment and cooperation amongst all members, ii) committed and motivated staff within research teams, iii) achievement of research milestones in a timely and efficient manner, iv) development of lasting relationships between research users and research providers; and v) effective capturing of the commercial and non-commercial benefits arising from the cooperative research.
The Board of Directors
The Board of Directors has a function of controlling the Centre. It comprises one member from each core participant, an independent Chairman and Deputy Chairman. Voting rights of the Board members are directly proportional to their equity in the Centre, with decisions requiring support from at least one industry participant. The Board met four times during the financial year 2002-2003.

Executive Director and Deputy CEO
The Chief Executive Officer (CEO) is responsible to the Board for day-to-day management of the Centre. Apart from providing leadership and direction for the Centre, the work of CEO involves liaison between researchers and the industry partners. The Deputy CEO assists the CEO in management and coordination of all research programs. Four groups advise the CEO: i) Technical Advisory Committee comprising one representative from each participating organisation that advise the CEO and through him to the Board about the technical program, ii) Education Committee with common membership to the Technical Advisory Committee, which advises on the education program, iii) Publications Committee that reviews proposed external publications on request from the CEO, and iv) Management Team from senior CRC ACS company staff that facilitates coordination across research offices and assists in the resource planning and staff development.
Management Team
Management team is composed of senior CRC ACS organisation staff that facilitates coordination of various activities across the research offices and assists in resource planning and staff development.

Publications Committee
The main function of the Publications Committee is to ensure that the IP developed during research activities is not unintentionally released in internal or external media publications. Because this committee did not meet during the year, the Technical Advisory Committee handled all issues. There are four active members registered for that committee.

Research Program Coordinators
There are six research program coordinators that supervise the major programs at CRC ACS. Their activities are supported and overseen by six other people as Special Research Advisors (SRA). The role of SRA team is to reinforce organisation’s research efforts as senior staff has often limited time. These people are responsible for research coordination and have the authority to allocate suitable personnel to manage research programs.

Education Committee and Technical Advisory Committee
Education committee provides all necessary means for CRC ACS members to continue their participation in upgrading their qualifications. CRC ACS sponsors PhD and masters programs. The Centre highly regards further education training and courses that are supported by participating universities and industry as an important aspect of staff development. In addition, internal and external workshops serve targeted professional developments for practicing engineers, scientists and technical staff. The CRC ACS continually monitors key employee skills level by way of annual performance reviews. Annual performance reviews are conducted for all staff members.

The Technical Advisory Committee has a role to review technical progress on all research tasks and usually meets every three-month. There were eight active members serving both committees during the financial year 2002-2003.
8.3.3 Business Administration

The management of administration activities of CRC ACS is conducted from Melbourne office. Office manager, administrative support person, an accountant, business development manager and financial controller perform specific functions. The office manager with assistance of administrative support person is providing the secretarial assistance to the CEO and management team in the organisation. They are also responsible for bookkeeping, office correspondence, records and cash expenditure. The financial controller focuses on budgetary control. Business development manager works with the management team to maintain industry participation and develop new Intellectual Property in the organisation.

Staff and Work Time Commitment

During the current study CRC ACS had 58 full-time equivalent research staff and 17 postgraduate students. Compared to last year the company employed a reduced core full time staff of around 30 to undertake research activities and to provide administrative support to the research and education programs. During business year 2002-2003 about 150 people contributed to the operation of CRC ACS and approximately 20 of them were women. The Executive Director dedicated 98% of time to work at the Centre. There were 27 participants from industry and academia who committed 100% of time, while 23 people dedicated 50% or over that. Those under 50% of obligation represented about 100 people.

8.3.4 Communications

Similar to other CRC organisations, ACS is obliged to be transparent with the Government and to be able to communicate effectively with its partners in order to achieve the desired results. At the Government level of communication this requires quarterly and annual reports. CEO is responsible for communications as well as for the running of six major programs at the Centre. The official nature of communications and its channels are very much in line with the organisational structure, however, what seems to be more important is the intensity and levels of informal exchanges (P22). To maintain all channels of communications open, some management meetings are frequently conducted in Sydney offices. The relatively big group of permanent employees in the organisation allows for more effective communications at all levels.
(P22; P25). Full participation of members in the organisation reflects the effectiveness of internal communications, which in turn may influence outcomes. The organisation assures that bright ideas are always followed and not left just in a corner to fade (P22). The degree of people’s relaxed manner sometimes helps to break barriers and could be seen as a positive personal ability, though not necessary their attitude at work (P24).

The running of the organisation that spreads over three sites is a fact that may have some disadvantages and can cause inconveniences at times (P24). In similar way, this may apply to communications with the industry participants that need to be sometimes carefully orchestrated to maintain correct image of the Centre (P25). Official forms of communications through reports and papers also have a significant value to CRC ACS members (P25). The senior management and some staff members are aware of the importance of good communications and therefore their wish is perhaps the most important thing that members continue to communicate a strong support for the existence of the CRC (P28).

8.3.5 Organisational Culture and Attitudes

The cooperative nature of work in CRC ACS organisation highlights the need to develop and nurture culture that could demonstrate the ability to produce intellectually based outcomes. For nature of our work in the organisation, very informal interactive culture is required without partition or isolated structures (P24). The ability to produce outcomes as a cooperative arrangements do not only relate to good communications, but also to skilful management of people that may have a variety of different attitudes. It may not be helpful all the time, but many people realise that the existence of CRC fulfils the Governments political program, though their attitudes to each other have none of that stigma and are based on communal interactions and consulting (P25; P27).

Work performance appraisal, rewards or job security may shape peoples attitudes in the most profound way. Not all Board members views may be identical and often their motivation to introduce more changes to the organisation may be controversial and bring a bit of a shock to the established culture. According to these opinions, some staff needs are seen as a bit unrealistic and too high an expectation. Their role is first to do research work as they are paid for it. The formal recognition mechanisms may be
dangerous, if approached from a viewpoint of achievements and failures as most people can easily commit only to the recognition of good performance (P23).

CRC’s are an example of place where clash between research, academic and industry cultures may often occur because of many conflicting views and opinions. These opinions need to be compromised if acceptable outcomes to all participants are to be delivered. Presence of confidence in the organisation allows building better future, but the realities of business world should not be ignored. Overconfidence in some cases may be as troubling as the lack of it and customers are not necessarily always right (P25). The engagement of universities is not seen in a favourable light by the industry if instead of tangible outcomes they produce only scientific papers and use the Centre as the mean of getting funding for research suited to their needs. This had changed recently when additional steps were taken by universities that finalised their research with IP that could be commercialised (P25).

Most people in the organisation would probably agree that CRC represents a good working model with relaxed work style and very serious relax attitudes that ought to lead to serious objectives such as innovation (P27). In order to survive, CRC ACS organisation needs to change people attitudes to blend with what is happening in the industry and maybe to do things in a bit different way. In some case it may not be enough to produce incremental changes, instead the need to deliver some revolutionary and radical solutions for these partners who require them (P23).

Differences in opinions about nature of work could be related to organisations that people come from to work in CRC ACS and bring with them their general work philosophy. The seven years of limited life of the organisation puts everybody in the cycle that could have positive and negative effects on some staff (P29).

**8.4 Human Dimensions**

Nearly thirty people from CRC ACS are employed as full-time employees. The other major contributing group of members comes from organisation’s partners. It is recognised that the human composition of staff and structures of the Centre could be closely related to organisational outcomes. The secret to success may be in matching
organisational skills base to the internal and external customers. To achieve this the most important qualities that management looks for in their staff would probably be commitment, high expertise and flexibility (P23). Researchers may put themselves into trouble and their reputation on the line when they deal with manufacturing bureaucracy that often does not acknowledge the fact that discoveries and innovations cannot be produced like sausages. Some researchers on the other hand do not know when to stop and tend to overdo self-disciplining work time (P25). Those people who conduct research and have hands on experience know how ‘draining’ it could become to conduct endless searches about existing knowledge on any subject, not to mention working on a discovery (P28). There are many instances where interactions between members of the organisation help the flow of information and subsequent growth of knowledge, but some interactions may be like idling an engine and wasting the power. Getting more multi skilled people or rotating staff more frequently may be the answer to organisational effectiveness (P22).

These skills and abilities of individuals related to cognition could be most important in the creation of intellectual property in the organisation like ACS (P25). At the end of the day, what maybe most important in research is an ability to apply the knowledge to the process of creating new things (P26). There needs to be a climate in the organisation for knowledge creation if there is an expectation from participating organisations and the Government for continuous development of tangible outcomes (P30). Knowledge from research viewpoint may be contained within reports or technical papers produced by CRC, but fair amount of it also flows from the industry. Good communication with industry is a key to acquiring that knowledge (P22). It is without doubt that wider cooperation with the international organisations could create more opportunities for ACS to learn and use new knowledge (P23). Very often, the hardest things for researchers and others generating knowledge and engaged in IP creation is to figure out what that is worth (P24).

The complexity of humans often adds to the dimensions of organisational uncertainty. There are no rules that could be followed and applied to everybody in the same way, however the more effort that is applied the better the performance maybe. The matter of having reasonable working environment and good mixture in the team for interaction to
take place requires a balance approach to demand and working at their full potential (P22). However, even in the type of cooperative arrangements that is the backbone of ACS, it is often difficult to overcome the attitude ‘but what is there for me’ as most participants have to serve two masters, an organisation that pays them the salary and one that employs them and often could demand the best of service (P30).

Day to day contacts with participating organisations are usually maintained by phones and emails (P23). The organisation seems to function not only because of good communications, but also the ability to produce new ideas that can be commercialised. It is assumed that ACS outcomes result from the array of dynamic factors that people try to manage or control, but they have limited ability to predict many events. The work at CRC and the organisational structures gives many people some sort of freedom and enjoyment not experienced at universities or typical industry. There is even room for some limited blue sky research, but always with a focus on the end results. Personal motivation is very important in research because the amount of available information or organisational culture has limited effect in the creation of innovation (P24). Motivation may not be the answer to everything, but it is difficult to imagine how things could otherwise work at CRC. Generally speaking, if people are motivated they can overcome cultural problems and may acquire the information to get on with the job, “but if they are not motivated, it doesn’t matter how good everything else is, it’s not going to happen” (P29).

It is also probably the cyclic nature of CRC with seven years life span that sharpens the view about many performance determinants in the organisation. However, moves such as securing IP may blur the atmosphere of openness and free exchange of information, and therefore discourage interactions and hinder innovation to some extent at ACS (P25; P27). The management role in bridging all conflicting and clashing aspects of this integrated organisation is skilfully crafted and undeniable (P29).

8.5 Performance Outcomes

One of the Government criteria for the renewal of CRC ACS to the third term was the ability of the organisation to produce or assist local industry in the production of outcomes that are in market demand and may help local industry to survive in the
international arena (P24). The livelihood of the organisation depends on the cooperative
efforts of members at all levels in providing results, assisting in research and creating
the desirable outcomes for the Centre and all its participants (P23). The existence of
ACS and organisational model helped to engender a culture of innovation in composite
industry in Australia. It cannot be assumed that the Centres future is absolutely assured,
but if it there are ‘enough runs on the horn’ and good ideas worth progressing are
generated, it is not the end of the game (P30).

The organisation looks forward to make a good profit and win more projects from the
customers or see a greater rate of adoption by the industry of its products and processes.
On the other hand cooperation with CRC has to show some benefits as well, such as
savings on expenditure, broadening technology base or new knowledge (P30).

It is natural that the organisation members seek more work satisfaction, better pay or
working conditions. Performance outcomes, especially in R&D type organisation, may
differ for various people depending on their ability or functions that they have to
perform (P27). It is common that work satisfaction in research may be one of the main
drive that maintains people’s enthusiasm (P30). The other motivator may be a shared
vision of where the organisation is going (P24).

The most important drive in the organisation is towards outcomes leading to applied
research, experimental results or technical reports towards tangible goals (P22).
CRC ACS is proud of its industry and is looking for innovative research outcomes as
number one priority (P23).

8.6 Results from Case Study Data Analysis
The outcomes from data analysis of CRC ACS include results from interviews, surveys
and key organisational performance indicators.

8.6.1 Interviews
NVivo software was used to manage the process and to code interviews. The first
results were obtained from broad-brush coding method. They revealed in total over one
thousand and sixty broad-brush nodes (B-BN) related to three major factors making up
the proposed research framework. Their relevant value had to be calculated, as there were different numbers of questions in the interview instrument for each examined major factor and the examined text for each case study varied in size. The approximate number of all words from case study three interviews was 27320. The creation of Node Density Indicator (NDI) allowed for rational assessment of each major factor indicating its significance to the organisation activities (Table 8.1). NDI’s represent the number of nodes per 10000 of the analysed words in the text data.

<table>
<thead>
<tr>
<th>FACTORS</th>
<th>NUMBER of QUESTIONS</th>
<th>B-BN</th>
<th>NDI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognition</td>
<td>7</td>
<td>324</td>
<td>16</td>
</tr>
<tr>
<td>Culture</td>
<td>9</td>
<td>382</td>
<td>15</td>
</tr>
<tr>
<td>Motivation</td>
<td>5</td>
<td>351</td>
<td>25</td>
</tr>
</tbody>
</table>

Table 8.1  Major factors nodes distribution from CRC ACS interviews (Author).

The preliminary results from the analysis of interviews show that the majority of the organisational issues relate to motivation. Cultural significance and cognition are at the similar level and present far less concerns in the organisation.

The next set of evidence results from detailed analysis of each major factor into elementary nodes. The elementary nodes and their descriptions derived from the preselected frameworks described in chapter three. Node numbers related to occurrence of the elementary nodes are presented further in Table 8.2. The analysis of the elementary nodes profile obtained from NVivo shows the significance of each node by displaying their groundedness and density in Table 8.3.

According to previously set rule only those elementary nodes that have at least three occurrences in each case study organisation or come from three independent sources were taken for further examination. This allowed to exclude node ‘attention to detail’ as not significant for further research. The summary of the elementary nodes significance is presented further in Table 8.4.
<table>
<thead>
<tr>
<th>FACTORS</th>
<th>ELEMENTARY NODES</th>
<th>NUMBER of NODES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scanning</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>Sensemaking</td>
<td>303</td>
<td></td>
</tr>
<tr>
<td>Action from learning</td>
<td>101</td>
<td></td>
</tr>
<tr>
<td>Total Cognition elements</td>
<td>445</td>
<td></td>
</tr>
<tr>
<td>Innovation enhancing</td>
<td>435</td>
<td></td>
</tr>
<tr>
<td>Innovation hindering</td>
<td>105</td>
<td></td>
</tr>
<tr>
<td>Attention to detail</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Outcome orientation</td>
<td>201</td>
<td></td>
</tr>
<tr>
<td>Process orientation</td>
<td>313</td>
<td></td>
</tr>
<tr>
<td>Culture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual orientation</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Team orientation</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Competitiveness</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Easy going</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Stability</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Growth</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Total Culture elements</td>
<td>1184</td>
<td></td>
</tr>
<tr>
<td>Effort</td>
<td>212</td>
<td></td>
</tr>
<tr>
<td>Performance</td>
<td>157</td>
<td></td>
</tr>
<tr>
<td>Motivation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reward</td>
<td>61</td>
<td></td>
</tr>
<tr>
<td>Goal</td>
<td>201</td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Total Motivation elements</td>
<td>701</td>
<td></td>
</tr>
</tbody>
</table>

Table 8.2  Elementary nodes values for CRC ACS (Author).

<table>
<thead>
<tr>
<th>ELEMENTARY NODES (EN)</th>
<th>TOTAL NUMBER of EN</th>
<th>ELEMENTARY NODES DISTRIBUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scanning</td>
<td>41</td>
<td>3</td>
</tr>
<tr>
<td>Sensemaking</td>
<td>303</td>
<td>7</td>
</tr>
<tr>
<td>Action from learning</td>
<td>101</td>
<td>3</td>
</tr>
<tr>
<td>Innovation enhancing</td>
<td>435</td>
<td>8</td>
</tr>
<tr>
<td>Innovation hindering</td>
<td>105</td>
<td>0</td>
</tr>
<tr>
<td>Attention to detail</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Outcome orientation</td>
<td>201</td>
<td>6</td>
</tr>
<tr>
<td>Process orientation</td>
<td>313</td>
<td>3</td>
</tr>
<tr>
<td>Individual orientation</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>Team orientation</td>
<td>34</td>
<td>1</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>Easy going</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Stability</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Growth</td>
<td>23</td>
<td>0</td>
</tr>
<tr>
<td>Effort</td>
<td>212</td>
<td>8</td>
</tr>
<tr>
<td>Performance</td>
<td>157</td>
<td>2</td>
</tr>
<tr>
<td>Reward</td>
<td>61</td>
<td>0</td>
</tr>
<tr>
<td>Goal</td>
<td>201</td>
<td>4</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>70</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 8.3  Elementary nodes distribution for CRC ACS (Author).

<table>
<thead>
<tr>
<th>ELEMENTARY NODES</th>
<th>DENSITY and GROUNDEDNESS of ELEMENTARY NODES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scanning</td>
<td>41 (9)</td>
</tr>
<tr>
<td>Sensemaking</td>
<td>303 (10)</td>
</tr>
<tr>
<td>Action from learning</td>
<td>101 (10)</td>
</tr>
<tr>
<td>Innovation enhancing</td>
<td>435 (10)</td>
</tr>
<tr>
<td>Innovation hindering</td>
<td>105 (9)</td>
</tr>
<tr>
<td>Attention to detail</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Outcome orientation</td>
<td>201 (10)</td>
</tr>
<tr>
<td>Process orientation</td>
<td>313 (10)</td>
</tr>
<tr>
<td>Individual orientation</td>
<td>50 (8)</td>
</tr>
<tr>
<td>Team orientation</td>
<td>34 (10)</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>11 (5)</td>
</tr>
<tr>
<td>Easy going</td>
<td>3 (3)</td>
</tr>
<tr>
<td>Stability</td>
<td>8 (7)</td>
</tr>
<tr>
<td>Growth</td>
<td>23 (7)</td>
</tr>
<tr>
<td>Effort</td>
<td>212 (10)</td>
</tr>
<tr>
<td>Performance</td>
<td>157 (10)</td>
</tr>
<tr>
<td>Reward</td>
<td>61 (9)</td>
</tr>
<tr>
<td>Goal</td>
<td>201 (10)</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>70 (10)</td>
</tr>
</tbody>
</table>

Table 8.4  Significance of the elementary nodes for CRC ACS case study (Author).

The next operation in the analysis involved sorting nodes from Table 8.4 into four classes: i) insignificant, ii) minor, iii) major, and iv) fully supported, accordingly to their occurrences in the case study data displayed in Table 8.5.

<table>
<thead>
<tr>
<th>FULLY SUPPORTED</th>
<th>MAJOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensemaking</td>
<td>Scanning</td>
</tr>
<tr>
<td>Action from learning</td>
<td>Innovation hindering</td>
</tr>
<tr>
<td>Innovation enhancing</td>
<td>Competitiveness</td>
</tr>
<tr>
<td>Outcome orientation</td>
<td>Stability</td>
</tr>
<tr>
<td>Process orientation</td>
<td>Growth</td>
</tr>
<tr>
<td>Individual orientation</td>
<td></td>
</tr>
<tr>
<td>Team orientation</td>
<td>Reward</td>
</tr>
<tr>
<td>Effort</td>
<td></td>
</tr>
<tr>
<td>Performance</td>
<td></td>
</tr>
<tr>
<td>Goal</td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td></td>
</tr>
</tbody>
</table>

MINOR  INSIGNIFICANT

<table>
<thead>
<tr>
<th>MINOR</th>
<th>INSIGNIFICANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy going</td>
<td>Attention to detail</td>
</tr>
</tbody>
</table>

201
This table shows that fully supported nodes represent the largest group with eleven significant themes, however ‘scanning’, ‘innovation hindering’, ‘competitiveness’, ‘stability’, ‘growth’ and ‘reward’ selected into major category could still carry fair degree of importance to the research.

Further analysis of the sorted data involved selection of only one elementary node from each of the major factors of cognition, culture and motivation with the highest ranked relative value. These elementary nodes were taken for the process of intersection using NVivo software to reveal their common text content. The selected nodes were: i) ‘sensemaking’ from cognition, ii) ‘innovation enhancing’ from culture, and iii) ‘effort’ from motivation. As a result of intersection, data was further reduced to thirty-six common text passages. The final interpretation of common text content allowed creation of few uniform nodes. When generalised they could represent the final research indicators. These indicators were used to establish the new concept theory. Their numbers are listed in Table 8.6. The universal meaning of final indicators could fit into the general description related to perception, participation and objective.

<table>
<thead>
<tr>
<th>COMMON THEME NODES</th>
<th>GENERALISED INTERPRETATION of COMMON TEXT DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Perception</td>
</tr>
<tr>
<td>36</td>
<td>25</td>
</tr>
</tbody>
</table>

Table 8.6 Results of generalised interpretation of data for CRC ACS (Author).

<table>
<thead>
<tr>
<th>FINAL INDICATORS</th>
<th>NUMBER of INDICATORS</th>
<th>FINAL INDICATOR DISTRIBUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perception</td>
<td>25 0 3 2 3 4 2 3 0 5 3</td>
<td></td>
</tr>
<tr>
<td>Participation</td>
<td>12 0 1 0 2 1 4 0 0 3 1</td>
<td></td>
</tr>
<tr>
<td>Objective</td>
<td>12 1 0 1 1 2 3 1 0 3 0</td>
<td></td>
</tr>
</tbody>
</table>

Table 8.7 Final indicator distribution for CRC ACS organisation (Author).
The analysis of final indicators properties revealed their distribution through the data (Table 8.7). The assessment of their groundedness and density allowed to establish relative values that could be more meaningful in the concluding analysis of all results from the examined interviews. The relative values of final indicators come from the calculation method described in chapter four and is displayed in Table 8.8., which will be used in chapter ten to develop the proposed innovation framework.

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>Perception</th>
<th>Participation</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>DENSITY and GROUNDEDNESS</td>
<td>25 (8)</td>
<td>12 (6)</td>
<td>12 (7)</td>
</tr>
<tr>
<td>RELATIVE VALUE</td>
<td>26.25</td>
<td>13.42</td>
<td>13.89</td>
</tr>
</tbody>
</table>

Table 8.8  Final values of primary data indicators (Author).

8.6.2 Surveys
The information contained in two research surveys provides an additional meaning to the qualitative research data for CRC ACS. Surveys can help to verify meaning of primary data and to provide the attributes that give more credibility to research evidence. The data from surveys was obtained from the participants at the time of conducting interviews.

The first survey contains the quick assessment of the opinions held by interview participants about the major influence of the key research framework factors on innovation. Results of this assessment for CRC ACS are listed in Table 8.9. They support the opinion about influence of motivation which may dominate in organisational innovation. Much smaller is participants claim to the role of culture and in only a single instance indicates low concerns about the influence of cognition on innovation.
<table>
<thead>
<tr>
<th>PARTICIPANT</th>
<th>MAJOR FRAMEWORK FACTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>COGNITION</td>
</tr>
<tr>
<td>P21</td>
<td>X</td>
</tr>
<tr>
<td>P22</td>
<td></td>
</tr>
<tr>
<td>P23</td>
<td>X</td>
</tr>
<tr>
<td>P34</td>
<td></td>
</tr>
<tr>
<td>P25</td>
<td>X</td>
</tr>
<tr>
<td>P26</td>
<td></td>
</tr>
<tr>
<td>P27</td>
<td></td>
</tr>
<tr>
<td>P28</td>
<td></td>
</tr>
<tr>
<td>P29</td>
<td></td>
</tr>
<tr>
<td>P30</td>
<td></td>
</tr>
</tbody>
</table>

Table 8.9 Opinion survey about the importance of major factors on innovation in CRC ACS (Author).

The second more comprehensive survey includes attributes of interviews participants that permitted greater in-depth analysis to understand the case study organisation (Table 8.10). All interviewed members were male and six out of ten had PhD qualifications. Among the rest of the members, two had masters and two bachelor qualifications. Fifty percent of participants were between 45 and 60 years of age with the average 8.9 years of experience within CRC ACS organisation. Also, half of the interviewed CRC members had two last jobs of similar type, six had industry experience, six worked previously in research and only two had academic experience. It appears to the author that five of the participants could be more sensitive to cultural aspects of life/work through their knowledge of other foreign languages. The knowledge of another language and the type of work experience signified to the author the possibility that some of the distinctive cultural values from these members could enhance or give an advantage in dealing with people work attitudes and may influence organisational outcomes.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>POSITION at CRC</td>
<td>RES</td>
<td>IND</td>
<td>BD</td>
<td>PL</td>
<td>PL</td>
<td>RES</td>
<td>RES</td>
<td>RES</td>
<td>BD</td>
<td>IND</td>
</tr>
<tr>
<td>QUALIFICATION</td>
<td>P</td>
<td>B</td>
<td>M</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>B</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>GENDER</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
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<td>M</td>
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<td>AGE GROUP</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>YEARS of CRC EXPERIENCE</td>
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<td>12</td>
<td>1</td>
<td>12</td>
<td>12</td>
<td>9</td>
<td>8</td>
<td>4</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>CULTURAL SENSITIVITY</td>
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<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>TWO PREVIOUS JOBS</td>
<td>1st</td>
<td>IND</td>
<td>IND</td>
<td>AC</td>
<td>RES</td>
<td>IND</td>
<td>AC</td>
<td>ST</td>
<td>IND</td>
<td>RES</td>
</tr>
<tr>
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<td>IND</td>
<td>IND</td>
<td>IND</td>
<td>RES</td>
<td>IND</td>
<td>RES</td>
<td>RES</td>
<td>RES</td>
<td>IND</td>
<td>RES</td>
</tr>
<tr>
<td>PEOPLE in NETWORK</td>
<td>15</td>
<td>13</td>
<td>60</td>
<td>25</td>
<td>12</td>
<td>90</td>
<td>6</td>
<td>5</td>
<td>50</td>
<td>6</td>
</tr>
<tr>
<td>MEETINGS</td>
<td>FORMAL</td>
<td>2</td>
<td>4</td>
<td>20</td>
<td>25</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>#</td>
<td>INFORMAL</td>
<td>10</td>
<td>20</td>
<td>40</td>
<td>15</td>
<td>30</td>
<td>20</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 8.10  Survey data about CRC ACS interviews participants (Author).

Legend: Positions at CRC have following meaning: RES = researcher, IND = industry participant, BD = member of board of directors, PL = project leader.
Qualification codes represent: B = bachelor, P = PhD, M = masters.
Gender: M = male,
Sign ‘#’ = means the same description as above.
Cultural Sensitivity = knowledge of other language than English that increases the probability of greater cultural awareness than that of single culture.
People in Network = the number of people in personal network related to work at CRC.
Meetings Formal and Informal = the number of arranged meeting per month.
Meetings Informal = the number of unplanned and spontaneous meeting/discussions per month.
Some people work for CRC ACS organisation on part-time basis. The total contribution of time from all people working for the organisation is represented as ‘full time equivalent research staff’. Taking into consideration the total number of 150 people who worked during the year for the organisation with an average size of the network calculated from ‘People in Network’ as 28 people from Table 8.9. This gives the impression that each member could operate knowing only one fifth of the organisational staff.

The other conclusion that emerges from the survey data (Table 8.10) is that the ratio for an average number of informal to formal monthly meetings at CRC ACS. This ratio is just over two (2.2), what could suggest the intensity of communications, connectivity or networking intensity of its members. This ratio could also mean that people interact with each other about two times more often than the opportunities given to them by the formally arranged meetings in the organisation.

For additional analysis from the data in Table 8.10, average number of informal meetings and average size of the network has been compiled with types of work/function at CRC and is presented in Table 8.11.

<table>
<thead>
<tr>
<th>ATTRIBUTES</th>
<th>TYPE of WORK at CRC ACS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RES</td>
</tr>
<tr>
<td>Average of Informal</td>
<td>11</td>
</tr>
<tr>
<td>Meetings</td>
<td></td>
</tr>
<tr>
<td>Average of Network Size</td>
<td>29</td>
</tr>
</tbody>
</table>

Table 8.11 Network size and intensity of networking at CRC ACS (Author).

These results indicate that on average, the size of the network for researchers and board members is more than two times larger than the number of informal meetings they may have during a month. This may point to, as earlier described in this chapter, the degree of uncertainty that researchers have conducting their affairs. On the Board site, the large
network size is probably a matter of securing contacts for future needs. The number of informal meetings by project leaders or board members also nearly doubles those held by researchers or industry partners, what could be part of their normal work function to satisfy needs of daily operations. However, if the first unusually high value for the network size and the networking intensity could be ignored for CRC ACS as abnormal, the trend seems to be showing slight growth with the increasing years of experience for members of the organisation (Figure 8.2).

![CRC ACS Experience and Networking](image)

**Figure 8.2 Attributes of CRC ACS networks (Author).**

Data specially extracted form survey results in Table 8.10 showed years of experience, network size, networking intensity and total number of people engaged in the centre and represented properties that could be compiled into a single factor demonstrating overall organisational connectivity. According to the formula described in chapter four, these attributes allow expressing the Connectivity Indicator (CI) for the organisation members. Value of contributing attributes to final CI are presented in Table 8.12, however only if compared with other case study results they may indicate some tendency. Discussion about CI indicators is presented in chapter nine.
8.6.3 Organisational Performance

The information about organisational performance has been analysed and extracted from the CRC ACS annual report 2002-2003. Data used for case study analysis represents only those indicators that are believed to be common to all organisations. It is beyond the scope of this study and practically impossible to present all organisational performance indicators and later to conduct some meaningful comparison and analysis. For example, one of the listed indicators is “number of tasks in CRC ACS research program”. This indicator does not carry any significant load supported for example by expenses, number of people involved or the duration of task and therefore does not have much value to this research. The performance data extracted for the organisation is compiled and presented in Table 8.13.

Profit of an organisation is commonly accepted as one of the most important indicators of business activities. The presented economic benefit to the Centre shows earnings of the organisation in the financial year 2002-2003. The other important indicator of CRC ACS activities is the total money that was available for operations during the financial year. The role of partners as contributors of funds is crucial to the existence of CRC programs. Funds obtained from contributors demonstrate CRC ability to attract outside interest. They could be link for example to networking and entrepreneurial skills of the Board. The number of publications from the organisation and the rewards received for research activities give also an indication of drives other than economic profits in the organisation. The other similar measure of the organisation success could be number of

<table>
<thead>
<tr>
<th>ATTRIBUTES</th>
<th>VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Years of Experience</td>
<td>8.9</td>
</tr>
<tr>
<td>Average Network Size</td>
<td>28</td>
</tr>
<tr>
<td>Average Networking Intensity</td>
<td>2.2</td>
</tr>
<tr>
<td>Total Number of People Involved</td>
<td>150</td>
</tr>
<tr>
<td>CONNECTIVITY INDICATOR</td>
<td>5.5</td>
</tr>
</tbody>
</table>

Table 8.12  Connectivity at CRC ACS (Author).
received patents or postgraduate students completing their study sponsored by the Centre.

<table>
<thead>
<tr>
<th>ATTRIBUTES</th>
<th>PERFORMANCE INDICATOR</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTCOME</td>
<td>Economic benefit to Centre ($1M)</td>
<td>1.266</td>
</tr>
<tr>
<td>INPUT</td>
<td>Government money p.a. ($1M)</td>
<td>3.17</td>
</tr>
<tr>
<td></td>
<td>Total money p.a. ($1M)</td>
<td>10.15</td>
</tr>
<tr>
<td>OUTPUT</td>
<td>Journal papers</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Conference papers</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Postgraduates completed</td>
<td>1</td>
</tr>
<tr>
<td>RELEVANCE OF R&amp;D</td>
<td>Awards</td>
<td>3</td>
</tr>
<tr>
<td>INPUT</td>
<td>Research programs resources ($1M)</td>
<td>4.38</td>
</tr>
<tr>
<td>MEMBERS</td>
<td>Full Time Equivalent staff</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>Postgraduate students</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Total members</td>
<td>150</td>
</tr>
<tr>
<td>OUTPUTS</td>
<td>Patents</td>
<td>0</td>
</tr>
<tr>
<td>COOPERATIVE ARRENGEMENTS</td>
<td>External Collaborations</td>
<td>11</td>
</tr>
</tbody>
</table>

Table 8.13  Key Performance Indicators for CRC ACS organisation (Author).

For relevance and credibility of analysis of CRC ACS, outcomes are compared to the effort put by the total number of people in the organisation. It could be assumed that the true value of all organisational performance indicators can only be realised if they are compared to the performance of the other similar organisations. In order to prepare the performance data for comparison and analysis, major performance indicators have been compiled using data from Table 8.13 into the Total Performance Indicator (TPI) according to formulas explained in chapter four. Values of major performance indicators and TPI are presented in Table 8.14.
Table 8.14  Major Performance Indicators CRC ACS (Author).

Legend:
C1 = Leverage (Total Money/Government Money)
C2 = Economic benefit to Centre/Government Money
C3 = Journal and Conference Papers/Total CRC Members
C4 = Postgraduates completed/Total CRC Members
C5 = Patents/Total CRC Members
C6 = External Collaborations/Total CRC Members
C7 = Staff Time Commitment (Full Time Equivalent Staff/Total CRC Members)
C8 = Research program resources/Total Money

The comparison and discussion about all results presented in this chapter to other case studies is included in chapter nine.
9.1 Introduction

This chapter builds on researcher’s understanding of individual case organizations presented in three previous chapters. According to Yin (1994), comparison of descriptions from multiple cases offers contrasts and similarities that enrich more comprehensive and detailed analysis of findings. In a similar way Miles and Huberman (1994) recommended benefits to theory creation from the examination of the conditions and the organizational climate under which major results are created. The evaluation of multiple cases also gives the researcher unique field experience, which stimulates the creation of theoretical organisational insight.

The thesis outcome is created using two out of four types of the triangulation methods proposed by Patton (2002). It integrates three theories of cognition, culture and motivation, which formed the proposed research framework. The three different sources of data come from interview material, survey data, and organisation’s annual reports.

The discussion of this chapter begins with general observations from case study organisations, which follows into the results from analysis of interviews and surveys. Towards the end of this chapter, externally obtained organisational performance data is compared. The conclusion to this chapter is presented in chapter ten and describes the development of the new innovation framework.

9.2 General Observations

This section compares three case study organisations examined in terms of settings, function and performance outcomes.

9.2.1 Broad-Spectrum Comparison

One of the common factors within three CRC organisations examined is their life span. The Government funds CRC organisations for seven years of operation. The other
commonly shared characteristic is the cooperative nature of organisational interactions with Australian industry, by providing them with research support. It is mandatory to the existence of CRC organisations that they focus on deliverables considered important by industry.

CRC ACS is the oldest among the organisations examined dating its beginnings to 1991. The other two organisations began operations in 1993. The support base, which comes mainly from universities, does not differ greatly in size for all case study organisations. CRC IMST and CRC ACS cooperated with five universities, while CRC CAST with only four. What makes a difference is the quality of cooperation and financial assistance from industry. While CRC IMST had thirteen industry partners, CRC CAST cooperated with eight and CRC ACS with only six. It is vital to the survival of CRC organisations and growth that they continue to maintain these relations. On the other hand, the survival of organisations also depends on the health and the status of the industry in which they operate.

At the time of conducting interviews CRC IMST was in its fourth year of operation, did not succeed to be refunded for the next term and will cease to exist in July 2006. CRC CAST was also in its fourth year of operation and probably due to overall performance results and the satisfaction or demands from the industry it will continue beyond 2005 for another seven years. CRC ACS is probably in a similar position to CAST and was awarded in July 2003 another term till 2010.

Whilst CRC IMST was aiming to better utilise Australia’s research capability and to foster a culture change in both academia and industry, CRC CAST wanted to be a partner of choice to the other casing organisations for the creation of innovative light metals technology that could benefit Australia. In contrast, CRC ACS intention was to be more globally competitive by providing a comprehensive base of advanced engineering technology and expertise that could enable Australian industry to exploit innovative composite structures. It is unfortunate for CRC IMST that the culture change of the cooperating organisations and universities did not happen quickly enough due to the resentment to change or wrong methods used to implement it. Innovation, which is the surviving strategy, seems to work well for the other two organisations.
Some of the organisational objectives are common to all case organisations. They are: i) postgraduate education, ii) maintaining links between universities, and other research organisations and industry, iii) development and education of staff, or iv) getting international recognition. However, they may be slightly different in detail such as: i) CRC IMST is interested to develop new high value products and processes as exports or import replacements, and to ensure that the participating organisations could add value to the Centre greater than that of each independently performing identity, ii) CRC CAST recognise the role of culture and effective communications by promoting face-to-face interactions, iii) CRC ACS promote the organisation as the focal point of technology for advanced composite structures within Australia and is available to provide support to wider industry by providing a stimulating environment that encourages equality of opportunity.

The research interactions between all participants of CRC organisations are vital to keep their objectives on course. While achieving results through cooperation is the main strategy, maintaining direct contacts with industry is also mandatory. However, there are no formal mechanisms in any of the three organisations examined, except annual meetings that allow for more openness and sharing of knowledge and experience across various projects. A major dilemma and difficulty with more exposure to conducted research lies in efforts to protect the intellectual property.

Though, there are whispers about or ambitions at CRC IMST and CRC ACS to portray themselves as virtual enterprise models, all organisations accept the reality of the day and maintain a small office administrative staff and CEO preferably in one location. The reality of today is that conducting research and development business in the manufacturing sector in Australia requires a good set-up to run activities across various locations as integrated organisations. The other common practice by CAST and ACS is helping small businesses to survive in Australia and thereby create a stronger industrial base for their own survival. This is according to one of the principal philosophy of CRC organisations about sharing the workload and sharing its benefits. It is also interesting to note that each organisation prefers to engage with larger companies and be involved in large long-term projects. However, it is CRC CAST that recognised building up own strength and that of small local companies as a part of its strategy, by offering general
consulting to the light metals industry. Through the Best Practice Program, they revitalised the Australian Casing Members by diffusion of new technology. This helped the organisation to prosper and it was rewarded with the next cycle of seven operational years. A similar initiative was taken recently by CRC ACS through the commercialisation of patent rights and new products. This resulted in the continuation of operations and service to Australian composite industry for another seven years. CRC IMST was maybe too slow or not too conducive towards contacts with SME’s and ‘had to pay the price’ of closing down its operations.

CRC CAST managed to maintain their interests with a large customer base which consists of nineteen member organisations and eighteen associates. CRC IMST maintained interest of fifteen member organisations and fourteen associates, while CRC ACS had only nine major participants and three associates. On the basis of performance assessment it may be concluded that while the size of customer base may matter as it gives more opportunities for interactions, the quality of good contact may equally be important as shown by the ACS example.

Work in all organisations is structured around projects and project leaders manage them. Though organisations shouldn’t be assessed by the number of projects run during a year, CRC IMST had twenty active projects during the year 2002-2003, CRC CAST had twenty seven, and CRC ACS was involved in eighteen active projects. The issue of the number of projects in the organisation is similar to the size of customer base and the quality of research is perhaps more important than numbers.

Intellectual Property (IP) protection and commercialisation are very important to all CRC organisations, as it becomes an income stream from royalties and licences created from research work. While CRC IMST relies on the services of Patent and Trademark Attorneys to provide professional advice about IP, CRC CAST has the Commercialisation and Intellectual Property Manager, which also emphasises the culture that nurtures the responsibility to protect IP in the interest of all organisational members. On the other hand, it is uncertain how CRC ACS manages the issues of IP. One thing is known that the organisation produced a commercial-in-confidence Intellectual Property register to highlight its achievements.
Australian industry faces strong competition from overseas manufacturers and suppliers. CRC organisations which are partially funded by the Federal Government have a role to provide support and scientific base to increase chances of survival for many local companies. At the same time it gives an opportunity for growth and development of the local industry. However, with the exception of CRC CAST, which is engaged with a small business sector, the other organisations examined did not foresee that need. One of the conflicting issues between research and industry is of too much time spent by researchers on solving scientific problems and often not enough time spent to solve the immediate problems of the industry. Although the examined CRC organisations look to compromise solutions it may be a good idea to follow the example of CRC CAST which had established a consulting arm for the industry to help them with day to day problems. On the other hand the ability demonstrated by CRC CAST and CRC ACS to innovate and bring change by switching from process methods to products could be an important solution for their long-term survival and success as has been suggested by Abernathy and Utterback (1978), Amabile (1996), Mogee (1993), Urabe (1988) or Utterback (1996). It can be proposed that CRC organisations need to be more open to new initiatives, and as one of the participants from CRC CAST expressed, it gives people a bit more opportunity to work outside their boundaries (P20). On the other hand knowing the ‘politics’ of business, it is possible that the existence of CRC’s and the processes they are involved in are more complicated than this research had discovered. It is also unlikely that CRC research organizations can ever earn enough money to support themselves. As long as the industry supports these organizations along with the Government help, they may survive (P7).

9.2.2 Organisational Settings Comparison

It is probably the nature of their business that some types of organisations are clustered together, while others are spread all over Australia. Three of the examined organisations have their offices in Melbourne with CRC CAST also operating from a second office in Brisbane. CRC ACS has in total four offices including interstates. Such spread of administration and activities may not be helpful in maintaining high level of integration. The literature supports the assertion that structures of the organisation whether formal or informal often determine how the organisation can function at large (Amabile,1988; Christensen and Overdorff, 2000; Drucker, 1985; Gopalakrishnan and Damanpour,
There are no major differences between the three organisation structures examined. They all have a Board of Directors and a CEO. Members of the board are elected from the member organisations. Voting rights of the Board members are directly proportional to their equity in the Centre. There are usually four meetings of the Board per year in each organisation.

There is also no major difference between the three organisations in the way they conduct research and communicate with their members and staff. They all have research, education or project management committees that help in the development and integration of research activities. The important part is in the detail that shows efficiency and effectiveness of their endeavours. Research outcomes often depend on good communications, networking and the right atmosphere at work. Sharing ideas and knowledge is quite difficult in the CRC environment as there are sensitive issues of IP protection and the consequent financial rewards for research work.

The intimacy of communications and opportunity to interact, as put by one of the members of CRC IMST may be as important as communication about objectives to be achieved. The development of relationships and understanding of industry partners may not be effective in a virtual environment. CRC CAST recognised the importance of quality communications and constant interaction, and therefore employed a Communications Manager. It also established its own publishing media CAST communications that produces a range of promotional material describing the research work and is promoting some of the spin-off opportunities that have emerged from CAST projects. This work is of the great importance not only to communications at CAST but also provides a clearer focus (P11) and to build the desired image of the organisation outside. CRC ACS probably knows from experience that good communications mean good participation in organisational activities and sharing of ideas and knowledge. As it previously happened, some people resisted in being drawn to common work. The important fact about communication is that results should not only lead to production of technology to satisfy participating organizations, but also it
has to have a certain image attached to it. And perhaps the most important message that CRC ACS would like to communicate to all other organisations is that of continuing support from its members for the existence of the CRC’s (P28).

While most policies and governing responsibilities of CRC IMST and CRC ACS are identical, CRC CAST maintains two-tier Board structure that is similar to European Board systems. The Board of CAST Centre Pty Ltd, is appointed with the agreement of the Governing Board which manages the organisation. The existence of Board of CAST offers a separation between the management of research issues and the commercial decisions. Such structure may reduce the potential for conflicts of interest within the Board of Directors. It also offers smaller, flexible and direct ways to deal with the dynamic issues of research, especially on commercialisation matters. CRC ACS on the other hand has the position of the Deputy CEO that may take the responsibility for some of the management and coordinating activities.

All case organisations have a dose of bureaucracy (administration, politics etc.) in running their activities. Their well-being may depend on the personality and the experience of the CEO. The author wishes not to comment about interesting, but personal issues of CEO’s, as this is inappropriate and may represent only his perception. However, it is recorded that CEO from CAST has research and academic background, CEO from and ACS academic and industry background, while CEO from IMST had only industrial experience. Despite the best intentions of the IMST CEO, the lack of exposure to the academic and research environment may be the cause for the downturn of this organisation.

The other concern with arrangements at CRC’s may be about jobs for life (seven years) for CEO’s. This may leave organisations wide open in situation of succession when alternative replacement after unforeseen CEO departure may be required. The example of CRC CAST shows that after the resignation of CEO in 2002 the organisation was on the verge of disintegrating as various factions tried to regain power.

In all cases, the number of people with fractions of their working time committed to CRC organisations activities is the highest (Figure 9.1).
There is a small group of people in all organisations who have dedicated 100% of their time to each organisation and that group is slightly larger than those who commit 50% or more time. The largest group of full time engaged people within an organisation is in CRC ACS representing 18% of the total number of participants, followed by 12% at CRC IMST and only 8% at CRC CAST. The smaller group represent those people who have dedicated 50% or more time. For CRC ACS they are 15% of total number of members, 11% for CRC IMST and only 7% for CRC CAST. However in all cases the largest proportion of people dedicated only a fraction of their time, that is less than 50%. This group was the biggest at CRC CAST and represented 85% of all members, 77% at CRC IMST and only 67% at CRC ACS. CRC CAST’s way of engaging large numbers of casual staff for very short durations may be the winning formula. This organisation relies on core staff and calls for outside expertise more often, thus saving time and delivering necessary outcomes.

The last element in this comparison, but not of least importance is the gender factor and the role of women in the mostly male dominated research and manufacturing environment in Australia. While their numbers in the organisations examined are very
small (5.5% of CRC IMST members, 10.8% of CRC CAST and 13.3% of CRC ACS) the influence of gender on the organisational culture was beyond the scope of this study, however it may be considered influential (P16).

9.2.3 Organisational Culture and Attitudes Comparison

All CRC organisations examined have slightly different structural configurations as their makeup integrates academic, industry, and government cultural backgrounds. All of them adopt the cooperative approach and their common goal is to deliver preferably tangible outcomes that industry partners require. It is recognised at CRC IMST that different things motivate and drive people and for this organisation to move forward it should be able to deliver outcomes and must find the common ground with everybody. Some members see their organisation like glue that bonds the industry and the research organizations. However, to have this power in the organisation it requires closeness to the objective and personal chemistry between people who work together. Very often it is a matter of “massaging individuals to make them work better in teams and rubbing down their ego” (P8), because the culture they came from may not have promoted communal approach and sharing. The other important factor that may hinder creating CRC IMST culture is the higher level of loyalty from people to their base organisations, which pay their wages rather than with CRC where they may only work temporarily on specific projects. This opinion is echoed similarly at CRC CAST that it does not have a unique culture and is rather seen as a meeting place of different cultures. In addition, some people at CRC IMST and CRC CAST carry the image of their organisation as a virtual enterprise without much substance, whereas CRC ACS is not described by its members as bureaucratic nevertheless it seems to hold such an identity within its structures. It is also worth noting that when there are more people in organisations from different ethnic backgrounds, their behaviour and culture may be more or less inclined towards achievement of common goals (Hofstede, 1991). Management of CRC IMST recognised that everybody in the organisation and participating organisations should see positive outcomes from cooperation to survive into the future. It is cooperation and continuous interactions of people through generations of common values that create the CRC culture (P12). The degree of relax, casual and informal arrangements may not be familiar in many professional circles, but it helps to create a productive culture of CRC CAST. This culture is capable of delivering innovation and commercialisation. By
achieving Government objectives, the organisation had survived and has been rewarded to continue its operation. A lot of confidence among people is built on their success stories that equipped them to tackle many big issues. “It is really the culture that nothing is impossible” (P14) and people feel that they fit into it (P16). Some people may require from time to time a bit of guidance as to what innovation really is, but there seems to be no lack of motivation (P18). The close involvement with many companies from industry gives researchers enjoyment when they see their work implemented. The ability to integrate people and their interests is probably the way to reduce many work related uncertainties and that approach makes a good part of CRC CAST culture.

In contrasting the two other organisations, CRC ACS is portrayed as a community-based environment where experts with different disciplines and skills can interact to produce desired outcomes. Because attitudes from the top of the organisation changed recently and it is not rare to hear that staff needs to be realistic in order to understand that first of all they are paid to do their job, perhaps they shouldn't expect anything special. They've got the job and should do what they are asked to do (P23). This is a bit of the master and slave arrangement and may not go well in the longer run with the creative work that is expected from scientists and researchers. As an other ‘incentive’ what may always motivate them is knowing that: “if they achieve, they are going to be rewarded and if they do not achieve they might be out” (P23). Compared to other organisations examined, CRC ACS may have a lot of confidence in its capability, but may lack manners in dealing with the outside world (P25). There is also a feeling of secrecy and unnecessary security attached to the organisational research that may overshadow its value and sensitive relationships with other participating organisations. The work style in the organisation might be relaxed, “but it is a very serious relaxed attitude, very serious about the objectives that need to be met” (P27). The fact that CRC ACS is behind high fence and the access to it is through the ‘defence style reception/guard house’ could emanate this type of energy and mentality into people working there. With new life granted for the organisation for another seven years there will be probably no more ‘day in and day out’ attitudes accepted and mainly incremental changes as the result of research activities. Certain pressure from the Board is expected to force a change of culture there and it is almost inevitable to be one of the more radical thinking and greater efforts to produce industry-required outcomes. On the
other hand, it may benefit CRC ACS if less staff would be employed on a permanent base and people from participating organisations could see more benefits for themself from working for this organisation as is practiced at CRC CAST.

9.3 Human Dimensions Comparison

For managers who are accustomed to change and may look for new ways to improve products, processes or services, the multicultural mix of staff should provide some interesting opportunity to explore for the benefit of an organisation. A glimpse at a list of names of any CRC confirms that a fair proportion of them may have, or inherited ethnic backgrounds other than Anglo-Saxon, which could give them different perspectives to view the work, life or the world. None of ethnic groups in the world could claim the monopoly for knowledge however, the cultural background may have an influence on people behaviour, work motivation and outcomes (Amabile, 1988; Hernandez and Iyengar (2001); Markus and Kitayama (1991); Thompson and McHugh, 2002).

All organisations examined follow the same process of preselection of candidates for CRC with the assessment of their skills, knowledge and inclinations towards work in the integrated communal arrangements. Researchers should have PhD qualifications or they are postgraduate students working at CRC in order to obtain one. Similar arrangements apply to project leaders who should have PhD qualifications, however when personnel perform more administrative work, lower qualifications are accepted. It is assumed that the lack of the qualified personnel for project leaders or the justification for full time employment of personnel had to be made that created the need for Special Research Advisors to oversee the quality of conducted research at ACS.

Boards of Directors in all cases recognised the difficulty in sharing knowledge and the experience between the participants mainly because of IP arrangements. The cooperative nature of CRC organisations that integrates participants from universities, industry and government research organisations might break many barriers and create a climate of open communications and learning. However, this is not as simple as different individuals and organisations may have their own motivations to participate in cooperative arrangements and other goals than common to CRC to achieve. CRC IMST
for example had instances where despite the expectations, people from participating organisations involved in projects did not contributed enough or committed well enough and have decided for their own reason that they are not going to be involved. This organisation fully recognised the difficulty in motivating integrated staff. Therefore it cannot be assumed that the majority of people working in CRC’s are motivated by the challenge and enjoyment of solving problems and getting a ‘buzz’ out of achieving results that are meaningful. Though motivation could be personally or culturally driven, the active engagement and the ability to generate research in collaboration with universities and industry shapes the future of all CRC organisations. For CRC ACS those interactions are like cross-pollination of projects and interests that may create more potential to be involved in research and therefore more opportunity to continue operations in the future.

The mechanism installed in organisations that allows for ‘free exchange’ of information during the annual conferences may prove to be insufficient for the needs of researchers to maintain the flow of knowledge during the whole year to enhance learning or to satisfy curiosity. Some CRC IMST members were not happy to have one annual review as the only chance to meet all people in the organisation, but also expressed that there is no golden rule to get good information or to be inspired. It is quite possible that through research and intuition knowledge about new products or new ideas is acquired or the combination of all other things put together could indicate, which is the right direction to go. The wishful thinking of management about good intentions of staff may not create the organisational culture where sharing of knowledge can become a norm. The commitment of people towards CRC IMST could depend on the level of satisfaction and whether they are rewarded appropriately. Despite some conflicting interests and frustration, the majority of people in the CRC IMST realised that it is in their personal interest as well as in the interest of the organisation to work well and compromise on issues related to different cultures and environments that they come from. On the other hand, CRC CAST recognised difficulty in expecting the same type or level of interest and motivation from all its members. The highly valued people tend to have a combination of in-depth knowledge in the area, the desire to carry out excellent research work, and the ability to see the big picture and the outcome of their work. In contrast, the narrow specialist who cannot see the big picture, or who see the big picture, but
lacks or has no competencies to do the detailed work and to be innovative, have vary small value to the organisation. Recognition for the personal achievements in CRC CAST plays the significant role in confirming usefulness of work to the organisation, thus giving researchers satisfaction and encouragement to perform. In addition this organisation acknowledges the fragile nature of the organisational knowledge, which exists while CRC functions. Reports and scientific papers are only historic records of things. To maintain this knowledge and for everybody to benefit from it, there is atmosphere of general openness at CRC CAST which requires honesty with people, their values and contribution, while giving everybody enough freedom to have a bit of fun while they do their work. Good communications and many interactions are probably some of the driving forces that keep everything moving at CRC CAST. In contrast, the feeling is that maybe people at CRC IMST are too selfish and hold information to themself. One of the major industry participants recognised the fact that it is quite difficult to share knowledge around there. The other problem with CRC IMST could be that rewards were not well defined or widely practiced. It is assumed that researchers who are interested in common topics of the organisations and want to be successful, aim towards delivering outcomes desired by the organisation. But to have such drives, there ought to be a mixture of personal and professional satisfaction from the work they do.

Compared to two other organisations, CRC ACS holds the larger proportion of full time employed staff. The author’s impression is that this organisation is like a duck that can fly, but enjoys sitting on the water. Though in recent years a lot of staff were retrenched, the mentality of ‘secure job for life’ may hinder the organisation to be more proactive. The alternative to organisational culture of many own ‘experts’ it could be the reliance on more temporary, multi-skilled personnel or project based arrangements that would depend on professional researchers and scientists doing work without the backup of so called ‘special research advisors’. The other drawback to CRC ACS could be the composition of staff that has got too much experience in the government type of research organisations with the lay back culture where research tend to be an open ended occupation. To participating organisations, CRC ACS is as the window of opportunity where they see the benefits of interactions on local and the international level that otherwise would not exist for Australian companies. Like in CRC CAST,
some researchers in this organisation see the need and recognise the benefits of conducting a bit of blue sky or generic research that could benefit future developments.

9.4 Performance Outcome Comparison

There are probably more examples of common outcomes than differences from case organisations. Some of the major outcomes and the criteria by which each organisation may be judged include: i) the number of projects with good industrial solutions for industry partners, ii) the number of patents created during research, iii) the number of collaborative activities, iv) the number of students graduating from the centre, and in the recent years, and v) commercial returns. It is worth noting that since the CRC program began in 1991, none of the CRC organisations delivered profits for the financial year. The attempts have been made by CRC IMST to show returns on organisational research, but this data is unavailable to public. The other criterion of performance shared by CRC IMST and CRC ACS is the acceptance of projects by the industry partners. The interest of people working in the organisation is on the commercialisation of research from which certain percentage of money may flow to the team involved and key individuals. CRC IMST recognises that there could be also some spin-offs from research that may flow to the universities as additional research work or it may involve engaging postdoctoral researcher to work at the Centre. The opinion of industry about CRC IMST is that it should be working only with such goals and directions that have practical application. Conversely, all CRC’s saw that the industry lacks a vision of things that may be required in the future and therefore does not appreciate the values and the meaning of the basic research. From all investigation and judging by the feeling from the interviews participants author could claim that realistically, the only reward for the outcomes of CRC IMST organisation activities is probably research itself.

In contrast to two other organisations, the emphasis in CRC CAST is well focused on the economic benefits from main activities, especially returns from generated IP. The organisation recognises the importance of benefits not only to the Centre and core participants but is also concerned about the impact of research on the environment. Many individuals recognise the importance of the cooperative arrangements, but on the other hand wish to be the best in the particular research area (P11). The other outcome
often mentioned is the constant good relationships between researchers and the industry people. As far as the individual acknowledgement, there are rewards awarded by the organisations such as the best scientist of the year or fully funded trips to conferences or organisations with similar profile of activities in the world. These rewards are important as they confirm the value of effort that a person may put into the common goals. It is understood that in CRC CAST, the management requires from researchers creativity and initiative and is prepared to deliver rewards for innovations. Management of the organisation is never easy with the dilemma of whether to attract larger number of industry partners or industry partners who can invest large sum of money (P16).

In the case of CRC ACS, the wealth creation through transition of ideas to products could be an ideal outcome (P30). The organisation creates opportunity for the participating members to broaden the knowledge of technology that may result in creating their own tangible outcomes. The satisfaction of researchers working on some of these prestigious projects may be as important as receiving higher monetary rewards in other organisations. Thus if there was money attached to work outcomes it wouldn’t change the degree of commitment or motivation of these people. The recognition of the fact that CRC ACS prides itself as industry focused and acknowledges its own existence from the benefits provided to the core industry members, makes customer satisfaction as the number one outcome (P23).

The recognition of the contributions of CRC’s to the relevant industry sector or the related organisations in the form of generated net cost savings is listed in the latest report “The Economic Impact of Cooperative Research centres in Australia” by the Allen Consulting Group. For CRC CAST this contribution is $6.6 million and for CRC ACS $6 million per annum. Performance impact of CRC IMST was not mentioned in the report as this organisation is closing down by the end of June 2006. This report publishes quantified data verified by the end users of mentioned CRC organisations. Financial contribution of CRC CAST is in line with author’s assessment of top performance by this organisation. Other details about organisational performance are discussed at the end of this chapter.
9.5 Comparison of Interviews Results

Results from the analysis of the interviews were the primary source of data in this research. Careful attention has been given to earlier formulated research protocol and the process of analysis in order to arrive with credible and repeatable results. The sequence of analysis followed the process established earlier in chapter four (Figure 4.1). The first results from the analysis of interviews text were obtained using broad-brush coding method. They revealed the number of nodes per case study according to major framework factors of cognition, culture and motivation. These nodes were extracted from each interview text and may represent popular views of the particular organisation. Results obtained at this stage of the analysis did not represent any meaningful information. The number of elements for each adapted framework used for this research varied with the number of questions composed for each research instrument. The additional assessment was required in order to find out the relative density of nodes per organisation examined in the relation to the size of the text data available. Therefore, the total number of nodes representing each major factor was divided by the number of questions composed for each factor, and by the number of text words in each case study interview to arrive with the Node Density Indicator (Table 9.1).

<table>
<thead>
<tr>
<th>ORGANISATION</th>
<th>NODE DENSITY INICATORS (NDI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cognition</td>
</tr>
<tr>
<td>CRC IMST</td>
<td>7</td>
</tr>
<tr>
<td>CRC CAST</td>
<td>9</td>
</tr>
<tr>
<td>CRC ACS</td>
<td>16</td>
</tr>
</tbody>
</table>

Table 9.1 Combined NDI values from all case studies (Author).

The creation of NDI represents a normalised value of nodes that are proportionally distributed among the factors and could indicate a true significance of the first finding. At this stage of analysis, it was evident from the NDI results that the emphasis in all case organisations was on motivation issues. This is in contrast to findings from literature review where cognition and knowledge factors dominated the importance of innovation. It can be stated that cultural and social issues are holding middle ground in this research and are supported by similar findings from the literature. Though the
attention given to culture in literature emphasises its importance as the basis of innovation activities, it may be difficult for innovation to take place without motivation. The highest NDI rating for motivation in all case organisations is in sharp contrast to the lowest occurrence in the literature. This may indicate that from practical viewpoint behavioural factors play the most important role in innovation, which is still not recognised by the wider research community. It maybe the case that equal importance of culture and cognition to CRC ACS is because this organisation’s long involvement with high value, precision products. At this stage of analysing all major factors it appears that cognition is least important for other two organisations, as knowledge and its creation are natural in research environment.

The second stage of data analysis concentrated on the refined coding of selected information from major factors of cognition, culture and motivation, which could show sharper picture of organisations. This view is based on the preselected elements of three major factors that are explained in chapter three. The general trend emerging from all the case studies fine-coding is uniform within the highest rate findings located in the same category of nodes. For the framework factor of cognition the maximum node density happen to be in ‘sensemaking’, for culture in ‘innovation enhancing’ that took the leading role and for motivation in ‘effort’ that had the highest score. All elementary modes are presented in Table 9.2 and top-scored ones are highlighted.

The examination of nodes properties using NVivo software allowed to create density and groundedness values for each node and subsequently to evaluate the importance of each theme that the elementary nodes represent (Table 9.3).
### Table 9.2  Elementary nodes values (Author).

<table>
<thead>
<tr>
<th>FACTORS</th>
<th>ELEMENTARY NODES</th>
<th>CRC</th>
<th>IMST</th>
<th>CRC</th>
<th>CAST</th>
<th>CRC</th>
<th>ACS</th>
</tr>
</thead>
<tbody>
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<td></td>
<td></td>
<td></td>
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<td>41 (9)</td>
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<td></td>
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<tr>
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<td>169 (10)</td>
<td>303 (10)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action from learning</td>
<td>105 (10)</td>
<td>114 (10)</td>
<td>101 (10)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>415 (10)</td>
<td>435 (10)</td>
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<td></td>
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</tr>
<tr>
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<td>67 (10)</td>
<td>105 (10)</td>
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<tr>
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<td>201 (10)</td>
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### Table 9.3  Density and groundedness of the elementary nodes (Author).

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<tr>
<th>ELEMENTARY NODES</th>
<th>DENSITY and GROUNDEDNESS of ELEMENTARY NODES</th>
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<th>IMST</th>
<th>CRC</th>
<th>CAST</th>
<th>CRC</th>
<th>ACS</th>
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<tr>
<td>Scanning</td>
<td>77 (10)</td>
<td>101 (10)</td>
<td>41 (9)</td>
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<tr>
<td>Sensemaking</td>
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<td>303 (10)</td>
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<tr>
<td>Action from learning</td>
<td>105 (10)</td>
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<td>101 (10)</td>
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<tr>
<td>Innovation enhancing</td>
<td>287 (10)</td>
<td>415 (10)</td>
<td>435 (10)</td>
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<td>Innovation hindering</td>
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<tr>
<td>Attention to detail</td>
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<tr>
<td>Reward</td>
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<td>70 (10)</td>
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<td>Goal</td>
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<td>204 (10)</td>
<td>201 (10)</td>
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<tr>
<td>Satisfaction</td>
<td>102 (10)</td>
<td>73 (9)</td>
<td>70 (10)</td>
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</tbody>
</table>
Analysis of all nodes displayed in Table 9.3 followed by sorting them into four categories based on their groundedness values. Fully Supported (FS) nodes are those that have appeared in all 10 interviews of each case study, Major (Mj) in between 5 and 9 documents, Minor (Mn) in less than 5 documents, and Insignificant (In) in less than 3 interview documents. Results of this categorisation are presented in Table 9.4.

<table>
<thead>
<tr>
<th>BASIC NODES</th>
<th>ELEMENTARY NODES</th>
<th>CRC IMST</th>
<th>CRC CAST</th>
<th>CRC ACS</th>
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</thead>
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<tr>
<td>COGNITION</td>
<td>Scanning</td>
<td>FS</td>
<td>FS</td>
<td>Mj</td>
</tr>
<tr>
<td></td>
<td>Sensemaking</td>
<td>FS</td>
<td>FS</td>
<td>FS</td>
</tr>
<tr>
<td></td>
<td>Action from learning</td>
<td>FS</td>
<td>FS</td>
<td>FS</td>
</tr>
<tr>
<td></td>
<td>Innovation enhancing</td>
<td>FS</td>
<td>FS</td>
<td>FS</td>
</tr>
<tr>
<td></td>
<td>Innovation hindering</td>
<td>FS</td>
<td>FS</td>
<td>Mj</td>
</tr>
<tr>
<td></td>
<td>Attention to detail</td>
<td>In</td>
<td>In</td>
<td>In</td>
</tr>
<tr>
<td></td>
<td>Outcome orientation</td>
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<td>FS</td>
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<tr>
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<td>Process orientation</td>
<td>FS</td>
<td>FS</td>
<td>FS</td>
</tr>
<tr>
<td></td>
<td>Individual orientation</td>
<td>FS</td>
<td>FS</td>
<td>Mj</td>
</tr>
<tr>
<td></td>
<td>Team orientation</td>
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<td>FS</td>
</tr>
<tr>
<td></td>
<td>Competitiveness</td>
<td>Mj</td>
<td>Mj</td>
<td>Mj</td>
</tr>
<tr>
<td></td>
<td>Easy going</td>
<td>Mj</td>
<td>Mj</td>
<td>Mn</td>
</tr>
<tr>
<td></td>
<td>Stability</td>
<td>Mj</td>
<td>Mj</td>
<td>Mj</td>
</tr>
<tr>
<td></td>
<td>Growth</td>
<td>Mn</td>
<td>Mn</td>
<td>Mj</td>
</tr>
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<td>Effort</td>
<td>FS</td>
<td>FS</td>
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<td>Reward</td>
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<tr>
<td></td>
<td>Satisfaction</td>
<td>FS</td>
<td>Mj</td>
<td>FS</td>
</tr>
</tbody>
</table>

Table 9.4 Combined classification of all nodes (Author).

The first consistency among the elementary nodes in Table 9.4 is that node ‘attention to detail’ proved to be insignificant due to very low density and groundedness for all organisations. Out of the total nineteen nodes allocated to each case, the majority of them are fully supported. These elementary factors are: sensemaking, action from learning, innovation enhancing outcome orientation, process orientation, team orientation, effort, performance and goal. The other two common factors for all case
study organisations were of ‘competitiveness’ and ‘stability’ in majority category. It is also interesting to note that while node ‘growth’ is of the minor concern to the members of CRC IMST and CRC CAST organisations, it has much higher status for CRC ACS on the contrary, while ‘individual orientation’ may be recognised at CRC IMST and CRC CAST organisations it is of smaller significance to CRC ACS. On the other hand, quite opposite node ‘easy going’ that describes the atmosphere and no stress attitudes among members is quite high for CRC ACS, but relatively low for the other two organisations examined. This could be explained by the uncertainty that CRC ACS was facing when starting a new round of its seven years of operation. At the time of interviews the organisation has gone through the round of retrenchments, and had new CEO appointed to the organisation proposing some radical changes.

The consistency in findings among the highest density and fully supported nodes of ‘sensemaking’ coming from the major factor of cognition, ‘innovation enhancing’ placed within the major factor of culture, and ‘effort’ belonging to the major factor of motivation permitted their use for further analysis and the triangulation process. The triangulation process delivered majority of common nodes for CRC IMST with the least for CRC CAST. The subsequent interpretation of final common text produced three generalised meanings of perception, participation and objective with corresponding number of occurrences listed in Table 9.5. It is evident that the numbers of occurrence for each final indicator are proportional to the total number of common nodes from each case study triangulation process. The most common themes were found in the final analysis of data from CRC ACS organisation rather than CRC IMST and had least contribution from CRC CAST.

<table>
<thead>
<tr>
<th>ORG.</th>
<th>COMMON THEME NODES</th>
<th>GENERALISED INTERPRETATION of COMMON TEXT DATA</th>
</tr>
</thead>
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<td>6</td>
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<tr>
<td>CRC ACS</td>
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<td>25</td>
</tr>
</tbody>
</table>

Table 9.5 Generalised interpretation of common text data (Author).
The examination of final nodes properties with density and groundedness (Table 9.6) produced clearer image of organisational characteristics, but still not decisive to conclude. Each final indicator that appeared at least in three different interviews was qualified for further assessment.

<table>
<thead>
<tr>
<th>ORGANISATION</th>
<th>DENSITY and GROUNDEDNESS of COMMON TEXT DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Perception</td>
</tr>
<tr>
<td>CRC IMST</td>
<td>13 (6)</td>
</tr>
<tr>
<td>CRC CAST</td>
<td>6 (3)</td>
</tr>
<tr>
<td>CRC ACS</td>
<td>25 (8)</td>
</tr>
</tbody>
</table>

Table 9.6  Significance of final research indicators (Author).

First, like in other similar situation, the relative values of the final indicators were calculated by combining groundedness and density numbers into their square root in order to obtain the meaningful final relative value for advanced analysis. These values are displayed in Table 9.7. The snap comparison can reveal that in situation of CRC IMST and CRC ACS, values of perception are the highest, indicating probable emphasis in these organisations on seeking new ideas, rather than being concern about organisational participation or objectives. In contrast, participation of members at CRC CAST is the prime aim or concern, which resulted in leading performance of this organisation.

<table>
<thead>
<tr>
<th>ORGANISATION</th>
<th>RELATIVE VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Perception</td>
</tr>
<tr>
<td>CRC IMST</td>
<td>14.32</td>
</tr>
<tr>
<td>CRC CAST</td>
<td>6.71</td>
</tr>
<tr>
<td>CRC ACS</td>
<td>26.25</td>
</tr>
</tbody>
</table>

Table 9.7  Relative values of final research indicators (Author).

The last stage of analysis involves assessment of pooled meanings for perception, participation and objective in the context of the all the case study organisations in order to build a new concept of innovation. The results of assessment process bring the significance of this research finding and are supported by the compatible values verified
by the other research evidence from surveys and organisational performance indicators. This process of creating the new concept of innovation is presented in chapter ten.

9.6 Comparison of Survey Data

The comparison of survey data from three case organisations allows for the reflection that could enrich findings from the primary data analysis. This section includes the discussion of main survey results presented for each individual case study in chapters six, seven and eight, and the secondary survey about innovation.

As observed after the examination of the main surveys results, all interviewed CRC IMST members were male and 5 of them had PhD qualifications. Majority of members were under 45 years of age with the average 6.3 years of experience within their organisation. Members of CRC CAST were also in the same age group in majority of cases, but 7 out of ten had PhD qualification. As an exception, one female researcher was interviewed from this organisation. The average experience for CAST interviewed members within the organisation was 7.7 years. In contrast, majority of interviewed members from CRC ACS were in the older age group between 45 and 60 years what is probably reflected in the averaged experience within the organisation of 9.4 years. Six of the interview participants from ACS were holding PhD qualifications. There is no set conclusion that could be drawn from this assessment apart of presuming that years of experience and qualifications of members can have the influence on the opinion about their organisations.

Whilst four out of ten people from CRC IMST knew another language other than English while four others had past working life with a mix of experience coming from two different types of work and only three out of ten members were from CRC CAST who knew another language, and finally only two had a mixture of different types of work experience. There were five members at CRC ACS who knew another language and only two out of ten people interviewed had mixed past working experience. The knowledge of another language and the type of work experience signified to the author of this study deeper than average person’s awareness of the other cultural values, such as those that could be described as personal, national or organisational. These values
can be detrimental in shaping common organisational culture and may influence the highest presence of elementary node ‘innovation enhancing’ in all case organisations.

Many people work for CRC organisations on part-time basis and the total contribution of their time represents the equivalent of organisation size calculated as ‘full time equivalent staff’. The average size of the personal network for CRC organisations represented a quarter of all organisational staff for CRC IMST, one third for CRC CAST and only one fifth in the case of CRC ACS. The ratio for the number of informal to formal meetings held per month could indicate the nature of communications and its intensity within each of the case study organisations. For CRC IMST organisation this ratio was three and a half, for CRC CAST just over 6, and for CRC ACS a little over 2. Compared to other organisations, the information about the size of average network and the ratio of informal to formal meetings may suggest the highest quality of communications at CAST. This may stress importance of network size, greater opportunities and willingness for informal interactions at this organisation that leads to the best performance compared to other cases. This finding from survey about the ratio of informal contacts between CRC members to the number of formally arranged meetings or gatherings may represent what McElroy (2000) described as connectivity. In his opinion, connectivity characterises the density of communication in networks, which is important for organisations innovation. McElroy argued that the richness of connectivity might affect the rate and the quality of innovation. The consideration to the importance of connectivity takes in this research the combination of factors such as number of years of experience, network size, number of formal and informal monthly meetings and the total number of people involved during a year in the activities of organisations. The author assumes that these attributes when expressed by the single value could represent in the best way the connectivity within an organisation. The Connectivity Indicator (CI) was constructed by multiplying the average years of experience of interviewed participants, by the average network size, by the average ratio of informal monthly meetings to formal monthly meetings, and this number was divided by the total number of people involved during a year in the activities of each organisation. Results of CI for each organisation are presented in Table 9.8.
The richness of connectivity at CRC CAST confirms the efforts of this organisation towards maintaining the best possible communications not only within the CRC, but also in the broader public sense. This top result may be due to the employment of the professional Communications Manager in the organisation who is responsible for quality of communications. The other two organisations are well below the mark of CRC CAST with CRC ACS having less than half of the top connectivity attribute.

The secondary survey conducted at the end of interviews examined opinions of participants about which of the major factors of cognition, culture or motivation may have the greatest influence on the innovation in their organisations. This data derived from the summary of detailed information about each member’s preferences tabulated for each individual case study organisation in chapters six, seven and eight. Final comparison is presented in Table 9.9.

<table>
<thead>
<tr>
<th>ORGANISATION</th>
<th>Cognition</th>
<th>Culture</th>
<th>Motivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRC IMST</td>
<td>E</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>CRC CAST</td>
<td>VS</td>
<td>Se</td>
<td>M</td>
</tr>
<tr>
<td>CRC ACS</td>
<td>VS</td>
<td>Se</td>
<td>M</td>
</tr>
</tbody>
</table>

Table 9.9 Innovation survey (Author).

Legend: M = majority, E = equally, Se = secondary, VS = very small

The surprising result of this opinion survey was that the significance of cognition was mentioned only once in CRC CAST and CRC ACS organisations and not at all in CRC IMST. This maybe explained by the nature of R&D work and the organisational research environment. People working in CRC organisations are accustomed to creating and using knowledge and do not view it as anything special. It is presumed that to be able to cognate becomes the second nature to them. Although, the use of knowledge in
R&D organisations is very important, but the very low result of cognition could be attributed to the modesty of the interviewed people. However, it is interesting to note that much stronger opinions existed in the relation to the importance of culture and motivation. The only exception is CRC IMST organisation where the opinion about culture and motivation was equally important. Members of the two other organisations emphasised motivation rather than culture in the organisational innovation. Five participants in CRC CAST and six in CRC ACS organisation out of the ten declared that motivation influences innovation more than culture. This quick analysis did not have any impact on the general process of interviews data analysis as question about the influence of cognition, culture or motivation was the last one in the interview protocol. The survey results however provided the independent information from that which was extracted from interviews about participant’s personal preferences and the major emphasis on one of the factors examined in organisational innovation.

9.7 Comparison of Performance Data

One of the problems faced during the annual Government evaluation program of CRC organisations, is the lack of the uniform measure to assess the performance of all participating organisations and the different types of indicators used by all organisations to highlight the significance of their achievements. In order to unify reported performance findings from the annual reports of three CRC organisations, the author of this thesis analysed the content of each report, extracted common performance indicators and worked out the formula, which could combine all key performance indicators into the single meaning unit namely Total Performance Indicator (TPI). The intention is to use this indicator as relevant to the overall performance effort of each organisation. Details for the TPI formula are described in chapter four. The results of TPI calculations are presented in Table 9.10.

<table>
<thead>
<tr>
<th>ORGANISATION</th>
<th>TPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRC IMST</td>
<td>0.71</td>
</tr>
<tr>
<td>CRC CAST</td>
<td>1.70</td>
</tr>
<tr>
<td>CRC ACS</td>
<td>1.45</td>
</tr>
</tbody>
</table>

Table 9.10 Total Performance Indicators (Author).
The results of integrated performance indicators TPI suggest that CRC CAST organisation outperformed the other two organisations. Performance of CRC CAST and CRC ACS was two times better than that of CRC IMST. The existence of single performance unit describing organisations helped to verify this research finding because the organisational performance data was independently collected and published, and is considered as the external source of data to findings of this research.

9.8 Summary

This chapter about comparison of case organisations concludes that all indicators such as results from primary data analysis, surveys and organisational performance data point to the superior accomplishments by CRC CAST. These findings are in line with the latest published report by the Allen Consulting Group about “The Economic Impact of Cooperative Research centres in Australia” that recognised higher contributions of CAST to the relevant industry sector than from other two cases organisations. The accomplishment to foresee the lack of consistency in performance of CRC IMST justified by the least satisfactory results of this organisation were realised much earlier by the author of this thesis than the Government decision to terminate their operation, highlighting the reliability of this study.
CHAPTER TEN

Development of Innovation Framework

10.1 Introduction

This chapter describes the development of innovation framework, which is the result of the final analysis of interviews data from three case studies organisations. Findings from the literature review and some material from interviews support the justification for the new innovation framework. The final analysis presented in this chapter combines the meanings of three indicators: the aptitude to perceive (perception), predisposition to participate (participation) and the clarity of objectives (objective) which builds a new concept of innovation. This new concept is not a recipe for innovation, but demonstrates conditions that are necessary to be predisposed to it. The proposed new concept of innovation can be best described as the Innovation Propensity. This concept originated from the existence of perception, participation and objective indicators that were integrated into one single identity.

10.2 Discussion of Innovation and Literature

This research started as the exploration of innovation and the relative topics applicable to innovation. The selected topics of the literature review represent author’s choice. The content analysis of all literature topics revealed the emphasis on cognition, culture and motivation issues that could enhance innovation. The author did not found many links in the literature leading only to single factor such as recommended by Drucker (1975; 1986; 2001) towards development of innovation in organisations as an objective. The only country in the world that implemented innovation as an objective at the national policy level is Romania (Dragulanescu et al., 2002). The existence of innovation as an objective at the national level could encourage implementation of innovation as a policy or strategy at the lower organisational levels.

The overall picture of Australian industry and innovation is not so bright. For example, there are no companies developing products for the worldwide markets such as Nokia or Phillips (see Appendix I for “Australian Industry is Different”). According to Greiner
(1972) the existence of clear purpose in organisations helps them to grow in the long-term. More than thirty years ago Greiner identified five stages of organisational growth. It is very interesting that he predicted in the last stage of organisational growth some of the practices that make organisations successful today. Those practices are: i) management focus on problem solving and innovation, ii) organisational structure made of matrix of teams, iii) participative style of management, iv) organisational control by mutual goal setting, and v) emphasis of management on rewarding teams with bonuses for their contributions. Many organisations in Australia do not probably know Greiner’s visionary work. However, they are interested to have continuous growth for shareholders and most likely follow common management practices of watchdog or delegation. It may be possible that the conflict of interests between those who own the tangible assets such as factories, machines, tools etc. and still do not recognise the power of the intangible factors like knowledge or culture that could be used to the greater benefit if managed wisely, creates innovation deadlock.

Human nature, culture, motivation or organisational politics could be the other factors that hinder the innovation efforts. Right or wrong, the attitude of ‘what is there for me’ may often discourage the continuation of promising developments in organisations. The story about an engineer from Japan who won the Nobel Prize in chemistry may serve as such an example (Kho, 2002). The shares of the company he worked for nearly doubled in value due to the Nobel Prize announcement, but a dilemma about how to compensate an engineer for his invention obstructed his just treatment by the company for many years. This example shows inability of organisations to deal with some basic human issues such as rewards for exceptional achievement. Currently, some companies in Japan and USA implement systems of compensation that includes incentives or profit sharing for employees to encourage them for more innovation. Kho argues that organisations, which are seriously interested in innovation, need to approach compensation for innovations not as the matter of necessity, but as a mandatory strategy. Drucker (1996) highlights the other side of a coin where compensation packages of many executives do not relate to the organisational performance, giving them free hand to manage organisations for their own gains (London, 2004). On the other hand, it might be also a bit unrealistic in countries with the individualistically orientated cultures such as in Australia that some organisations generally hope for the
spontaneous intellectual engagement at work without creating a personal interest. The only hope for these organisations may be that there are enough ‘mad scientist’ or researchers for whom the nature of discovery or proving the unknown principles might be beyond the materialistic reaches praised by the majority of the society. The undeniable fact is that the Australian society in recent years became very materialistic, therefore there are no reasons to believe that organisations in the user pay society can capitalise on the creativity of its members without paying the additional price for innovative ideas. It is rather unreasonable to expect from the Western culture and society, which learned to treat its people like numbers that they would display a sympathetic behaviour to the common course (Neisser and Jopling, 1997). However, it may be possible that efficient and effective organisational innovation could take place in the wider Australian context through the transition into new social dimensions that treasure innovative culture of cooperation and sharing or by maintaining the same Western societal values, but engaging individuals to produce intellectually based outcomes under fairer recognition terms. Setting directions for the knowledge workers contribution into organisations could not be achieved by demanding from them responsibility but rather allowing them to do what they are paid to do. For example, allowing researcher to do research work not to be administrators or managers (Drucker, 1996).

It seems to be that organisational life is not absent from Machiavellianism and after all if the world at the moment depends on the knowledge economy, there is a large army of poor inventors who could have a status of ‘knowledge-worker-aristocrats’. Though new ideas or inventions are part of the intangible intellectual capital, they represent substantial values to many individuals. The power of the intellect is displayed in the example of Internet company Google whose assets value are more than hundred times lower than the value of its shares. Intellectual agility in transferring knowledge from one context to the other or linking distinct pieces of information together is often a source of innovation and a crucial element to organisational success. The sooner organisations learn how to treasure the knowledge, better for them in the long run (Ross et al., 1997).
Though Drucker (2001) have been concerned with unrealistic drive in discussions about management towards ‘one right objective’, the author of this thesis believes that organisations that aspire to be innovative must have innovation as one of their core objectives. Achieving the ultimate results in an organisation may require selection of the right employees for the job, managing work by providing individuals with the right kind choices of intrinsic rewards that could be linked to outcomes (Kanter, 1983). Drucker’s (1999) question of: “what we could describe knowledge worker’s productivity with?” may be best answered that only innovation could satisfy that measure.

As there is probably no single answer to what could determine organisational innovation (Wolfe, 1994), this thesis attempted to explore and disclose some of the determinants that may help to assess the inclination of an organisation to innovation, or be used to enhance its performance. The first most significant observation is that though most of innovation ideas come from individuals (Amabile and Conti, 1999), it may not be necessarily the creativity that is all responsible for it. For example, the results from Millennium Product survey show that majority of generated ideas come from the logical and structured approach to problems solving, rather than using lateral thinking (Brunel University, 2002). Earlier research by Dunbar (1999) supports the opinion that there is no single type of cognitive process which is responsible for creative thinking or mental functioning involved in generating ideas. It is also known Albert Einstein’s claim that he never discovered anything through the process of rational thinking. On the other hand, William Tiller (Tiller and Walter, 2001) believes that spiritual interaction with physical reality gives individual intentions to create new things, but for many researchers and scientists it is mainly a deliberate method of problem solving that contributes to new breakthroughs (Isaksen, 1988). One of the findings of this research is that rather than claiming creativity as the input to new ideas it may be more generous to recognise individual’s aptitude to perceive things as an appropriate universal input to innovation. The second specific observation about innovation is that although implementation is often described as the second face of the innovation ‘process’ after creation of ideas, and most of the steps are known, the very open term ‘implementation’ does not give any specifics to the details of that process. There is no doubt about big expectations from the implementation of ideas, but the existing knowledge and very
little attention in the literature about it is like “cooking with a list of ingredients but without the recipe” (Sabherwal and Robey, 1993, p. 549).

In addition to good communications and feedbacks that are some of the important determinants of innovation (Axtell et al., 2000), there seems to be no clarity of objective to be achieved as activity’s outcome. It also seems to be controversial that ‘innovation process’ terminology is very often used to please the readers and at the same time to create more confusion about what really the term ‘innovation’ means. For example, in some European countries, like Finland, which is one of the most innovative nations there are more emphasis to present innovation as an outcome of the innovative activities, but not the process. One would expect that when talking about process, the ingredients and the methods used during the process would be known and unchanged and could give more or less anticipated outcomes. However, the fact is that no one is able to predict the outcome of innovation (Wolfe, 1994).

This study proposes to expand on the meaning of ‘implementation’ in relation to innovation activities. The author realised during this study the need to include ‘predisposition to participate’ and the ‘clarity of objective’ as the important elements to proposed Innovation Propensity framework that may help to take some of the ineffectiveness and disillusions out of innovation studies (Hage, 1980). The full importance of participation has been realised after the interviews with all case study organisations where getting involved in research, and sharing of knowledge and experience was one of the major determinants to performance. These issues are discussed in detail further in this chapter.

10.3 Discussion of Research Findings and Literature

The analysis of the primary data in this research was based on the proposed framework of cognition, culture and motivation and involved examination of three case studies. Final analysis of case studies discovered three main indicators namely: perception, participation and objective that have the influence on an organisational innovation. The clarification about importance of aptitudes to perceive ideas, predisposition to participate in innovation activities and the clarity of objectives are explained in relation to innovation and subsequently to proposed innovation framework.
10.3.1 Aptitudes to Perceive

It is assumed that the aptitude to perceive is the most important personal attribute to produce new ideas or inventions as subsequent inputs of innovation. Perception may be a determinant that influences organisational goals and through individual’s ability the recognition of opportunities available to create and to exploit innovation related advantages (Bell and Kozlowski, 2002). The range of aptitudes may include: ability, talent, skills, gift or propensity. The variety of ways in which new ideas can be perceived such as: sensing, realisation, understanding, comprehension or recognition, create a number of difficult combinations to predict. The results of innovation activities may also depend on person’s needs, motivation, experience and interpretation and are often unpredictable (Hampton et al., 1982; Hodgetts, 1991). It may be a case that “reciprocal assumptions made by others and ourselves produce a social world where we actively transform ourselves according to our context” and innovate (Thompson and McHugh, 2002, p222). In addition, Hampton et al., (1982) claims that person’s needs, motivations and experience often affect perception and may not necessarily represent a reality. He identified perception as a main difficulty in communicating new ideas, because most people prefer the simple and regular things to the complex and irregular, which may not fit into the existing structure of their mind. In his opinion this is especially visible in people with low tolerance for ambiguity and who tend to lag in perception and recognition. Such critical aspect of perception makes it like a gate of go, no-go for innovation.

According to Thompson and McHugh (2002) perception is like an umbrella under which people organise, process and interpret incoming stimuli, which form their identity. Individual’s perceptual set may include factors such as learning, intelligence, ability, training, interests, expectations, goals, past experience, motivation and personality (Mullins, 2005). Perception is not constant and if altered it can change attitudes and behaviour. Thompson and McHugh give an example of some Japanese work practices such as single status canteens or uniform work clothes, which can alter perception of division between workers and managers. It is generally accepted that
people actively transform their perception throughout their life in order to make sense of an environment. Some authors view perception like painting a picture which may include only those elements of a subject that are important to the painter’s construction of representative events or his vision of reality (Northcraft and Neale, 1990). It can be also claimed that many people act upon their perception of the world around them or in a biological sense upon their neurological sensations. Though the process of perception is complex, it often includes some of the basic steps such as construction and interpretation to produce outcomes. The ability to perceive depends on many factors, with the choice to select inputs and accommodation of them that provides new information, being one of the most important factors (Northcraft and Neale, 1990). According to Hodgetts (1991) there are four major factors that influence person’s perception: selection of stimuli, organisation of stimuli, the situation, and the person’s self-concept. Hodgetts suggests that self-concept is probably the most important one as it contains the mental picture of self which determines what a person perceives to do. He also supports a common view that an individual’s concept of self may change as a person matures. On the other hand Hodgetts recognised that perception about the physical reality such as machine or car does not cause many problems in communications, but normative perception of reality that is open to interpretation and opinions may often be a reason for conflicts. Zaltman et al. (1973) recognised that it is perception that may change during innovation and therefore alter behaviour and outcomes accordingly. It is therefore especially important that organisation members can participate in spontaneous work related discussions where “bouncing ideas of each other” can give them the opportunity to identify something that could be useful to their research or they may share the information or knowledge relevant to others in a group (P3; P5). The ability to identify all gathered knowledge may be used as a sort of input into strategic decision made for individuals and organisations to survive in the long run (P29).

It is difficult to capture the capability of human mind making sense of lifetime experience, connecting patterns from past to the present and to the future, however the unique ability to foresee innovation needs to take place and is essential for an organisation (Leonard and Sensiper, 1998). Further, Leonard and Sensiper are saying that innovation may not be possible without creative cooperation of individuals. The
significance of individual’s tacit knowledge during innovation activities is also unquestionable, as people often know more than they could tell or realize (Polanyi, 1983). However, a general opinion is that innovation is an outcome of the purposeful, conscious, dedicated and focused mind (Drucker, 1985). On the other hand, it may be a case that innovation is not only about individual’s inner capabilities of making sense, but it could require the perception about an external awareness (May, 2005). Some authors argue that perception is the natural function of human brain that helps to understand the world around by the constant reconsolidation of the old information left in the general memory storage area (McCrone, 2003). Though it is an individual’s perception of ‘relative beings’ that brings them to a reality (Gershenson, 2002), the importance of sense making in innovation has significance only if it could be realised by the collective in the form of intellectual product (Jelinek and Litterer, 1995; Larsen and Christensen, 1993; Shepherd and Krueger, 2002). Although Zaltman et al. (1973) argued that innovation activities and its outcomes depend on a magnitude of perception, he did not included motivation in the makeup of his innovation framework, but listed it as the second most critical element that could move innovation process forward. However reading Zaltman et al. (1973) “Innovation and Organisations” book, one could get an impression that though there are people involved in the innovation activities, somehow the whole phenomenon lacks deeper analysis from personal perspective. On the other hand, more recent research of individual’s perception (Amabile et al., 1996; Chandler et al., 2000) included awareness of influence that organisational management could have on innovation-supportive cultures, if reward system could be implemented.

10.3.2 Predisposition to Participate

The other essential element within the proposed Innovation Propensity model is the predisposition to participate, expressed in short form as participation. The magnitude, effects and reasons to apply participation in every situation may not be necessary, however its importance to an organisations is absolutely critical (Kanter, 1983). “Participation is not a program or a formula, and it may not necessarily be a permanent way of doing everything” (Kanter, 1983, p277). It is transitional and transformational ritual calling for high involvement of people and alternating within changing tasks in organisations. Managing participation may be a matter of balance and patience (Kanter, 1983). In Kanter opinion, participation is about choosing between management control
or team opportunity, getting work done quickly or giving people a chance to learn, seeking volunteers or pushing people into it, and too little team spirit or too much of it.

Though implementation of innovation is recognised as group or organisational activities where participation of individuals can add value to the final outcomes, this thesis seeks to explore the other, more personal face of individuals commitment to common activities. Whether commitment from individuals is to support a single stage (Lucas, 1978) or a range of various developments within the cycle of a single innovation outcome (Ginzberg, 1981), participation may depend on individuals abilities or willingness and therefore is conditional to the implementation. The author claims that the search for the synergy between various stages to reduce complexity of the implementation process (Dodgson, 2000; Sundbo, 2001) may be resolved in organisations by openly addressing issues related to the obligation and the commitment.

As the development and transformation of ideas may be possible due to their successful diffusion (Rogers, 1995), it requires a supportive organisational environment (Axtell et al., 2000; Clegg, 2002). It seems to be that the development of the organisational environment depends on the composition and participation of employees (Hunton-Clarke et al., 2002) with the organisational gain-sharing making participation more effective (Tortia, 2000; Hatcher and Ross, 1991; Michie and Oughton, 2001). It is known that employee’s contribution to organisational productivity is related to motivation, focus of attention, skills and knowledge (Hendy, 2005) and the lack of participation in the organisation is one of constant dilemmas for management. According to Kanter (1983) integrative systems may provide a right balance to deal with some of the participation dilemmas such as: i) clearly designed management structure and involvement of people, ii) assignment of meaningful and manageable tasks with clear boundaries and parameters, iii) time frame with accountability and reporting to organisational standards, information and training for effective participation, iv) mechanism for involving all who have an interest or input to issues, avoiding a problem of power, v) mechanism for providing visibility, recognition and rewards for team efforts and vi) clear process for formulation and dissolving of participative groups thus capturing and transferring gained knowledge.
A common assumption among many managers may not be right that participation draws people because they want to be involved in the ‘big decisions’ and therefore somehow to satisfy own ego, but it could be for the social reason to avoid the alienation at work. Kanter (1983) claimed that majority of people prefer rather be engaged in local issues or solving daily work annoyances. She thinks that participation is fun and rewarding, especially when dealing with the novel issues and working in a spirited team. However, when novelty wears out formal compensation and recognition must be introduced to keep it alive for the longer run (Kanter, 1983). Many innovative organisations realise a great portion of productive gains through high participation of their employees. The tendency to reduce work pressure by reduction of working hours seems to encourage innovation. Some authors point to flexibility and treatment of human resources as an asset rather than organisational cost that have an effect on workers participation and performance (Mazzanti, 2001), while other authors emphasise management style which communicates shared values through interactions and open participation (Maccoby, 1995). Maccoby argues further that proper structuring of work process could make participation and learning in the organisation a part of worker’s job description. For example as (Kanter, 1983, p239) stated, “Corporate entrepreneurs--single-minded individuals that they are - still get their projects done by crafting coalitions and building teams of devoted employees who feel a heightened sense of joint involvement and contribution to decisions”. She argues that contrary to entrepreneurial approach, the integrative and participative arrangements with open communications, interdependent responsibilities, frequent team efforts, degree of power required to operate, access to information, resources and support, have far greater chances of implementing innovation in the organisation. Kanter postulated that very often “masters of change are also masters of the use of participation” (p239). On the other hand Mintzberg et al. (2002) states that participation or engagement is built on an experience of those who proved the existence of trust, judgement and commitment values in the organisation.

One of the ways to resolve the concern about participation was the introduction of teams to workplaces. However, even those arrangements could not escape the problems of individual participation, as they couldn’t solve problems of individual’s side of motivation. The same type of dilemmas seems to exist for individuals of whether to participate in the group activities, contribute to team goals or to support group
innovation efforts by seeking ‘what is there for me’ (Gilson and May, 2005; West et al., 2004). The assumption often used in the case of teamwork is that it is the ‘weapon against individuals’ and that it is difficult for individuals to resist change and innovation, in which they participate. Very often management in such participative arrangements is to some extent about “keeping everyone’s mind on the shared vision and being explicit about ‘fixed’ areas not up for discussion” (Kanter, 1983, p275), which may suppress individuals choices and restrict innovation in organisations. Free flows of information, free exchange of ideas and presentations of projects may create opportunities for people to share their ideas freely and allow for participation according to their own rules (P10). Individuals often feed of the review process and interactions with others and therefore they seem to be much more motivated (P18). Work in the organisations like CRC requires a big dose of trust as very often researchers are fulfilling the requirements of each project without management’s interference how and when work needs to be done (P16).

However, the existence of ‘organisational politics’ and power struggle within organisations may be another obstacle to overcome when looking at participation problems (Hage, 1980; Robbins et al., 2001). The strongest impediment seems to be rooted in national cultures that may have certain characteristic patterns imbedded in socio-cultural values prohibiting open or spontaneous participation in an organisational life (Neisser and Jopling, 1997). The extensive studies of Markus and Kitayama (1991) proved that the cooperation, sharing and common good are more common to Asian countries then to the Western European-American. On the other hand, regardless of culture, organisations which involved representatives of their employees in the decision-making participation increased the probability of enhancing performance and innovation (Lam et al., 2002; Michie and Sheehan, 1999; Patterson, 2000a; 2000b). In addition, Lam et al. (2002) claims that it is more probable that individuals in societies that encourage individualistic values are more likely to change a situation to fit their own desires rather than change themself to fit into a situation. Maccoby (1995) admits that participation is essential to individual’s development in an organisation and confirms that its true value can only be realised in the relation to other operating principles such as innovation, system integration or strategy implementation. Erez et al. (1985) stated that though participation affects organisational performance, it is the
attitude of individuals towards a goal acceptance that has to be address first, while Kanter (1983) associated participation more to goal setting process.

The main argument after analysis of literature seems to be that the issue of participation is like trading in futures on the stock exchange, where trust or comfort about potential outcomes determines behaviour. The attitude of individuals towards a goal acceptance is may be the most critical part in solving the participation dilemmas (Hodgetts, 1991; Thompson and McHugh, 1990). Robbins et al. (2001) claims that motivation to participate is like a rational exchange between an individual and an organisation through values of pay, security or promotion, which could be culturally sensitive, but does not rule out that for many employees, engagement in work may present an emotional, cognitive and physical experience, not just a rationally calculated trade off. There seems to be no general rule to individuals behaviour in organisations, but it is probably the divisions of labour existing in many societies where employees face the increased uncertainty and risk of being easily replaced that encourages them to seek more emotional support and social experience from groups (Heilbroner, 1975). On the other hand, those who feel secure enough may try to bargain for additional material benefits. Heilbroner goes even further arguing that participation of people in an organisation depends on the distribution system of rewards, which in turn influence the efficiency. Therefore it should not be surprising that knowledge workers who are at the heart of the modern free market society (Drucker, 2001) want to trade knowledge as probably the most valuable commodity that may influence innovation (Janssen, 2000; Nahapiet and Ghoshal, 1998).

The individual predisposition to participate in innovation may be similar to the modern social exchange theories that highlight the importance of reciprocal and negotiated forms of exchange and their effects on the wide range of outcomes (Molm et al., 1999; Uehara, 1996). Though, Molm (2003) categorised exchange behaviour by the use of power and the type of risk and uncertainty that individuals take, Northouse (2004) in comparison recognised difficulties to measure the effects of people work, when age, gender and abilities are interlinked within cultural diversity of an organisation. Another view was proposed by Coleman (1966) who argued that exchanges often take the place because individuals attempt to maximize their gains in the situations of partial control
of something that may have little interest to them, but could be traded for something of more interest with the greater control over it. It might be also possible that individuals want to ensure greater benefits at the beginning of innovation activities when possibility of receiving reward is not influenced for example by risky outcome, rather than investing their effort into the developments and trusting future fair distribution after commercialisation. Nahapiet and Ghoshal (1998) point out that it is like a knowledge market where knowledge sellers calculate whether it is worth sharing their knowledge with knowledge buyers who also think what they can offer in exchange.

Although quite rare, personal predisposition to participate in innovation that is culturally influenced may involve free sharing of knowledge or experience for intangible gains and could be more stress free than reciprocal or negotiated forms of exchange. These forms of exchanges tend to cause anxieties especially when: i) people without power agree to a course of actions imposed by their exploiters, ii) great deal of assurances are present from the unstable partners, and iii) aggressive bargaining takes place over long time, or ad hoc negotiations are conducted (Bonacich, 1995).

Though this study builds its finding about predisposition to participate in relation to Innovation Propensity on the importance of the theory of social exchange by Molm et al. (1999; 2003) and Uehara (1996), at the same time it recognises the role of cultural diversity that may influence individuals choices leading to innovation in organisations.

10.3.3 Clarity of Objectives
The issue of objectives is the third element from the primary data analysed of this thesis. There is probably no other author like Peter Drucker, who recognised the importance of organisational goals and the role of management. Drucker (2001) identified eight key areas within the organisational activities where clearly defined objectives could be set and listed human resources, productivity and innovation among the most important. Drucker insists that the organisational performance depends on the well-defined objectives. He admits that management by objectives could create the sense of clear direction in organizations by giving everybody a sense of direction, opportunity for self-control and self-assessment that motivate most individuals to perform well. I have been observed for example that project leaders in interviewed case
organisations have a sense of urgency and nearly a duty to do something useful with the research findings or information they possess (P10). Identifying outcomes from research that may be useful in the long-term for the industry participants is one of the major goals for CRC organisations (P20; P24; P26). However, to the ordinary members it might be more important to know each person in a team or an organisation in order to relate to their knowledge and experience when required (P6). Though, many goals exist in CRC organisations, the clarity of objectives and setting priorities may be the most important. The need to balance more appropriately the percentage of efforts, which are going into core generic research supports participants interest and balances that against the effort put in to get commercial funding coming in (P24).

Drucker (2001) also states that the most productive innovation is one that creates a satisfaction. Managing an organisation towards that satisfaction requires multiple objectives and good balance between needs and goals. The philosophy behind goal setting is not about a concept of having set goals monitored by managers. Thompson and McHugh (1990) recognised the role of inputs especially effective with scientist, managers or blue-collar workers to achieve desired outcomes in an organisation, by allowing individuals to set goals compatible with their own aspirations and needs. The degree of freedom of choice may provide individuals with opportunity to incorporate their identity into personal and organisational goals, and therefore to transform motivational behaviour into organisational productivity. Thompson and McHugh claimed that goal-setting technique could work beyond supervisory or managerial practices that enhance meaning of work by being a core motivational method to focus attention and action. This technique may also allow for self-regulation, where goals can be broken into simpler, manageable sub-routines that reduce the stress on workers and complexity of goals. At the same time rewards for performance should be maintained to connect behaviour to outcomes.

Common goals can also bring unity and sharpen a vision into an emerging objective such as innovation in the dynamically changing society (Drucker, 2001). However, the continually changing desires of customers may need a broader defining of organisational purpose and mission that could be translated into innovative objectives. Drucker identified some of those key areas where clearly defined objectives could be
set as:

i) profit requirements, ii) financial, physical and human resources, iii) productivity, iv) innovation, v) marketing, vi) and social responsibility. Some opponents to Management by Objective (MBO) say that it sets performance standards to the lowest attainable levels (Kane and Freeman, 1986), while others claim that it often results in internal competition, selfishness and lack of cooperation (Castellano and Roehm, 2001). While Marlow and Schihavy (1991) claim that the lack of organisational success could be due to the fundamental differences and difficulties in managing employees and management expectations, Gorelick (1991) recognised MBO’s great potential to develop shared values in the organisation. Drucker (2001) insists that the organisational performance increases if members know their objectives well enough to manage them. Management by objectives gives the opportunity for all members to be accounted for their performance and therefore introduces a very important element of self-control and assessment that motivates everybody to perform well. Drucker adds that management by objectives creates the sense of clear direction in an organization. Though an individual could see goal setting as cognitively mediated, rational action, Bandura (1977) argued that discrepancies between desired goals and actual achievements could produce the most motivation for inducing change and innovation. Conversely, Locke (1968) emphasised goal setting as an important step in motivating individuals towards better performance through monetary incentives or participation in a decision process. Although there have been a number of studies conducted on goal-setting theories, acceptance of goals from the aspect of participation is considered as the crucial matter despite not being well defined (Pfeffer, 1982). Success of goal-setting technique cannot be blinded by the collective goals of an organisation, as human nature may always take over in seeking personal benefits from favourable arrangements somewhere else (Thompson and McHugh, 2002).

The existence of objectives or goals is always helpful in the unification of the organisation’s efforts. Hersey and Blanchard (1988) proposed to have between three to five mutually decided goals in advance in order to improve a performance. In addition to having common goals, they saw the need to integrate individual’s strategies and risk taking into a group endeavour to increase the participation. Putti (1987) argued that goal setting and participation couldn’t happen in organisations with poor communications.
He went further saying that as organizations represent groups of people working together towards pre-established goals, their achievements should be beneficial to both employees and employers. To achieve common objectives, strong bonds need to be nurtured to have individuals involvement and commitment. Hongo (1980) proposed that management by objective would work if a cycle of goal setting, goal accomplishment and performance evaluation could be maintained in organisational practices and be promoted by the effective teamwork. The ability for self-determination could be related to the type of performed work and the level of education, for example engineers and scientists have generally no problems with participative goal setting (Hampton et al., 1982). It could be also generalised that principle of management by objective works if self-motivation is achieved (Levinson, 2003). Drucker (2001) is concerned with the drive of current management discussions towards ‘one right objective’ and proposes that innovation objective should determine what organisation should be. The real difficulty often lies not in the determining what objectives are needed, but in deciding how to set them up, though the solution may be in what should be measured (Drucker, 1975). It is therefore logical that those individuals who possess a certain amount of knowledge and could determine many critical aspects of an organisation should be more of the associates than the subordinates. They are the knowledge workers (Drucker, 2001). From this perspective management by objective and self-control may be called a philosophy of management with the anticipation of a future that could be materialised only if supported by the personal commitment to carry new ideas over into outcomes (Drucker, 1979; 1986).

It is perhaps necessary to realise that though most of the objectives in organisations represent a tangible entity, innovation as objective needs also to exist at a philosophical level to have one uniting and universal meaning for all the organisational activities. Though for most of organisations engaged in innovation a meaning of innovation is related to science and technology (Drucker, 1996), the true value of innovation could be measured by the impact on people and the environment. No one yet could foretell the destiny and impact of innovation from time when it was perceived by an individual or when fully commercialised (Drucker, 1985), therefore more philosophical look at the phenomenon, as personal and organisational objective might be the most appropriate. The link that may allow establishing relation between personal and organisational
objectives could be the most important for innovation. The author agrees with Erez et al. (1985), Hodgetts (1991) and Thompson and McHugh (1990) that the attitudes of individuals towards the goal acceptance may be the most critical part in solving the participation dilemmas and consequently fate of innovation.

10.3.4 Innovation Propensity

Term Innovation Propensity is adapted for this research to unify its findings. According to this research, the dynamic variables of perception, participation and objective contribute to innovation. The existence of one single Innovation Propensity indicator allows to compare survey and performance data and therefore verifies the findings from this research. Although the word propensity could be replaced by other similar words such as tendency, inclination or predisposition, this word have been used on previous occasions to describe organisational innovativeness (Daft, 1978; Tang, 1999). It appears that the difficulty in identifying organisations innovation propensity relates to the complexity of innovation (Drazin and Shoonhoven, 1996; Wolfe, 1994). The most commonly investigated innovation propensity factors are related to human behaviour (Amabile, 1988; Dess et al., 1999; Janssen, 2000; 2003; Jin et al., 2002; Senge et al., 2001; Sundbo, 2001) or internal and external environment variables influencing organisational structures and systems (Bruland and Mowery, 2005; Damanpour, 1988; Damanpour and Evan, 1984; Hamel, 2000; Lazonick, 2002; Nelson 1993; O’Keefe, 2004; Rogers, 2003; Wolfe, 1994). This research considered both types of determinants through examination of cognition, culture and motivation and proposes new Innovation Propensity model based on perception, participation and objective.

10.4 Development of Innovation Framework

Most of the conducted research in the world about innovation is quantitative. Generally, researchers analyse the known process variables leading to innovation or count the outcomes. However, the growing pressure on organisations to change by adopting innovation encourages search for new ways to discover determinants that would allow emphasising the importance of capabilities to innovate. This research evaluated performance of three independently operating research and development organisations and on the basis of the collected data provided the evidence that allows to envisage likelihood of their successful innovation. The final analysis of primary evidence from the case studies resulted in the selection of three main elements namely: perception
(aptitudes to perceive), participation (predispositions to participate) and objective (the clarity of objective) that could represent the variables critical to organisations innovation propensity. These three indicators endorsed the formulation of the model for Innovation Propensity that resulted from the number of major transition steps during the study such as:

i) analysis of the available literature on innovation and related topics,

ii) analysis of cooperation between the Government, Industry and Research,

iii) analysis of CRC as integration of the Government, Industry and Universities,

iv) formulation of research framework on the basis of literature findings and CRC makeup,

v) creation of research instrument,

vi) collection and analysis of data,

vii) identification of final results and generalisation of findings,

viii) development of new concept of Innovation Propensity.

The proposed relational Innovation Propensity concept is integrated. According to this concept, the presence of all three elements of this model is essential for innovation to take place in an organisation. The logic about bringing these three constructs together to form the unified model of Innovation Propensity derives from the earlier conducted analysis of cognition, culture and motivation framework factors that contained the research outcome elements of perception, participation and objective. Outcomes of cognition were identified in the interpretation of information processed by individuals. These outcomes were labelled in the research analysis as ‘action from learning’. Cultural elements have included the ‘outcome orientation’ as the personal or organisational goals and ‘process orientation’ as a mean of concentrating on process methods to achieve goals. While it could be distinguished that cognition factors had only one outcome and culture two, motivation may have three of them. In the case of motivation, outcomes could be a general ‘goal’ by itself, with a some type of received ‘reward’ and a ‘satisfaction’ from that reward, making this factor the most significant from the outcome viewpoint. The significance of motivation to innovation was confirmed earlier in research by results of the broad data analysis and the highest Node Density Indicators listed in Table 9.1 of chapter nine for all examined organisations. Motivation was also the preferred determinant from the conducted survey about factors
The existence of various types of outcomes in cognition, culture and motivation factors of the research framework justifies the use of the ‘innovation as objective’ to be the one general objective. There is also enough evidence from the presented literature reviews in this chapter to support the view that innovation propensity in the organisational context could be related to all three main indicators namely: aptitudes to perceive, predisposition to participate and the clarity of objectives. The proposed Innovation Propensity model is relational to its three main indicators and has the dynamic nature as illustrated by contributing variables (Figure 10.1). The unpredictable nature of organisational innovation and the intricacy of the proposed model was strengthened by opinions of interview participants and the additional review of literature in this chapter related to selected indicators. The knowledge about the unique combination of personal qualities of interviews participants assisted in the challenging task of defining the boundaries for an organisational innovation and the proposed innovation framework.

![Innovation Propensity Model](image)

Figure 10.1 Innovation Propensity Model (Author).

The author of this study assumes that it is mainly the unique capability of an individual deriving from knowledge and experience that allows perceiving some times unrelated information that may be turned into innovation (Amabile, 1988; 1996; Amabile et al.,
West and Altink (1996) confirmed that innovation activities are mainly individual dependant. As a whole process is unpredictable, organisations are often losing out due to poor communications and lack of participation (Commonwealth of Australia, 1995).

The proposed model suggests three things that require attention in the organisation. The first thing is to be aware of the cognitive nature of innovation initiation, but at the same time not to ignore the special ability or gift that certain people may have to foresee it by unconventional ways such as intuition. The second aspect relates to the cultural, reciprocal or negotiated participation that depends on the socio-cultural or motivational aspects of organisational engagement of individuals. The influence of faith or unconditional sharing may play some role in the organisational participation. And thirdly, organisations should have a clear objectives supported by policy or strategy that would allow them to create the culture of innovation. The successful innovation may take place in an organisation when personal and other goals can be supported by enough drive to persevere innovation as the objective. This research established that the strength of the drive towards the final outcome might depend on the relation between the predispositions to participate and the aptitudes to perceive new ideas. The ratio of the predispositions to participate to the aptitudes to perceive new ideas is expressed as Commitment Indicator (CInd.). The proposed ratio between these two indicators may represent the outcome of an organisation turning its vision, ideas and various inventions into the participation of members and therefore setting itself on the road to achieve desired goals. The commitment of individuals to persevere towards the outcomes as innovation might be reinforced by the clarity of objectives. This finding allowed creating the formula for the Innovation Propensity. The Innovation Propensity relationship is described as:

\[
\text{Innovation Propensity} = \text{CInd} \times \text{Objective}
\]

The formula reflects the emphasis of this innovation concept on the strength of commitment to drive objectives towards innovation. The multidisciplinary model of Innovation Propensity indicates the predisposition of an organisation to innovate. The relative values of three main indicators for each case study organisation are presented in Table 9.7 in the previous chapter. These indicators were used to calculate values of
Innovation Propensity for each case organisation and are displayed in Table 10.1. The value calculated Innovation Propensity is relational to the number of words in text documents of each organisation.

<table>
<thead>
<tr>
<th>ORGANISATION</th>
<th>INNOVATION PROPENSITY INDICATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRC IMST</td>
<td>2.3</td>
</tr>
<tr>
<td>CRC CAST</td>
<td>3.5</td>
</tr>
<tr>
<td>CRC ACS</td>
<td>2.6</td>
</tr>
</tbody>
</table>

Table 10.1 Values of IPI from three case studies (Author).

Results from Table 10.1 suggest that the greatest tendency towards innovation is observed in CRC CAST organisation, with CRC ACS displaying lower capabilities and CRC IMST having the smallest inclination towards innovation.

The justification for the creation of the single Innovation Propensity value was from the need to use a replicable mean that may have the practical application in assessing organisational inclination to innovate. The ability to interpret and compare the results from three different CRC organizations by one indicator could also be referred to the established single index of Total Performance Indicator (TPI) that allowed verifying research findings with the independently collected external data. This verification is described in chapter eleven.

10.5 Summarising Annotations

The analytical approach of this study leads to the conclusion that selected indicators namely: aptitudes to perceive, predispositions to participate and the clarity of objectives could represent the inclination of an organisation to innovation. The relationships between people in examined organisations and their activities as indicated by the proposed Innovation Propensity model are meaningless unless they have some form of direction and could result in achieving the desired outcomes. The significance of organisations practicing innovation as process or activity is in acceptance that this may lead to innovation as an outcome. This practical approach may demonstrate how two
approaches to innovation described earlier in chapter two about ‘Defining Innovation’ can be interlinked.

According to the proposed model of Innovation Propensity, an individual’s clarity of objectives that triggers the conditional motivation to disclose an idea and therefore to seek participation from others or offering own input in common perseverance of innovation may be critical to innovation activities. It is quite possible that Schumpeter’s suggestion of individuals holding back their inventions relates to gaining a temporary monopoly and to internal and external power struggle when inventors explore the competitive advantage of potential innovation. The element of connectivity and perseverance is like a drive to innovation activities. For example, this national characteristic of determination and the desire (‘Sisu’) to control the destiny is probably what makes Finland at the moment one of the most innovative nations.

This chapter presented the evolution of the qualitative data into the meaningful Innovation Propensity model and the formulation of Innovation Propensity indicator that is compatible to the organisational performance and may indicate the tendency of an organisation to innovate. The issues of all available research findings and the comparison to other types of data from this study are discussed in the next chapter.
CHAPTER ELEVEN
Discussion, Conclusion and Recommendations

11.1 Introduction
The previous chapters have presented the analysis of results, a comparison of case study organisations and the development of the Innovation Propensity framework. This chapter brings all these results together in the discussion which than leads to the conclusion of the study. The final part of this study presents the implications of findings and the possible directions for future research.

11.2 Discussion of Final Results
This study leans on the premise that innovation, especially in organisational arrangements is critical to organisational survival and performance. In addition, the level of measured connectivity between members of each examined organisation may also indicate the influence on the overall outcome results. The tabulation of main research indicators from this study namely: Innovation Propensity Indicator (IPI), Connectivity Indicator (CI) and Total Performance Indicator (TPI) are presented in Table 11.1 for the final discussion.

<table>
<thead>
<tr>
<th>INDICATORS</th>
<th>CRC IMST</th>
<th>CRC CAST</th>
<th>CRC ACS</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPI</td>
<td>2.3</td>
<td>3.5</td>
<td>2.6</td>
</tr>
<tr>
<td>CI</td>
<td>8.3</td>
<td>12</td>
<td>5.5</td>
</tr>
<tr>
<td>TPI</td>
<td>0.71</td>
<td>1.70</td>
<td>1.45</td>
</tr>
</tbody>
</table>

Table 11.1 Major research findings (Author).

The results of the Innovation Propensity Indicators are the final outcome of the qualitative data analysis. The Connectivity Indicators were calculated using combined data from surveys conducted with members of each examined organisations. The Total Performance Indicators derived from the analysis and the creation of the formula that could combine various organisational performance outcomes.
The Innovation Propensity Indicators resulted from the analysis of cognition, culture and motivation. The convincing relationships among these factors have been confirmed in the examined literature by Chiu et al. (2000), Eisenberg (1999), Erez (1992), Erez et al. (1985), Hernandez and Iyengar (2001), and Markus and Kitayama (1991). The three factors selected were integrated into a single framework to represent the overall research direction. In addition, they also served as the basis for the search of appropriate individual models of cognition, culture and motivation that would emphasize innovation. The development of the research instrument, which was used to acquire the primary research data, was based on the extended description of the elements for three major framework factors. The data analysis supported by the computer software NVivo allowed the identification of dominant elements and commonly appearing research themes which led to the generalization of findings and the formulation of the Innovation Propensity model. The highest value of an IPI indicator shows that the most inclined organisation to innovation was CRC CAST, followed by CRC ACS and CRC IMST.

Although the final results from the organisational survey indicated that CRC CAST cross-sectional profile of staff was not very different from the other two organisations, it clearly suggested that some practices such as more informal contacts through networking were favourably inclining it towards innovation. The second examined indicator CI was calculated from the survey data and showed that the same CRC CAST organisation had most of the necessary attributes to hold the integrity of its members well. The second organisation was CRC IMST, and the organisation showing the smallest connectivity was CRC ACS. The situation regarding the low connectivity for CRC ACS organisation may be explained due to the signs of insecurity among the members as there were fresh retrenchments and the possibility of further restructuring of the organisation. In this type of situation it can be assumed that every member would look after their own interests and therefore, there would be a lack of meaningful interactions leading to the display of common interests within the organisation. The third variable, Total Performance Indicator was also created by the author and calculated values represent the overall organisational performance effort. This similar trend like the one for the Innovation Propensity, points to CRC CAST as being the best performing organisation, while CRC IMST being the last company in this classification.
The ultimate goal of this exploratory research was to find what the intangible factors of cognition, culture and motivation have in common, that may enhance innovation in an organisation. This question can now be satisfactorily answered by the discovery of some elements within perception, participation and objective. These elements helped in the development of the Innovation Propensity model that may contribute to better understanding of organisational innovation. The aptitudes to perceive new ideas, the predisposition to participate in implementing them and the clarity of objectives expands a view of the model and integrates the Innovation Propensity. However, during the process of analysing data, the values of the final indicators from Table 11.1 confirmed also other significant points that indicate:

- predisposition of an organisation towards innovation is performance related,
- connectivity in organisation effects organisational innovation.

In addition, the theory behind the Innovation Propensity implied that innovation is a dynamic and unique activity and that change in values of any elements within the model may have to be compensated by the values of the other variables.

The author recognizes that innovation is a complex subject to analyze because of the large number of involved variables to assess. However, while the comprehensive general theory of innovation is not yet available, it is assumed that this study and its supporting research will present a proposition to unify the phenomenon from cognition, culture and motivation perspectives, that could contribute to general efforts towards establishing one homogeneous view of innovation activities in an organisation.

Overall, this thesis demonstrated the effectiveness and practicality of the Innovation Propensity model to determine the predisposition of organisations towards innovation, by verifying the main research findings with other types of data from surveys and organisational performance. In the process of the verification for the proposed model of the Innovation Propensity, the relation between organisational practices and organisational performance was measured and assessed positively allowing to conclude that the proposed innovation framework with its three main indicators presents the credible way to assess the inclination of an organisation to innovation. It is hoped that this research can contribute to a better understanding of essential requirements in the complex and dynamic field of organisational innovation.
11.3 Conclusions

11.3.1 Conclusions to Case Study Organisations

The existence and performance of organisations like CRC may depend on the size, type of industry and the number of outcomes these organisations are able to generate as projects with good industrial solutions for their industry partners. Though it has not yet been recorded if any of these organisations produced surplus for the financial year, it is also very unlikely that R&D organisations such as CRC could ever earn enough money to support themselves. It may be the case that the Government has other things on its agenda such as the survival of the Australian industry in the global environment that justifies the ongoing financial support to CRC organisations. Regardless of the ongoing support from its many members for the existence of the CRC’s, the continuation of program may depend on whether the Government will be interested in funding the organisations. The reinforcement of Government support could come from industry providing support to these organisations, on the basis of the generated net cost savings for them.

The efficiency of CRC’s in the delivery of outcomes may be compromised if the administration and activities of various research projects are scattered throughout too many locations. However, the separation between the management of research issues and the commercial decisions of the organisations may be beneficial from the operational viewpoint as it reduces the potential for conflicts of interest and offers greater flexibility in dealing with the dynamic issues of research and development. On the other hand, the mix of research and industrial experience could benefit not only the organisational members, but CEO’s too.

The seven year life cycle of CRC’s creates time pressure to deliver outcomes. Considering this, many of the organisations have had a second renewal and opportunities to develop policies or strategies that may clearly lead to innovation. The philosophy of merit-based, project specific selection for the position of project leaders instead of a permanent appointment within an organisation, the lack of contingency plan or the preparedness for the succession for an alternative CEO are unfamiliar. In addition, though innovation is practice in all organisations examined and there is no lack of motivation, the presence of innovation as the flag star objective is possibly missing.
The capability of an organisation to deliver outcomes and to progress may also depend on the ability to find common ground with the variety of people participating in the integrated organisational activities that can satisfy their individual needs. The principal idea behind establishing CRC’s is that the cooperative approach and sharing of knowledge and experience will be greater when all efforts of participating organisations will be integrated. This may not happen on the basis of wishful thinking of management, but rather by resolving individuals needs such as psychological, security, social, ego or of self-actualisation. A mixture of personal and professional satisfaction from working people may drive them better towards delivering outcomes desired by the organisation. The commitment of CRC organisations to share knowledge and gains between participating organisations may prove to be necessary to their existence. However, sharing could be more beneficial if reached to its own people as well. Reliance on the satisfaction of researchers and scientists gained from the research outcomes may prove less sufficient in the long run. The acknowledgment of an individuals’ effort and performance may best be served as individual or team who are offered compatible recognitions in the forms of reward for the best scientist of the year, fully funded trips to conferences or monetary rewards.

Researchers and scientists are considered to be knowledge workers. Therefore, organisational knowledge of their needs must be greater than that applied at the beginning of the century to the conveyor-line production workers. In addition, the loyalty of CRC members must be earned not demanded, as they often first serve a master who pays their bills. Similarly, it may require a bit more effort from CRC’s to build their own and strong organisational culture, rather than be the meeting place of different cultures. It is the cooperation and continuous interactions of people through a generation of common values that creates the CRC culture and climate which ought to be maintained or created. These interactions could be like the cross-pollination of projects and interests that may evolve into innovation. Though it is recognised that intellectual property protection creates benefits to organisations, at the same time it restricts the opportunities for free interactions between people. The degree of relaxing, casualness and informality, but with seriousness in the objectives that need to be met may not be familiar in many R&D organisations. However, this can help in the creation of the right atmosphere to build unique bonds between people. The author presumes that the benefits and opportunities of interactions at organisational and international levels
for Australian companies would not be as fruitful without the existence of CRC’s. Generally, the size of the customer base may not matter for these organisations as much as connectivity and the quality of interactions.

The full time staffing of CRC’s and the composition of other people engaged should be at levels which provide the necessary stability but at the same time create a degree of ambiguity that is necessary to prevent bureaucratisation and can encourage change and innovation. Greater mobility, flexibility, cultural diversity and more external staff might benefit organisations more than ‘home grown experts’. That could also prevent stagnation and improve manners when dealing with the outside world. The intimacy of face-to-face communications and interactions may not have the same effect as in the visions of running CRC’s as a virtual organisations. Good communications often result in good participation in organisational activities with opportunities for sharing ideas and knowledge. The existing annual conferences for getting together may not be enough to satisfy demands of most researchers for broader and more frequent exchange of ideas and interactions within an organisation. More work/social gatherings could be organised to maintain the integration. While organisational reports and scientific papers may carry some useful information they are mainly historic records of things from the past.

The opportunities for innovation in CRC’s are many. For example, they may include: i) ability to switch from process methods to products or vice versa, ii) opportunity to conduct small scale generic research, iii) involvement with small business, or iv) confronting own line of research with the environmental issues. There is no formula for innovation in organisations, but knowledge of determinants and principles may help CRC’s to relate to the changing environment to produce efficient outcomes desired by the users.

11.3.2 Conclusion to Final Results
The final results of this study are based on the three independent sources of data. These sources are: primary data from the analysis of the interviews, data from two surveys with interviews participants and the externally produced data describing each organisation’s performance and outcomes. While primary data was used effectively to create new concept of innovation, the supplementary evidence from surveys and performance data reinforced this study finding.
This study presented three case organisations involved in innovation and answered the research question about what the intangible factors such as cognition, culture and motivation have in common that could enhance innovation in an organisation. The answer to the question was materialised as the integrated Innovation Propensity model and was constructed from three main indicators that describe the aptitudes to perceive new ideas, the predisposition to participate in implementing them and the clarity of objectives. The author of this thesis recognises that proposed factors form the relationships that may have unique organisational strength. Included in the main model is the ratio between participation and perception created to emphasise the Commitment Indicator (CI) that implies how well an organisation could turn various perceptions of ideas and the participation of members towards achieving the outcomes that would satisfy requirements of innovation. These often changing requirements of the final objective must maintain innovation principles during a quest to deliver an outcome.

This research did not attempt to provide the answer to the other type of question such as how to conduct innovation activities. There is probably no simple answer to this question other than to follow some established frameworks or methods and to adopt them accordingly to individual organisational circumstances and conditions.

The author believes that the research methods used in this study were selected and applied appropriately within the uniform rigor and therefore delivered credible results that can be related to innovation. The initial selection of the main framework factors of cognition, culture and motivation from the multidiscipline literature was justified for their influence on innovation. The consequent final results of this qualitative analysis delivered the outcome in the form of the innovation framework with elements that are equally important to innovation. Each of the types of data used in the research namely: interviews, surveys, and the assessment of organisational performance, produced outcomes that were compatible within this study and were supported by the sourced literature and evidence from interviews. The methods selected to analyse the data have been consulted with other researchers with positive feedback about the clarity and the potential usefulness in reapplying them in similar organisational case studies.

The preliminary and the final analysis of the primary data was referenced to the size of the examined text data and therefore represents the comparative value. The generation of The Node Density Indicator (NDI) revealed that motivation issues dominate
interview participant’s minds during the data collection. The results of the short survey conducted at the end of each interview confirmed that personal preference was towards motivation as the major determinant of the organisational innovation. These two results may indicate that although not recognised widely among some researchers, behavioural factors play the dominant role in an organisation’s innovation.

Although the CRC’s program run by the Government does not have a current uniform assessment method for all CRC organisations, the author was able to present one homogeneous indicator of their organisational performance. The results of this evaluation demonstrated that CRC IMST was not performing well compared to the other two case study organisations. This verdict was later confirmed when the Government decided to close the organisation down, probably on the basis of its unsatisfactory performance level. At this stage, the confirmation of information about the performance of the other two organisations is unavailable due to the confidential nature of the Government business. However, the latest independently conducted study and produced report (CRC ASSOCIATION, 2005) suggest that the economic impact of CRC CAST organisation was greater than that of CRC ACS, which confirms the trend in the author’s evaluation of the Total Performance of examined organisations. CRC IMST performance was not listed in the CRC ASSOCIATION report as the organisation is closing down in mid 2006.

From the methodological research perspective, one of the contributions to the available knowledge is the use of the triangulation method to intersect the multidisciplinary meanings of the independent fields of science into the effectively synthesised final research result, which shows the effects of concluding indicators on an organisational innovation. The three approaches chosen for this research were dominated by the qualitative enquiry to interviews, the survey data and the organisational performance indicators. These three approaches were well articulated in theory and practice to stand together in support of this research findings.

The contribution from this thesis to the general field of knowledge about innovation is two fold, one being theoretical and the other being practical. The theoretical aspect utilised three independently recognised indicators related to innovation activities and came up with a simple concept that could explain their influence on innovation. The
practical side supported by the data demonstrated that final determinants namely: the aptitudes to perceive new ideas (perception), predisposition to participate in implementing ideas (participation) and the clarity of objectives (objective) may enhance innovation in an organisation. The use of the multidiscipline and multidimensional perspectives of innovation demonstrated uniform results and drew to attention the inadequate measures that were possibly used in the past, which might contributed to conflicting findings. To the best knowledge of the author of this thesis there are no other similar models of innovation available that utilise together perception, participation and objective indicators. To the possible critics of this model, this study claims to be innovative as well, as it like innovation integrates the known elements into the new applicable outcome that did not exist before.

One of the other conclusions from this research is that although innovation may be a function of management, the human side of the phenomenon is the most critical to the innovation activities. This multidisciplinary research also proved that innovation has multidimensional aspects, with culture and motivation dominating the field of enquiry, but specifically depending on the personal aptitudes to perceive new ideas, predisposition to participate in activities and the clarity of objectives to be achieved.

This research is supported by Denzin (2002) in achieving its aim by capturing and analysing innovation phenomenon through obtaining multiple results from various data sources. As Coffey and Atkinson (1996) encouraged, the author of this thesis went beyond collecting data and proved that the process of analysis could be imaginative, flexible and reflexive. Due to maintaining good methods of research with scholarly and intellectual rigour, the final results lead to the creation of a new innovation concept. The results obtained from the main data analysis and key organisational performance indicators produced the credible information leading to the uniform conclusion. The only exception to the uniformity of all results from this study was the main survey data that did not have the same hierarchy as the interviews and performance findings had, though it pointed clearly to the best performing organisation. The fact of picking the organisation that is the most and least inclined towards innovation was reliable in all methods of data analysis, which proved the credibility of an undertaken approach and the methods used in this study.
This multidisciplinary research built on cognition, culture and motivation in the organisational environment demonstrated that qualitative analysis can lead to the tangible findings that are compatible to organisational performance and innovation. It confirmed that people make the most significant difference to organisational innovation. The investigation strengthened the opinion about complexity and the dynamic nature of innovation by revealing that there is no single determinant which influences a process or an outcome. The information about an experience and the inside knowledge of participants from three interviewed organisations was analysed and used in the context of the main research question. The model of Innovation Propensity emerged from the final analyses that strengthen the judgement about the complexity and the dynamic nature of innovation. Innovation always begins as a vision and as a creation in an individual’s mind. To bring this creation to a commercial reality requires not only a strong will from the creator, but also the cooperation, participation, recognition and sharing of common beliefs and experiences among many people in organisations. Managers in organisations could use the presented Innovation Propensity model to assess the work environment in order to reduce threats and uncertainty while attempting to innovate. In essence it is suggested that decision-makers for an organisations can use it as a tool, but need to fine-tune it by applying changes to the structure or composition of their organization’s resources. Like playing jazz, organisations aiming for success may require a degree of improvisation and may need a quest for the discovery and exploration in the pursuit of innovation along social, economic and technical dimensions (Kamoche and Cunha, 2001). Although many researchers might see goal setting as the rational activity (Locke, 1968; Bundura, 1977), it does require cognitive skills from them to mediate between needs and goals in order to gain satisfaction from outcomes (Drucker, 2001). Overall, it is possible that satisfaction from work may represent the strongest drive to members participation and good performance which may result in innovation (Pfeffer, 1982).

11.4 Summary of Contributions

The implications of this study are that the contributions of the presented integrated and multidisciplinary perspectives on organisational innovation may bring a more practical and simpler approach to future research and practice. The author of this thesis agrees that from a theoretical point of view there is no ideal innovation theory as claimed by
Damanpour (1996) and Wolfe (1994) or an ideal organizational structure for innovation adoption (Hage, 1980; 1998). The proposed Innovation Propensity model developed from three case studies ties together personal and organisational aspects of innovation and allows for the creation of an organisational strategy considering innovation as one of the main objectives. This model is practical and deals with essential organisational determinants that come from the synthesis of three different aspects of organisational life namely: cognition, culture and motivation. This perspective could help organisations to innovate or enhance their efforts. While a variety of factors may be behind the driving force for an organisational innovation, an important fact is that if the Innovation Propensity principles were followed, they would allow organisations to focus more on opportunities whilst threats could be minimized effectively. Understanding of the proposed model may help organisations to rely more on the knowledge workers who could adopt continuous innovation as a part of their task and responsibility and by doing so when appropriate conditions could be created at work. In a similar way like the model of Optimal Innovativeness in Society proposed by Sundbo (2001), this research may be viewed through the assessment of the implementation process as relying on selfish reciprocal or negotiated conditions, or socially accepted cultural norms that may determine innovation. In all, this research model of Innovation Propensity goes a bit further and sets a three dimensional dynamics of innovation. While it offers three necessary determinants for organisational innovation namely the aptitudes to perceive ideas, the predisposition to participate in implementing activities and the clarity of objectives, it puts forward the importance of discovering and identifying ideas, development activities and delivering innovative outcomes. Therefore, it is assumed that this Innovation Propensity model contributes to a more complete picture of the innovation phenomenon in an organisation.

11.5 Future Research and Recommendations

This study only examined local Australian organisations, therefore future researchers could use the protocol presented to assess the innovation phenomenon from the perspective of different cultures, political systems or economic environments. The substantial benefit may be in the examination of other cultures, which preferably should be Asian for their different value basis to those in a Western societies. The author of this thesis recognises that it is necessary to have another researcher’s independent
verification and opinion before claiming with confidence the universality of the presented Innovation Propensity concept. It is also despite the confidence deriving from the modest research sample that the general principles emerging from the data analysis may be required to be checked across a wider range of industries and different types of organisations and thus this may further create opportunity for additional research. As another recommendation, it is possible in a similar study conducted to select different models of cognition, culture and motivation, providing that they will emphasize the issue of innovation. For example, the model of culture proposed by Quinn (1988) offers among eight elements some that are specific to innovation.

It is with a great dose of caution coming from the experience of exploring the maze of only three framework factors, that it is suggested to look at an opportunity for an expansion to the field of enquiry. An enlargement to the field of other factors, for example organisational politics or some economic perspectives may be beyond the time frame available to most PhD students.

The other possibility existing within the framework of this study is the quantitative examination of the Innovation Propensity model indicators, that could be conducted in order to establish the optimal values for each of the model elements to assess their influence on innovation in relation to qualified values.

As the examined literature suggests, there is no ideal innovation theory which can be applied or used by all organisations. This exploratory concept-building study confirmed its complexity and the dynamic nature of innovation. It also presented a new multidisciplined perspective on organisational innovation through cognition, culture and motivation factors. The proposed model of the Innovation Propensity represents the conclusion from this research that establishes an alternative view to organisational innovation and may provide an opportunity for future quantitative research to examine relationships and the influence of model variables on innovation.
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Appendix A

Australia and Background

Brief Description of Australia

This part of the thesis briefly describes Australia by presenting country’s background from the historical perspective, looking sketchily at the making of a society, economic and political developments, describing the state of the manufacturing industry, status of education and current government in office.

Australia is the world’s smallest continent located in the south-western Pacific, with the population of about 19 million, English speaking people, living mainly along the coasts, and the area of 7.68 million square kilometres of mainly dry and flat desert land. It was the last part of the world “discovered” and occupied by British as the colony in 1788. More than half of all Australians live in four largest cities: Sydney, Melbourne, Brisbane and Perth. Agriculture, mining and the manufacturing play major role in the nation’s economy. It is a young country with ethnically diverse population representing almost all nations of the world, but dominated by the European descendants. The Commonwealth of Australia is made up of seven states and local governments, which are running its affairs independently, but on the national issues the Federal government headed by the prime minister oversees them. It is a federal parliamentary state. Australia belongs to the Commonwealth of Nations with the Queen Elizabeth as its official head of state.

Australia in Historic Perspective

A search for new lands in our world and opportunities to get rich ended with the ‘discovery’ of Australia in the 1788 and the landing of the British First Fleet in the Botany Bay near present Sydney. This set the beginning of the occupation of the Aboriginal land and marked the beginning for the development of the ‘white man’s world’.

Throughout the Australia’s history, the abundance of natural resources and the lack of any major threats to the existence hindered a development of progressive social trends, technological and economic progress, which over time developed into a self-adoration as ‘The Lucky Country’ (Horne, 1971).

However what really shaped Australian psyche was the spirit of the place, which could contribute to the understanding of many successes and failures. Presence of harsh environment sharpened the awareness to man’s insignificance and his helplessness. Clark (1976) believes that to the great degree climate and the physical environment shaped Australians the way they are today. It made them fatalists, acceptors and the skeptics about human endeavor. Some Australians today came a long way ahead to realize that they could control its own destiny. Contemporary Australians are very proud and quite easygoing people.
Isolation and the assimilation to the hash environment prevented transition of primitive Stone Age cultures of Aborigines, the original inhabitants of Australia for nearly sixty thousand years, to what was known as the civilization in the rest of the world, though they had to be very innovative in order to survive for such a long time.

There isn’t much Australian’s could be proud of from their early history, this was the dumping ground for the ‘unwonted element’ from Britain, mainly petty-thieves and political radicals. Not many of first arrivals were fit to do any useful work. Ethnically, quarter of them were Irish. Beginnings were about survival and opportunity. Early agricultural experiments with planting crops were a complete failure. Ruthless and corrupted guards were the beginning of the majority elite class in Australia who used their economic advantage of monopoly to grant themselves a free land and looked well after their own enterprises. At that time the amount of work in the colony was almost unlimited, but availability of skilled labor inadequate. The early structure of the society was made mainly of soldiers, guards, free settlers, squatters, servants and convicts. Those like squatters who use opportunity to illegally grab a land were continually expending and multiplying their wealth. The shortage of labor was one of the factors attracting free settlers and emigrants to this country. However only those in the position of power and monopoly like John Macarthur have got rich. There were not many government people like Governor Bligh, Macquaire or Maconochie, who were concerned with the public good or the future of the colony. Those rare people had future vision that could capture the motivation of public to create foundations of social stability. Education, building of public libraries, dismantling of convict system had a profound effect on colony’s people. However majority of governing elite was interested to build on fear and humiliation. Port Arthur is such an example. Though distressful today, the progress achieved in the colony by that time would be impossible without the slave labor of convicts.

Only some unexpected and major events helped to steer and accelerate social developments. The system started to crumble and could no longer be maintained when gold was discovered in Australia and that put the end to the misery for many people. Gates have been pushed open and floods of migrants arrived from all corners of the known world to seek a new wealth and to explore opportunities. Newcomers were bringing with them new ideas and hopes for better future, they were not afraid of unknown and prepared for the journey of the discovery and the exploration. Gold discovery lead to the transformation of the colony’s states. It striped the population of cities by shifting most of the available labor force to the diggings and set the beginning to the rapid transformation of the society. This transformation brought racial frictions, conflicts, lowered the standard of living for many and disrupted the conviction that wealthy in the society were better people, not the better money makers (Peel, 1997). Wealthy miners created a new society, which had the need to be included in the main stream of the colonial elite. Gold brought to colonies the waves of Chinese miners whose different culture caused often frictions between miners. Strikes and protests in the gold fields were also quite frequent with some like Eureka Stockade finishing as bloody confrontation with the government. To quell any movements towards equal or democratic rights and to maintain current social values, those in power at that time tempered radical moods by not allowing them to drift toward something like the ‘American Republicanism’. New initiatives had to be counter-introduced to dilute radical sentiments and they often resulted in creating public utilities, gardens, libraries and museums. Clark (1978) argues that it was the colonial dependence that caused
people’s incapacity to control their destiny and conditions under which they lived. Australians did not have enough conviction that they could make this country a paradise and instead they allow their institutions to promote the use of the country as a quarry.

A few attempts during Australia’s history for self-governing were settle for a compromise resulting in maintaining British dominance. Australians accepted for the long time that it would be better if somebody else could decide their future for them.

The life for most inhabitants evolved around the dream of becoming one day a landowner. Most people were sacrificing learning about new values with what was known, proven and presented to them by others. It was evident that the true values of conservatism were imbedded in the majority of minds of the society. People seems to be afraid of the change and to try on new ideas. Though gold gave some people a chance to be elevated to much higher social status in a very short time, life for many ordinary individuals was still a mater of survival. Position of Irish was generally ambivalent, while Asians were treated like subordinates. Aboriginal people were left or subject to slow extinction. The role of women was to stay home and look after children. In the 1870’s the average Australian family had about seven children. Economic situation cause the drop in rate of birth to three children per family by 1910. It was always the role of father to be a bread provider. Introduction of European plants and animals was aiming at maintaining the look and impression of the dominant British race. The 1890’s brought again fresh ideas about the nation and resulted in the 1901 Federation of Commonwealth of Australia, where surely all Anglo-Saxon values and laws had to be maintained. Creation of own Australian structures was too risky and British system of government has been adopted. As usually, poets and artists were first to clearly appreciate and capture moods and images truly reflecting contemporary Australians. Activists and feminists were active making sure that Federation would include them as well as equal citizens. Strikes and boycotts were the tools to fight for social rights and prevention of worker exploitation. Nationalist and conservative sentiments were dominating social and political arena. Out of the discontent with the current developments of ruling elites a Labor Party was born in 1891. However all hopes for fairer society were dashed by the system of checks and balances set by the government to maintain the status quo. The fear for the security of the country was created, but hopes were very high that it would be guaranteed by the loyalty of Australians to the British monarchy. That loyalty has manifested itself with ‘white only’ policy with some radical voices presenting ideas to deport all other nationalities out of the country. The expectations of harmonious society were far from a truth. The idea of ‘protecting’ its citizens was always confronted with radical nationalistic dreams. The outbreak of the First World War in Europe and the commitment of Australian government to ‘last man and last shilling’ set again deep divisions in the society, but internationally Australia gain its recognition. Many young men and women left country to fight the war they seen as the adventure. The enthusiasm was fueled by the large unemployment at that time and the rural depression. Out of 300 thousand Australians who went to the war, one in five were killed or died of wounds. The war put Australia as the nation on the map of the world. The loss of so many lives in the war affected the social fabric of the population. At the end of the war anti-conscription sentiments won and people voted to end it. Those in the majority were called anti-patriotic, fanatics, radicals or traitors. The issue was washed down as the matter of loyalty with equal rights for all in the society compromised again. The epidemic of influenza in the 1920’s killed about 12 thousand people and prompted government to implement quarantining policy. There were times
when some individuals wanted to close off the country from everything what was not Australian, even including music, art or political ideas. Peel (1997) expresses this as defense of loyalty against fearful tomorrow. Nationalism had radical meaning that did not allow for any different opinions. To do otherwise it was disloyal to live in Australia. Those citizens who dared to think otherwise were simplistically labeled communists. The paranoia about communism was evident when rumor about communists marching on Melbourne led some towns in Victoria to trench digging. Many powerful and ‘respectable’ people were involved in the secret movements and societies. Due to those sentiments the term of ‘Australia Unlimited’ was born. The old sentiments of everything good coming only from Britain were still strong and alive. However some capital and new ideas were slowly infiltrating the society, like issues related to science or industrial efficiency. The standards of living were generally low, rural Australia was struggling for living. The scheme to transform returning soldiers into settlers and farmers on the fringes of livable areas turned to another social disaster. Falling living standards and heavy dependence of foreign wealth were felt drastically during 1930’s depression. Nearly quarter of working population was out of work. Government introduced public work schemes and food rations. Hardship reduced the number of businesses, lowered the wages and prices and reduced spending. Many could not survive without charities or help from evenly suffering neighbors. Protective trade tariffs were introduced to give advantage to Australia’s businesses. Company profits started to recover two years after recession started, but many people felt psychological and financial impact well till the 1960’s. People’s livelihood was impoverished by the existing social and government structures. Ironically the outburst of another war in Europe and military activities in our region brought different realities to Australian lives. British supremacy and loyalty to Australia was gone without illusions forever. Treat to the country from Japanese aggressors was overcome by the arrival of Americans to a ‘new army base’. With their arrival came greater efficiency in using available resources. Civilian population was engaged in essential war and agriculture production. Women had the opportunity to learn new skills and access to paid jobs. Chance to confront different culture and people motivated Australians to look at reforming their own social values. Federal Government had risen in power experiencing successful mobilizing and defending the nation from the aggressor. Most of the success was due to the rational planning and the execution of those plans. Some reformists had even a vision to plan for structuring of the whole social life for all citizens in order to make it more predictable. The ideas of change coming from the government did not followed with the commitment of the business community to share this social responsibility of reforming. The end of the war brought hopes for long lasting peace. The confidence resulted in the unprecedented number of new marriages, following by ‘baby boom’, government initiating grand schemes of building power stations, dams or roads. Australia again experienced the shortage of working hands and new migrants from a whole Europe flooded the country. They were mainly displaced people and those looking for fresh start in life, and better opportunity to live away from conflict stricken world. Practically there was no way to stop this social and ‘cultural revolution’ coming to Australia. Tensions were high over wages and working conditions between unions and employees, but jobs were available to all who wanted to work. Labor long-term plans with fairer society were always jeopardized by conservative sentiments and scaring tactics with ‘imaginary enemies’. People were afraid of any radical change even if that could lead to the better future life. Preference for the security and stability was imbedded deeply into the conservative Australian society. Deep divisions existed not only in politics, but also in the religious life. Catholics and Protestants lived and worked in the completely different world. Living
standards generally improved and many people could afford refrigerator, washing machine or car, but still one in seven Australians were living in poverty. Quite racial discrimination and existed prejudices against all non-Anglo-Saxons were supposedly to protect ‘Australian way of life’ hoping that newcomers would abandon their culture. Quite opposite, Australian culture had nothing unique to offer by clinging to the old British values. Migrants were generally ignoring the prejudice and helping each other to secure a better living. The first significant test of how Australia could be seen in the world was positive due to 1956 Olympic games.

However the ongoing paranoia about threat of communism, if non-existent domestically was good to confront somewhere else, ensuring stability of the conservative values in Australia. This time Australians were helping Americans to fight the war in Vietnam with common enemy, the communists. The need to ensure the security to Australia was cemented by loyalty to the world’s new superpower. America replaced Britain as the centre of international relations. Domestically, younger generation people protested against conscription, highlighting deeper divisions in social values. Rebellion against conformity was mostly expressed at homes behind the closed doors. At that time new activism was born including indigenous rights, feminism and migrant identity. Aboriginal people gained recognition as citizens in 1967. Multiculturalism buried dead ‘white Australia policy’. The celebration of nationalism in arts and culture was just the beginning. Changes brought by the Whitlam’s government gave chance to many ordinary Australian to gain free higher education. Health care and social benefits for single parents and elderly became accessible to everybody. Return of conservativist to government did not bring anything new to the lives of the ordinary citizens apart of stack of reports without action. This and other international developments lead Australia to the recession in 1982, destroying the credibility of Liberal Party and brought the change with the Labor government. During the 1980’s and the 1990’s the cultural achievements were often celebrated, but social divisions between rich and poor grew even wider. Public infrastructures were privatized and sold in the name of the open global market. Reinventing Australia as the clever country or working nation was mainly in words. Very little action followed any programs with results not worth celebrating achievements. Though we still live in the stable and safe country, many Australians now than ever are concerned about reconciliation, global developments related to security or environment. It is this realization that we are a part of one global system and our well-being may be influenced by developments somewhere else that makes younger generations see Australia in positive light. However the question is, will we be able to contribute to the world’s developments and change our environment and social values later as we are paralyzed by the fear of bringing first that change at home?

Social, Technological, Political and Economic Developments

The economic developments had always coincided with the population growth in Australia. Most of the Australia’s economic growth had benefited from the availability of capital and growth of labour through the migration schemes. The population grew steadily from the 1000 of first arrivals in 1788 to 3.8 million at the federation in 1901 and 19.2 million people in the year 2000. By the data available from the 2001 Australian census nearly a third of people living permanently in Australia were born overseas. At the turn of the century in 1900 nearly one third of Australians lived in the metropolitan areas, with the steady growth to 50% in 1933 and by 1976 reaching 86 per cent. Majority of population is concentrated in two states NSW and Victoria with the
slow, relative shifts to north and west of Australia happening since the Second World War were due mainly to the mineral exploration. Recent distribution of the population is influenced by the establishment and a promotion by the local governments of new growth centers in the country. The growth of those areas depends largely on the available financial incentives. Boehm (1979) claims that up to the 1860, migration provided about three-quarter of a population growth with the natural increases becoming the source of population formation. Despite the calls from Australian and British governments to populate the land with Britons of about 100 thousand quota per annum, only quarter of willing came to Australia. In the times of recession and unemployment quite often unions were opposing the government emigration policies. Decline in the fertility like one, which happened during the great depression of 1930’s had its consequences in the labor shortages on the market of 1950’s and 1960’s. Like in many industrialized countries, in Australia there are two important nonproductive population groups, for which every society has to care for. They are 5 to 19 years old in the education system and over 65 years of age retiring from the active working/productive life. Boehm (1979) argues that taking to the consideration natural resources and the pool of knowledge supported by the available labor and capital, the number for Australia’s optimum population has always been above the country’s population levels.

Apart of the emigration and the rates of the natural population, increase of the labor participation rates reflected on changes taking place in the social fabric and the educational trends of population. People retired at the increasingly younger age and especially young males remained much longer in the full time education. Those two factors had a special impact on the labor market with the continually increasing participation of females in the labor force. Growing numbers of people in the early retirement were due to a few factors, but mainly to the increased quality of available social security services. There were also new trends observed in the distribution of labor force since the beginning of the 1900’s, which change the social fabric of the society and had the influence on the economical developments. The total number of people engaged in the primary industries has been falling steadily from the 33% employed to nearly 9% in 1971. Labor force employed in the manufacturing sector has been rising to the 27% level in 1966 and than started to decline and lost its significance. The highest growth and the expansion rates have been experience in the education sector, which have employed by the 1970’s nearly two-third of the total work force. Those trends in the relocation of the work force were universally experienced in all highly developed countries.

The history of Australia could be also described as peaceful isolation. Pike (1970) states that the answer to the forces shaping Australians may lay in the geography, isolation, climate or remoteness of the place. Other historians may argue that economic developments, success of private enterprises or exploitation of labour contributed to the national character. Success and the frustration are probably two sides of the coin. There were those who made it rich and those who remained poor. From the beginning land speculators exploited the system for quick profits, but in the real terms were not so successful. Greed caused delaying in social progress and tempered entrepreneurial activities for majority of those willing to take the risk. Despite some difficulties people were free ‘to have a go’ at anything. However the sense of inferiority dominated Australian life in many disciplines. Convicts and migrants could not build a nation with the conviction of being the British outpost (Pike, 1970). Regardless of political
sentiments everybody’s dream was to own a quarter-acre town block with house and when this dream ended Australia became the workingman paradise, but the 1974 marked the end of full employment in Australia. Since then unemployment rates were rising from 1.2% to reach 9.4% in 1994. After the Second World War the age and the composition of work force in Australia started to change. During the 1950’s the norm for average working life was 50 years. By 1994 the time shorten and it is close now to be 35 years. The end of the Second World War marked also another phenomenon, the rise of consumerism.

It could be also reflected that the early economic developments in the colony were limited and giving first inhabitants little hope to make a profit. Early life for most people was about surviving. The land possessing, expansion (land grabbing) and the use of free convict labor were the main means for establishing wealth in the first place. Those in the position of power and people administrating the colony had decisively a huge advantage over the rest of population. While working towards establishing the colony on the land, some coastal exploration was also taking place. The sea provided Australia with the opportunity of first exports, but this initiative was not favorably received in Britain as the West Indies Company controlled the outcomes of a trade. That monopoly was having a negative impact on the early economic developments in the colony, however appearance of the entrepreneurial American sailors around fishing areas brought news about better opportunities somewhere else. Americans helped many convicts to escape. Newcomers were slaughtering whales or seals and having better harpooners were troubling local power holders and British establishment. In the end the bureaucratic machinery had suppressed ship building and whaling in early years of Australia by imposing unrealistic laws and regulations. This had for years the negative impact on the emerging ship building industry. Those with money to invest turned instead to land and sheep. Only the necessity of serving coastal trade resurrected and strengthened small local ship building industry. Large ships were build and purchased from Britain, but could not match the quality of freight offered by the other nations. Export from colony was also dominated and possible only when using British ships. The pressure of farmers on ruling committee brought them relieve from the British dominance, introduced the competition, lowered the shipping prices and gave the incentives to farmers to increase the agricultural and farm inputs. Wool was gaining the increasing export significance. Gold rush of 1850’s brought to the colonies more people and more ships. With gold came private investors and the speculators. Camels and cameleers have been brought from India helping to open inland trading roots. Government initiative and expenditure of railways changed the landscape of colonies. Those developments were breaking the stagnation of emerging economy. Australia in the 1870-90 had the highest income per capita in the world (Jones, 1996). The economic boom of that time was based on wool, wheat, metals, housing and building activities. With the increased trade there was ever growing need for quick communication with the destination markets. New routes to Britain were used and larger, quicker ships were constructed to cope with the growing emigration to Australia. Rising population increased demands for goods and services, provided opportunity to local pioneers and entrepreneurs or people with vision to invest and capitalize on it. In 1890’s emerging steam ship companies took control of the sea links, with British-owned lines still holding majority of existing trade roots. Isolation was reduced and intensity of trading had increased, however majority of migrants and manufacturing goods was coming from Britain. This monopoly had long and negative effect on the progress and indigenous growth of the colony in many disciplines. All locally produced goods were
subject to unscrupulous buyers in Britain. Monopoly slowed new local developments for years and put its inhabitants deeply in debt. Australia was only good to British Empire as the source of commodities like precious metals, wool and wheat. The country was plundered continually and little consideration was given to improving pastures, meat export opportunities or land degradation. Isolation and necessity created conditions for inventors to think about improving locally used farming machinery. Desperate farmers lobby government for establishing quality standards allowing them to compete fairly on the British markets and what finally has been achieved. Apart from main export commodities from colonies local manufacturers had no other goods to compete with on the British markets. Colonial industry was of no significance and existed only for small and scattered clientele in each colony. Integration of colonies was the pressing issue with the foreseeing benefits for the whole of the federation. Looming conflicts in the world brought the problem of security and defense to the spotlight. Britain withdrawal of some of its ships to Europe prompted Federal Government to plan a Royal Australian Navy. Local ship maintenance and building had followed contributing to a growth of another industries and local capabilities. However, sustained growth could only be maintained with the growth of local population. Emigration from Britain was the first thought and realized option. Demand for Australian produce was well thought in other parts of the world not only in the mother country. Interrupted supplies of steel from England forced entrepreneurs to develop local heavy industries. Increasing demands for more reliable transport renew the trade roots with America. Growth in shipping traffic prompted the government to form the Australian Commonwealth Line, but it failed to capitalize on the venture as the ‘socialist enterprise’ paranoia tarnished its name and chances to enter into profitable business. Local industry was developing slowly always under protectionist curtain of tariffs. Australians were not very good salesman, but nevertheless demands for our goods existed elsewhere when we could no longer supply British markets. In the return Australians had to open its borders for other foreign products. With influx of migrants from other European countries British share and influence were slowly diminishing, but still gripping on power as most of money for development and help during depression was coming from ‘mother country’. Imbalance of trade with England forced Australians to manufacture more goods locally. The event of First World War labeled the existing government in Australia the ‘war profiteers’ as they controlled wages and profits. The preference of majority business people was for free economic structures. Shortage of skills and money as well as development of new facilities, machines and tools did not produced results instantly, but allowed Australians to learn how to be more self reliant. Commercialisation of aircraft use opened another avenue in transport and communications. Slowly realization of distance with the outside world narrowed, allowing for more frequent contacts with the distant countries. International relations and alliances were tested during the Second World War when Australians were sent to help Britain. Japanese forces threatened our land and finally only Americans came to our support. Wartime arrangements set new rules for peacetime relations. Australians became more independent and open to the rest of the world. After 1945 multinational corporations acquired most of Australia’s major industry, bringing own capital, technology and management. The largest wave of immigration after the war brought to this country not only new consumers, but also the work force capable of supplying goods to the rest of the free world markets. Between 1945-1974 Australia had enjoy full employment with the highest recorded economic growth, reflected by consumer demand and rates of production, however she has never been able to maintain the population growth at the sufficient rate to maintain the rate of the economic developments.
Migrants coming to this country had the expectations of higher living standards and the prosperous future, which were the driving force and created new business opportunities. Housing development, car manufacturing and road constructions were leading this economic bonanza. On the other hand agriculture and mining sector enjoy good exports and were supportive of international free trades mainly due to the very high volume of commodities, where manufacturing nearly always required government protection in the form of tariffs to survive and prosper. Since mid 1970’s a slow decline of the manufacturing sector in Australia could be observed due to the world trends in this sector. To resurrect the ailing industry protection tariffs have been lowered number of times, but the trend of decline and closures of some industries like textiles, clothing and footwear continued. That marked the emergence and steady growth of the information processing and servicing industries with the development and production of ever-faster computers, however the confidence levels and pessimism had its lasting impact on people’s psychology. Consumerism and materialism became the substitute for social relations and spirituality, mainly due to personal dependence on the technology. According to Boehm (1979), there is a traditional tendency in Australia for employing new workers rather than to increase the capital per existing employee. The low levels of domestically available capital often tempered investment opportunities created by the high population growth and created imbalance between higher imports driven by local demand and lower export capabilities resulting from the lack of available production resources. Corporate business world has been ignoring the social side of changing work dynamics. In the recent years ‘nonprofit organizations’ emerged, fulfilling the role of the government by providing basic services to needed in the Australian society. Growth trend is also predicted for the outsourcing services. It is quite possible that in the future those people who value their free time and could afford alternative approach would be able to contract some of the mundane homework out.

Many Australians in their naivety believed that a good fortune from the minerals boom in the 1980’s would somehow transform into national prosperity and solve everybody’s economic problems (Blainey, 2000). Economic restructuring in 1980’s and 1990’s with the privatization of basic public utilities created a temporary growth, but in the recent times continuation of growth in standard of living was mainly to borrowing ability of the capital from Britain and even more from the USA.

Australia’s early fortunes have been tide up to land-dominated export with wool coming later, than gold and in the recent times minerals exports. Changes to the fortunes of the dominant industries were often followed by the shifts in the labor distribution and the alterations to social structures. It also seems to be that the opportunities in Australia were always great and they attracted believers from all corners of the world who were eager to get rich quick.

Economic developments in Australia were never free from a political influence. From the early days of the colony the goals were very clear to maintain this country for the destination of goods exported from Britain and to be the source of any valuable materials in return. For a long time West India Company held the monopoly of British trade and did not allowed any exchanges between the rests of the trading places in the region. Australia had no export trade in the early years. However when the first fortunes were made from gold, those in government learned lessons that materialism and free economic competition if uncontrolled could pose some social frictions. The ideas that regulating colonial economic and political activities could maintain the order
and stability of prosperous society had to be supplemented by governments expending on public utilities. Like in the case of diggers from the gold fields, who were radical democrats and the cause of the concern to the government, special organisations were set to ‘protect’ returning Anzac soldiers. In a short time those organisations and their founders quickly gain a strong political voice in the community. Political scenery was changing quite rapidly with labor party losing its support in the society due to the pre First World War conscription debate and unions fighting for restoration of pre-war living standards. The exemplary case in Australia’s history was that after the First World War, it became a new colonial power by securing German New Guinea under the pretext of guaranty for security in the region. The first decade of the federation brought to the Commonwealth protectionist laws aiming to guarantee the dominance of ruling race, access to education, fair living standards and protection at the old age. Alfred Deakin who was promoting those values believed that unless we all share the benefits of this nation, the full benefits of peace, security, prosperity and progress would be ensured to none. The coalition of Liberal and National party had ruled Australia since the 1949 to 1983 with only 3 years break for Whitlam Government in the early 1970’s. The election of Labor government in the 1983 brought major adjustments and changes to the political and economic life of Australians. Economy was deregulated by floating the Australian dollar on the international markets. More competition was brought to banking sector and the industry as a result of reduced tariffs and protections, but stopping short in the restructuring of labor market due to the unprecedented power of unions. Deregulation of industry and opportunity with increased exports coincided with the large imports of chip products from Asia, which applied extra pressure on local manufactures. This trend continues till today with the slow decline of manufacturing in Australia (Jones, 1996).

Substantial changes to learning and schools could be observed during the last three decades of the nineteenth century, when a compulsory education system at the primary level has been established in each colony. From the historical perspective and beyond the primary levels of education, Australia’s efforts in the education field did not compared favorably with the rest of the world. National expenditure on the education compared to the GDP is not favoring Australia internationally. The process of making secondary education universal and compulsory started in the 1950’s, however was truly encouraged and supported by the Whitlam Government during the 1972-1975 and finally was completed in the 1980’s (Jones, 1996). Growing understanding of the role of education in the employment and social life resulted in the pioneering work in Australia and establishing of distant education system. There were clear signs, that by the year 2000, majority of young people aged 17 to 24 should be engaged in some form of tertiary education (Jones, 1996). Education became a long life process and it is no longer a periodic event, mainly due to the changing nature of employment. This is due to the fact that demand for unskilled labour nearly disappeared, people have more than one career in life, they live longer and want to work less. On the other hand education creates opportunity to capitalize on a fewer available jobs with high status, good income and high job satisfaction. The similar situation had occurred with the training of skilled workers, mainly due to the small resources dedicated by the government for upgrading of the education. The problem lies with the increasing proportion of population engaged in secondary and tertiary studies. Till the 1970’s the number of enrolled students had increased more than six times comparing to the beginning of 1911 national census. Higher engagement of young people in the education has been driven by the low availability of jobs, but at the later stage they provided a highly qualified labor force
capable of facing new opportunities on a changing market. Historically, Australia has been lucky being able to fill any shortages of skilled labor, by supplementing demands through the skilled immigration programs. Generally, highly educated work force in Australia could offer the opportunity for greater efficiency, economical and technological developments leading to the growth of the economy and the higher standards of living to the society as whole. Investment in the education of the population could be seen as the development of human capital with the long-term benefits. Quality of education in the strategically important areas of science, technology and commerce could offer a genuine possibility of advancement in a human life.

Though the pioneering days of the 1800’s and early 1900’s in Australia saw a dose of some impressive inventions, not many of them were turned into the advantage and did not became a commercial success here. Australians were dependant to rely on their own resource and showed the extraordinary ingenuity and inventiveness even adopting imported technologies (O’Flahertie, 1995). However the early inventions came out of the necessity and mainly benefited inventor who used it. The examples are the grain stripper, stump-jump plough, electric drill or xerography. Most of these inventions like the famous ‘black box’ flight recorder finished being manufactured somewhere else without real benefits to the Australian society. Some of the main problems in the popularising those inventions were related to a lack of capital for commercialisation or a small market, but ability to mass-produce was the main reason stopping to capitalise on it. Only after the Second World War technological developments and manufacturing have been gaining considerable importance in Australia. Manufacturing in particular helped the country to become one of the highly industrialized nations. The growth of the manufacturing importance and of the labor force employed in the sector could be observed till the 1966, with the slow and continuing decline of the prime industry at the same time. However change in the world markets was coming to begin the biggest loss to the manufacturing industry with the decline in textiles, clothing, footwear and the transport equipment. Recession in the 1970’s gave the beginning to the growth of knowledge-based industries build on the principles of providing services to the government and to the public sector. Despite the downtrend in the manufacturing industries there is optimism for the future as the ratio of the invested capital to labor has been steadily increasing in Australia (Boehm, 1979).
Appendix B

Cooperative Research Centres

Cooperative Research Centres (CRC) have been established in Australia as the government’s response to the fragmentation of main research streams in the country and their very weak links with the industry and business. Fragmentation of research was also due to institutional and geographical factors. A program to form CRC’s was launched in May 1990 with the first round of selections announced in 1991. One of the main objectives for new organisations was to change the culture of university and business research by bringing them together into cooperative ventures delivering new outcomes (Besley, 1998). Opportunity was there to establish a new environment for teamwork with strong links to research users (Slatyer, 2000). Slater who is a spiritual founder of CRC program in Australia always believed that research outcomes from cooperative groups would be greater than from the individual providers. Funding, which was going to be critical from an operational viewpoint, was guarantee by the government, but effective cooperation in Slatyer’s opinion required motivated individuals attracted to joint undertakings by the perception of mutual benefit. Additionally, integration and strengthening of links between industrial research organisations, educational institutions and government agencies had goals to enhance: economic and social development, transfer of research outputs and cooperation among researchers with improved efficiency in the use of intellectual and other research resources. There is evidence that among other CRC activities, their PhD programs educate graduates praised by local and international industry (Metcalfe, 2000). This successful cooperation between business, academia and government can serve as a role model in the world and there is growing interest from the other countries such as Austria, Sweden or Canada to set up similar programs (Young, 2003). On the other hand spectacular CRC successes come at the very high price and it is maybe a time to look at their commercial results (Gome, 2001). Similarly, industry in Australia regards highly scientific achievements of CRC’s, but is critical of its commercialisation efforts (Department of Education, Science and Training, 2003). However, Mercer and Stocker review of CRC’s performance for Department of Industry Science and Tourism (1998) points out that commercialisation is not the only measure of an organisational success. The Association of CRC (2000) supports the view of Slater that although many of CRC researchers have proved to be good managers and entrepreneurs, generally this is not their core business. They play an important role in maintaining a two-way link and communication with research users to ensure that the outcomes are effectively transferred. Though all existing seventy CRC’s are engaged at the forefront of research and development there is no uniform measure to assess their performance. Garrett-Jones and Turpin (2002) proposed to implement return on investment method to evaluate performance, but at the same time stressed the importance of including qualitative and quantitative approach. The other measure of effectiveness of CRC’s could be the number of spin off companies generated from research, number of graduates or published articles (Garrett-Jones and Turpin, 2002; Yencken et al., 2001).
Appendix C

General Innovation Issues

**Stages of Innovation**
Creation of ideas and the idea implementation are both part of an innovation process. These phases share common steps where a direction is set, generation of tangible outcomes starts to take shape, outcomes are produced, tested, finally evaluated and implemented (Amabile, 1988; Axtell et al., 2000). Opinions about stages of innovation activities vary as much as the definitions of innovation. In Schepers et al. (1999) view of the process, there is more detail about the beginning of the process than final stages. The process starts with the idea creating stage, selection and pre-evaluation, commercial and technical evaluation, realization and finishes with market penetration after release of a product. A similar proposition presented by Stevens and Burley (1997) included: i) raw idea gathering, ii) screening of ideas, iii) evaluation of idea values with the aim of patenting, iv) selection of ideas for commercial evaluation and initial development of concepts, and v) major full-scale commercial launch of product to the market. Another view presented by Smith (2000) is nearly identical to the previous one but it recognises the commercial value of patented ideas and puts more emphasis on the testing and validation process. Dodgson and Bessant (1996) claimed further that initial recognition of opportunity or need, ability to search and long-term learning and developments from original innovation are the most critical steps in the innovation process.

Knowledge-awareness, evaluation-choice and adoption-implementation are major stages in decision based activities leading to innovation according to Meyer and Goes (1988). In comparison, developing innovation constitutes only four steps according to McDaniel (2000). Basic theoretical and following it, applied research often provide a directions for future outcomes. Development stage takes concepts into a prototype build. Demonstration of the concepts leads to proper development of the product and verification of its usefulness in a real world conditions. Finally commercialisation duplicates demonstration model and delivers it in sufficient qualities to the market. Commercialisation of projects carries a high level of risk. The federal government is often in the position of a last resort to help finance such projects if they demonstrate enough social benefit. Required analysis of innovation processes may include stages and factors of uncertainty, competition, risk, intellectual property management, rewards for ingenuity, all of them integrated in the drive forward technological frontiers and stretching the boundaries of knowledge towards satisfying new human needs (Steiner, 1995). It is accepted that innovation is one of the most effective factors stimulating employment and economic growth and enhancing competition and business growth (ABS, 1997). More aspects of innovation will be examined further in the following literature review.
Innovation Activities

Innovation is a creation of new outcomes from generated ideas. Numbers of activities are required to transform an idea into a tangible form. Some of the key activities may include: goal formulation, designing and organising process, monitoring progress, and adjusting the goals, process and the organisation. Boer and During (2001) generalise innovation activities into three categories: i) problem solving, triggered by the recognition of a need or opportunity to innovate, ii) internal diffusion of continuous information processing and communications, based on knowledge awareness and formation of attitudes, and iii) organisational adaptation of new technology or innovation implementation. Meyer and Goes (1988) saw innovation as the assimilation process based on a set of decision-making activities, while similarly, Damanpour and Gopalakrishnan (2001) defined it as an adoption process with rate and speed as critical factors. In contrast to the above opinions, Hoffman (1999) emphasised culturally influenced strategic management practices that most influence organisational innovation. In the opinion of Damanpour and Evans (1984) successful innovation activities must integrate technical and administrative changes. In addition the organisation of innovation activities can be categorised into personnel and organisational arrangements. Innovation roles describe required performance, support and management of the process, while organisational arrangements are in place to cope with uncertainty, complexity, diversity and interdependence of the process. Organisational arrangements may include goal formulation, assessment of resources and communication. Successful innovation may depend on the organisation’s ability to balance attention to each activity and to provide a right fit to people-task capabilities. Regardless of the adopted strategy for innovation, the organisation should be flexible, smart, multi-functional and integrated to handle relations between various activities. Most of problems encountered during innovation are the mismatch between people’s perceptions and existing reality (Boer and During, 2001). Pavitt (2005) argues that the highly contingent nature of innovation presents many difficulties with generalisation of innovation process, therefore managing activities of knowledge production, transformation of knowledge into artifacts and continuous matching of products, processes and services to market needs and demands may lay foundations for innovation process.

Determinants of Successful Innovation

Since the times of Schumpeter (1934) and his analysis of what influences innovation, many researchers followed master’s footsteps exploring the size of organisation as the main determinant, but also looking at the market characteristics in search of variables. McDaniel (2000) argues that especially the size of research division is important to successful innovation. When conducting basic research of a ‘reasonable size’ and complexity, the number of required researchers may be around twenty-five to thirty, but for applied research twelve could be sufficient. Separation of research division from the main organisation often does not provide enough incentives to commercialise research as it loses its goal of profit motivation and engages mainly in a self-serving proof of the potential. Schumpeter’s view of close research and market cooperation for successful innovation can serve as a warning to many organisations, which do just the opposite. The foresight of management combined with the willingness of all departments to work together in a pursuit of common goals increases the probability of innovation implementation. Various motives such as increasing profits, market share, monopoly on the market or elimination of supplier dependence may drive the organisation towards innovation.
(McDaniel, 2000). In contrast to the above opinions Howes and Quinn (1978) saw the
success of innovation in the understanding of principles and planning. In their opinion
management first must prepare the organisation to accept the change and then assist in
change implementation. One of the biggest challenges for an organisation engaged, or
wanting to be engaged in innovation is to understand what type of change they are capable
and incapable of handling (Hage, 1998). Examination of the existing organisational
capabilities may give an understanding of how those capabilities can be changed in the
organisation over the time. Christensen and Overdorf (2000) argued the point based on their
research, that three factors determine what organisation can or cannot do: resources,
process and values. They classified resources into: i) tangible - people, equipment,
technologies, cash, ii) intangible - product design, information, brands, relationships with
suppliers, customers and distributors. Intangibles are in Christensen and Overdorf’s opinion
the number one factor, when determining preparedness for change. A contrary view is
presented by Lazonick (2005), who claims that abilities and incentives of managers who
make strategic decisions determine the fate of innovation in the organisation. The ability to
deal with uncertainty through the process of learning during innovation activities is one of
the most important factors determining the future of the organisation. Lazonick argues that
not only financial commitment to innovation, but also the attitudes of a society to change
and the ability to cope with gains and losses may prove to be important factor. Christensen
and Overdorf (2000) argue that innovation process as the pattern of interaction,
coordination, communication and decision making for employees is use to transform
resources into products and services of great worth but has sometimes a second degree of
significance to change in an organisation. Among common process two could be
distinguished: i) formal - explicitly defined and documented, ii) informal - routines
evolving ways of working. In addition, the most serious disability of organizations to
change resides in the nature of the process itself, as it often requires from employees to
perform repeatable tasks within tightly controlled internal procedures. Values are
interpreted by Christensen and Overdorf (2000, p69) as “the standards by which employees
set priorities that enable them to judge whether an order is attractive or unattractive,
whether a customer is more important or less important, whether an idea for a new product
is attractive or marginal”. Very often decisions in the organisation are valued at employee’s
micro and organisational macro level. Christensen and Overdorf state that priorities are
determined independently at every level as they affect rewards and profit. In addition they
argue that business cost structures and operational model reflect on acceptable gross profit
margin and the size of business opportunity to be attractive for engagement, what in turn
influences organisational innovation. Christensen and Overdorf related importance of
resources, process and values to the stages of the organisational life. They saw that at the
startup stage people’s resources are the most important, quite opposite to well-established
and successful organisations with the established values and process, where work
assignment is not that critical. In the middle years of operation the impact of business
founders has a deepest role and impact, while successful, mature organisations with unified
organisational culture have things done by assumption, rather than by conscious choice.
Managing the organisation where capability resides with people or with the established
process and values is straightforward operation, contrary to the situation when it is
extraordinarily difficult when all those factors are imbedded in organisational culture
(Christensen and Overdorf, 2000). However, there are three possible ways to deal with
creating capability to cope with management of change. They can be achieved by: i)
creating a new organisational structure within existing boundaries for developing of a new process, ii) spinning out an independent organisation with its own process and values to solve the new process, iii) acquiring a different organisation with closely matching processes and values for achieving a new task. Despite awareness of these capability factors that may affect innovation, managers often face a dilemma whether to increase market share for an existing products and services or to engage in a creation of new products and services (Christensen, 1997). However as the life of products and services often decreases in times of rapid technological changes and higher consumer demands, it is necessary to understand organisational innovation determinants before embarking on any new ventures (Timmons, 2002). Read (2000) distinguished five out of twelve examined factors and stated that the most important determinants could be: i) management support for innovative culture, ii) customer/market focus, iii) an appropriate level of internal and external communications and networking, iv) Human Resources strategies that emphasise innovation, and v) team work. On the other hand, it may be more essential to have an entrepreneurial spirit to produce innovation, but that could be “associated with a particular way of approaching problems that I call ‘integrative’: the willingness to move beyond received wisdom, to combine ideas from unconnected sources, to embrace change as an opportunity to test limits” (Kanter, 1983, p27). Kanter argues that in order to capitalise on the future, organisations must adopt to new environments by treating change not as a threat, but opportunity to use power to produce innovation. “What it takes to get the innovating organization up and running is essentially the same two things all vehicles need: a person in the driver’s seat and a source of power “ (Kanter, 1983, p209). Successful innovation in the organisation is often a management-induced process requiring constant measuring and monitoring, rather than a spontaneous activity. Drucker (1985) states that innovation can be systematically managed, providing one knows where and how to look. Opportunity for innovation could be generally found within and outside of the organisation or industry. Drucker reveals that often systematic and purposeful process of innovation starts with the evaluation of sources for new opportunities.

Research and Development
It is well accepted that many activities of Research and Development (R&D) are related to innovation (Amabile, 1988; Axtell et al., 2000; Dodgson, 2000; Nelson and Winter, 1977; Wolfe, 1994). More often than in the past, research is conducted now by groups rather than by individuals. The contribution of individuals to research is unquestionable, however it is a team effort in a socially inspiring environment that builds the culture and the image of the organization, where new things can happen more easily (Jelinek and Litterer (1995). There is also increasing pressure from government on research organizations to produce results and especially to commercialise outcomes quicker (Industry Commission, 1995).

ABS (1993) and OECD (1981) characterized R&D as creative work undertaken on a systematic basis in order to increase the stock of knowledge. Description of knowledge in their papers included one possessed by man, culture or a society, emphasizing its use for the practical new applications. On the other hand, Bennet’s (1991) opinion about research is that of discovery of new things and relationships. Basic and applied are two commonly used research categories, but ABS (1993) recognizes strategic basic and experimental developments as other new and important components of R&D. Creation, transfer and use of knowledge are critical ingredients of innovation process (Industry Commission, 1995;
OECD, 1997; Shukla, 1998). Knowledge can represent an asset to those who possess it (Nonaka and Takeuchi, 1995), therefore research is viewed by some authors as an activity, which adds to the stock of knowledge (El Sawy, 2001; Leedy, 2001; Slatyer, 2000). On the other hand, some authors are under the impression that economists view R&D only as additional cost (Gopalakrishnan and Damanpour, 1997). However papers published in scientific journals and patents are common form of community recognition of research outputs (Trajtenberg, 2002). Research is intellectually demanding and requires creative people (Stern, 1998). Those individuals, who have a capability to combine knowledge of various theories from different fields, make unique discoveries (Bundy, 1997). In addition, Bundy claims that in industry research is related to specific organisational goals and has an applied character, while universities tend to engage in more open, basic research.

Generally, the nature of work in R&D is based on continuous problem solving processes in which right decisions must be made and measurable progress achieved under conditions of uncertainty (Kozlowski and Gillin, 2005). In such an environment both types of research, basic and applied can take place successfully. From the business point of view, R&D is seen mainly as a development activity influencing growth, with the technological innovations as the most responsive to the economic incentives (Industry Commission, 1995). In the view of Industry Commission, the on-going government’s concerns and a discontent about effectiveness of R&D activities and it’s economical benefits lead to the emergence of the ‘New Growth Theory’ or ‘Endogenous Growth Theories’ seeking to find in the existing models new factors influencing economic growth.

Scale economies do not necessarily benefit large organisations when it comes to R&D and innovation. Scherer (1984) claims that analysis of US market indicate that large firms spend more on R&D, but not necessarily deliver more innovations. Investigation into this problem led Chakrabarti (1991) and Rogers (1998) to believe that small firms generate far more innovations per R&D invested money than large ones.

Kjelstrup (2001) claims that concepts of research work have not changed in more than two and half thousand years since the times of the Greek philosopher Socrates (469-399 B.C). Research in his opinion originates when questions are asked and the search for answers begins. However, what has changed is the conception of basic science, mainly due to the founding situation for research mostly influenced and dictated by commerce. Kjelstrup argues that perception of commerce and its importance was no different in the times of Socrates to what we are facing today. Similar dilemmas of how much effort should be dedicated to pure research and how much to practical application are often in people’s mind (Kjelstrup, 2001).

Basic research is sometimes called ‘blue sky research’. It is driven by the ideals and the ambition of future discoveries, which may have profound effects on the future, with no time limit attached and has much greater prestige attached for researches than applied research, despite taking far more time to be recognised. Those things often lead to some public misconception about the importance of basis research (Rice, 1998). The outcome of basic research is new knowledge or consequently more knowledge generated in the future. Contrary to that, applied research has much shorter life span and relies on new or existing knowledge, which can be used in the practical application for new products or processes.
(Dodgson, 2000). The refocusing of research activities from basic to applied science and the formulation of alliances between universities and industry has been forced in many instances by the third party, the government. In the case of Australia, this led to the formulation of foundations for integrated cooperation and consequently in 1991 to the emergence of first Cooperative Research Centres. There are many advantages from such cooperation, especially in product innovation, where knowledge and experience can be shared (ARC, 2001). Industry Commission (1995) claims that the capacity of an organisation to innovate effectively is acquired over time in a cumulative process of learning. Many firms are innovative and competitive, though they perform very little of formal R&D. The commission recognized that the effect of R&D on the firm’s competitiveness depends also on organisation’s size, its integration of R&D into the production and marketing activities and the availability of other ‘complementary assets’ such as networks. The major R&D performing bodies in Australia are: universities, government research agencies, and private firms. According to Industry Commission (1995), the public sector (universities and research agencies) accounted for around 55 per cent of Australia’s total R&D performance in 1992–93. The remainder was carried out by the business sector. With respect to the type of R&D, the higher education sector undertook most of the pure basic research (87 per cent). Government research agencies accounted for a large proportion of strategic basic research (43 per cent) and applied research (41 per cent). The business sector undertook 80 per cent of experimental development. While market forces may influence decisions to undertake R&D, government assistance and incentives proves to be also a powerful determining force. Financial support offered by government for R&D expenditure lowers the cost of acquiring knowledge and therefore raises returns to other factors of production. Generally more than 60 per cent of Australia’s R&D effort can be described as basic (28 per cent) or applied (33 per cent) research. The remaining 39 per cent is experimental developments. Though statistics are constantly changing every year, a constant picture emerges showing that Australia’s gross expenditure on R&D (GERD) is nearly half of the leading country in OECD (Berry, 2002; Erskine, 2003 Fenton-Jones, 2003). That is a growing concern to many people in the business and academia (Group of Eight, 2000). In addition, a practice of evaluating R&D expenditures after commercialisation is rather rare compared to other types of investment (Strategic Direction, 2001). This situation is paradoxical, because return of investment in R&D can be expected between 5 to 15 years (Walsh, 2001).

OECD (2001a) emphasized that future economic growth should include some of the drivers of R&D such as: i) more of international cooperation on a large-scale science projects, ii) improved conditions for international flows of knowledge, iii) more transparency; level playing field for new entrants and small enterprises in foreign markets, iv) more comprehensive domestic strategies including the promotion of innovation and entrepreneurship, v) improved means for formal and informal knowledge-sharing amongst R&D firms, and vi) greater complementarity between public and private investments in R&D to ensure that government-financed R&D generates fundamental scientific and technical knowledge that can seed innovation, and corrects market failures that may limit business investments in R&D.
Commercialisation

Schumpeter’s (1934) view on exploiting innovation value has a slightly different meaning today. Commercialisation may start when business identifies a way to use scientific or engineering advances to meet a market need (Nevens, 1990). Though the introduction of innovation to the market marks the end of implementation activities (OECD, 1997a), opportunities to exploit commercial value are present at all stages of a process (Dodgson, 2000). It is not uncommon that some companies try to obtain a benefit by patenting their inventions at all stages of the commercialisation process (Buderi, 2000). The ongoing discussion in many countries is whether patents have any benefits to the production of goods as they display rather low benefit to cost ratio, but the economic value of them on the market is very speculative and effects on innovation not fully examined (Irlam, 1982).

While industries involved in product/process innovation can get full benefit from its commercialisation effort, for universities their intellectual property is one of the prime assets. The most viable option to commercialise creative ideas created by universities is through spin-offs (Wright et al., 2004; Yencken et al., 2001). Some universities exercise various options to maximise their chances of commercialisation and use surrogate entrepreneurs in the process to increase their networks (Lockett et al., 2003). Milton-Smith (2001) claims that the probability of a successful university commercialisation may increase if small innovative organisations will be given opportunity to participate more often instead of larger ones. Reverse trends are also observed when industry people seek university support in the effort to use local resources in commercialisation process (Gibson, 1988). One of the purposes for technology transfer from universities is to assist researchers in the disseminating research results for public good. Carlsson and Fridh (2002) argue that success should not be only measured in the generated income or number of start-ups, as it depends on a reception of the surrounding community, culture and incentives within universities. Closer interactions are more beneficial to commercialisation and development of culture capable to explore mutual opportunities (Logar et al., 2001). Morand (1999) and Athaide et al. (1999) go even further, saying that maintaining close relationship with users during the time and after when technologies are commercialised has greater benefits for the economy in the longer run. To pioneer a new venture, individuals in the organisation need to examine the balance between new and existing technologies in the portfolio (Zahra et al., 1995).

In recent years, companies have increased the number of internal and external personnel engaged in the commercialisation effort. Zahra et al. (2002) observed that success of undertaking often depends on using formal and informal contacts and team integration methods. Building internal and external linkages between involved people creates a new culture and experience paying off during commercialisation of a next project (Gupta et al., 2000). Selection of key individuals on both sides of involved organisations to lead a process may guarantee better team integration and commitment, especially if marketing aspects are assessed from the beginning of the development process (Large et al., 2000; Theodorou, 2004; Single and Spurgeon, 1996). This may be especially important to break the mould during commercialisation of more radical innovations, when levels of risk, uncertainty, bureaucratic processes and focus on current operations are generally very high (O’Connor et al., 2002; Swan, 1997). Conflicts during commercialisation process have various backgrounds and some of them could be sparked by conflicting goals of individuals and organisations involved, when ideas are not fully developed, not protected, result from
serendipity and relatively high costs to implement (Duke, 1995). In Jolly’s (1997) opinion, consideration for cost is one of the most important factors during implementation process and should be monitored from the beginning. Cost-benefit analysis may be helpful to move through various stages or to abandon a project if not justified. Clear definition of market and demand can help to make some difficult decisions (Udell and Potter, 1989). Progress in commercialisation is often watched by the outsiders, who use the information for announcements to speculate the value of an organisation’s shares on the stock market (Kelm et al., 1995). Use of ‘real options’ logic to finance projects and to contain costs and risk is a common practice for other organisations (Gunther et al., 2000). The number of variables for scoring is usually big and may include some of them such as: i) the size of potential revenue streams, ii) speed or delay in market adoption, iii) development costs, iv) commercialisation and market access costs, v) company strengths, vi) likely competitive responses, vii) dependence on standards, and viii) the degree of uncertainty.

An ambitious plan to double the number of new ideas and triple the commercial impact on the market has been initiated in 2001 by 3M Company. Stevens (2004) thinks that the core of their success may lie in the fact that researchers have been given permission to spend 15 percent of their time at work to experiment with projects of their personal interest. Generally, probability to commercialise new business ideas is higher if scientific discovery and business needs correspond (Pruden, 2003). In the opinion of Jagersma (2003), commercialisation is subjected to risk exposure from internal process of introduction and at the same time from the external uncertainty of future customers needs. Efficiency of commercialisation process is an ongoing concern to organisations and funding bodies.

Parker and Mainelli (2001) argue that on average only three out of a hundred commercialised projects were related to scientific or technical problems, the rest of them were managerial failures. They claim that R&D process is very information sensitive and assessment of it may be often beyond managerial capabilities.

The Japanese approach to commercialisation is far more logical than the one practiced in the western countries. It is carried in the same place, with the same manufacturing process as standard production and involves people working in multifunctional department arrangements, performing all tasks from research to release of a product from a production line. There are no walls and divisions between research, design and manufacturing (Logistics Information Management, 1996).

Dimensions of Innovation
Lack of clear defining of innovation can be associated to a continually growing field of innovation research and too many aspects depicting the subject (Read, 2000). The earliest known classification of innovation is attributed to Schumpeter (1934) who distinguished five types of innovation: i) introduction of new goods, ii) introduction of a new process, iii) opening of a new market, iv) identification of new sources of raw materials or other inputs, and v) creation of a new type or changes in industrial organisation. New categorisation of innovation research by Gopalakrishnan and Damanpour (1997) and Cooper (1998) includes: types of innovation, stages of innovation and the level of analysis. These categories could in turn represent: i) types of innovation that relate to product or process innovation, incremental or radical innovation and technical or administrative innovation, ii) product innovation as a tangible outcome of the unit engaged in the innovative activity, iii)
process innovation that relates to methods of manufacturing, assisting in the delivering of required product or service. However what is important is the degree of change required to implement innovation within the system of enterprise, which innovation brings to the market and the society in general that classify innovation into incremental or radical type (Cooper, 1998). Incremental innovation can be predicted to a certain extent and involves small improvements to the existing products or processes. It depends on exploitation competencies of creators. In contrast radical innovation is impossible to predict and managing it in the established organisations exposes innovators to severe challenges (Leifer et al, 2000). Radical innovations have enormous potential and a true power of a creative destruction with the ability to entirely transform existing economies, relations between suppliers and customers, while creating new markets and industries, but they require the exploration competencies from innovators.

The other classification of innovation includes technical and administrative types. A technical categorisation of innovation is related to auxiliary products and processes assisting development of new product or methods of manufacturing, while an administrative innovation is about management related activities like the organisation’s strategy, structure, human resources or accounting system and is associated with the social structure of the organisation (Gopalakrishnan and Damanpour, 1997).

Stages of innovation could be better explained using the term Innovation Strategy to illustrate organisation’s philosophy and an approach towards innovation (Gopalakrishnan and Damanpour, 1997). Two types of such approach could be selected either to generate and develop innovation internally, creating ideas, providing solutions to solve a problem or to acquire and implement a readily available solution to the problem from outside of the organisation’s environment.

Levels of analysis relate to the field and the subject to be studied distinguishing between individual, group, organisational, industry or national level of research. Types of innovation, stages of innovation and the level of analysis highlight the possibility of conducting research with many combinations of available variables. The attitude, skills and knowledge of researcher, combined with the objectives of research create a multitude of dimensions to be explored. Framing innovation within a context is extremely difficult, especially from an organisational viewpoint. It requires understanding of many factors, facilitating and hindering the process of innovation. However, factors that include people, ideas, transactions and environment, from the perspective of an organisation and time, may not need detailed distinguishing into different types of innovation (Van de Ven, 1986). Such a distinction could result in the fragmented classification of innovation process and unnecessarily complicate it.

Technology that is mainly manifested in new products, processes and systems and which uses knowledge to deliver its functionality, is often used as a unifying medium that impacts on social and organisational change (Bryant, 1998; Dodgson, 2000). Other authors claim that technology represents three domains of human life encapsulated in: i) economic innovation as commercial product development, ii) social construction as materialised interests of particular actors or social groups and iii) cultural appropriation in relation to particular life-worlds and practical activities (Jamison and Hard, 2003). In addition Bryant
(1998) recognised: i) effective person-to-person interactions, ii) networking and linkages both formal and informal facilitating roles of entrepreneurs, iii) communication and cooperation among employees and organisations, as important social displays facilitating the flow of new ideas and therefore the generation of innovation.

Since the Industrial Revolution, radical innovations such as the combustion engine brought many social and economic changes and supported a personal income growth (Dossi, 1988; OECD, 1997a). Schumpeter’s (1934) work indicates that technological progress provides a common competitive advantage on the market. Dossi (2002) saw that the innovative dynamism often relates to the levels of GDP or a growth of patents, but many new developments are possible due to the social process of technological diffusion (Rogers, 2003). On a larger scale the development of technology, associated services and infrastructures has at times the power to lock whole economies into a particular direction (Dosi 1982). Bryant (1998) argues that technology transfers to international markets have the power to affect even national cultures. An example of this is how the Japanese car export influence many local industries.

**Invention and Innovation**

Invention and innovation are two related and connected terms used by many researchers in the relation to technological innovation. Invention is an important input to innovation. It is considered to be an idea, sketch or model of a new devise, product, process or system. Innovation usually requires the input of invention, which when allied with R&D effort may lead to the commercial transactions (Stoneman, 1983), but at the same time Mansfield (1968) suggests that the average lag between invention and innovation is of around ten years. However, relationship between invention and innovation may vary according to the environment in which process takes place. Mansfield claims that R&D spending is influential to both invention and innovation, though due to more emphasis on the development than the research happening during a process, a common view is that R&D is more innovation inclined. Status of innovation as such is accomplished only if it goes through the first commercial transaction (Stoneman, 1983).

**Sources of Innovation**

Not many innovations pop out from the flash of genius. For Drucker (1985) innovation is more about dedicated, conscious, purposeful, focused work and search for new opportunities rather than the result of genius. He claims that innovation requires knowledge of internal and external sources as the main contributors. Drucker’s opportunity for innovation resides in four areas of: i) unexpected occurrences, ii) incongruities, iii) process needs, and iv) industry and market changes. He states that unexpected occurrences can manifest themselves in the form of success or failure. They are a tremendous source of opportunities for innovation. The signs of innovation can be in the dismissal, disregard or even resentment to occurring events, but it could be the opposite when events are unfolding better than predicted or budgeted for. Early recognition of those events creates new opportunities, which should be taken. Further, Drucker understands incongruities as strange events taking place, where logic or rhythm does not apply to expectations and results creating prospects for questioning assumptions and to innovate with original solutions. Finally, for Drucker process needs often create opportunity for better answers to the existing, frequently happening problems and result in innovation. The excessive growth of
industry and market changes can be observed by unusually high rates of growth in the range of forty percent or more over ten years (Drucker, 1985). This growth alters existing structures, according to Drucker, and presents new opportunities for exploitation of created change that can lead to innovation. Drucker argues that opportunities for innovation outside of the organisational environment exist in three areas of social and intellectual domain such as: new knowledge, changes in perception and demographic changes. In comparison, Padmore et al. (1998) claims that it is the application of knowledge to create ideas and to bring them to commercial fruition that help innovation to occur. He states four sources of information for innovation activities in the organisation: i) in-house resources, ii) suppliers, iii) peer firms, iv) customers and public sector. Padmore et al. argues that effectiveness of innovation depends on integration of all sources of information. Although it may take a long time for innovation to build on new knowledge, Padmore et al. ranks usable attributes of such innovation very highly among new products or services. At the same time he recognised that knowledge based innovations seems to be very sensitive to customer perceptions and market dynamics. Additionally, changes in a perception, preferences and moods of society rather than facts often offer extra occasion to exploit by delivering needed innovation. Observation of demographic changes brings great rewards to those who watch and analyse them. Opportunities created by changes in population numbers, education, occupation age distribution or geographic locations are the least risky to pursue, in order to capitalise on them with innovations. Drucker (1985) recognised that the potential for innovation may lay in more than one of the sources at the time, due to their complexity, cross-occurrences and the associated risk they carry. He suggests that managing the process of innovation would guarantee a greater probability of success. In contrast Von Hippel (1988) questioned the existing assumption that product innovations are developed mainly by product manufactures. He presented a different classification framework for sources of innovation, which derives from a product function viewpoint and claims that in many instances users develop most innovations. The benefit of using product, process or service innovation links users with innovation by the functional relationship. Von Hippel recognised the fact that under appropriate conditions there could be many functional relationships between innovator and innovation in the context of user, supplier or manufacturer. Those factors of user, supplier and manufacturer are in Von Hippel’s opinion the main sources of innovation. He argues that variation and shifts in sources of innovation are mainly caused by the degree of variation in the innovator’s expectation of innovation-related profits. “A user will innovate if it sees an in-house benefits from doing so and typically does not consider whether other users have similar needs” (Von Hippel, 1988, p7). The difference from the manufacturer point of view is that innovation must have many users with the similar need for the product to be successfully launched on the market. Von Hippel (1988, p. 8) hypothesised that “innovation will be developed by those who expect a return they find attractive” and linked his theory of sources of innovation to innovation-related profits. He claims that a profit from innovation can be captured in two ways: i) by preventing others from infringement of an idea while developing it, ii) by licensing related innovation knowledge for a fee. Von Hippel saw that changes to the distribution of profits might result in the shift of the source of innovation. He postulated that the most effective way to predict the future source of innovation is by market research, which can identify important trends and lead users.
**Intangible Factors and Innovation**

Christensen and Overdorf (2000) included people in their classification of tangible resources with intangible ones consisting of product design, information, brands, relationships with suppliers, customers and distributors. The interest among researchers to study intangible factors derived from business economics with a need to better understand market value of the enterprises creating Intangible Economy (Zambon, 2003). Zambon questions the ability of existing financial statements to adequately represent the enterprise value. In his opinion during the last ten years the price-to-book value of many companies on the stock market grew three to four times fold. This difference between market value and accounting net equity is recognized by financial players as ‘goodwill’ and related by them to the influence of intangible factors creating that additional value for organization (Zambon, 2002). According to Del Bello (2002), intangibles related to the qualitative aspects of company performance often influence decisions by rating agencies when granting high-level functioning ratings. He claims that understanding of intangible factors is important to the financial players and to the management of enterprises for effective control of organisational activities that influence the outputs. Del Bello stresses a need to use appropriate tools and models to measure intangible factors within the existing arrangements as they affect the process of value creation such as innovation. Awareness of factors affecting innovation can often lead to the formulation of strategies helping to enhance it.

Till the 1970’s the old, physical capital based economy relied on resources and labour for greater economic returns. Slowing of the world economy shifted attention towards the knowledge based principles of growth. Peter Drucker (2001) emphases this phenomenon, declaring that knowledge will be the greatest future economic resource. Rising awareness of the intangible factors influence on organisational well being and innovation, prompted some European countries to investigate the phenomenon in order to standardise measuring and reporting procedures. In 1994, the European Commission began a series of studies examining the role of intangible factors in the competitive environment. The aim of their MERITUM project (Measuring Intangibles to Understand and Improve Innovation Management) launched in 1998 was to provide insight into the process of transformation of intangibles into wealth. In the next project EUROSTAT grouped intangible indicators into four major categories: Technology, Industry, Economy and Social Domain (European Commission, 2000).

Determinants used in this research can relate to the European Commission Industry Domain Factors (knowledge, performance, inter-enterprise alliances, economic, learning/training and cultural). The other common classification by Christensen and Overdof (2000) relies on grouping intangibles into human, structural (or organisational) and customer related categories. In their opinion the human category refers to employees knowledge; structural to organisational culture, data bases, information channels; and the customer category connection to values related to customers and any other existing external networks. Christensen and Overdof related intangible factors to information, brands and relationships forming resource-process-capabilities framework. The other term ‘soft assets’ as opposed to tangible assets has also been frequently used. Some researchers devoted efforts towards simplifying the classification with Roos et al. (1997) proposing two major types of intangible groups: human and structural, both containing three subgroups. He claimed that the human intangible factors are based on: i) competence (knowledge and skills), ii) attitude
(motivation, behaviour and conduct) and iii) intellectual agility (innovation, imitation, adaptation and packaging), while the structural intangible factors reflect on: i) relationships (including customers, suppliers, alliance partners, shareholders), ii) organisation (including infrastructure, process and culture), and iii) renewal and development.

Studies by Nonaka and Takeuchi (1995) demonstrated that human capital and knowledge management are the most important factors in evaluating effective innovation, but they may not be universally accepted in the categorization of intangible factors. On the other hand, Cooper and Kleinschmidt (1995) identified communicating new product strategy, entrepreneurial climate and cross-functional teams as intangible factors driving organizational performance. Christensen and Overdorf (2000) suggest that the presence of a link between tangible and intangible factors derives from classification of people as resources and recognition of their potential in communication and building relationships. Finding that link will be one of the challenges in the presented research.

Theories and Models of Innovation
It may never be possible to come up with one unified theory of innovation due to the complexity of innovation (Wolfe, 1994). For organisational innovation research Wolfe suggested three main streams: i) diffusion of innovation, ii) organisational innovativeness, and iii) process theory. The complexity of fields studied often predisposes researchers to use other theories to explain phenomenon of innovation. Some of those theories are described briefly below.

Diffusion of Innovation
Innovation Diffusion Theory refers to the spread of innovation through the population of potential adopters. Diffusion is “the process by which the innovation is communicated through certain channels over time among the members of a social system” (Rogers, 2003, p11). Therefore innovation itself is the logical unit of analysis, with the main objective to find out patterns and rates of innovation adoption in time and environment. Communication about the new idea in a social system is the essence of this theory with creating and sharing of information at vital stages in reaching a mutual understanding of the process. The nature of communication in Rogers’s opinion is a two-way convergence process, rather than a one-way linear act of transferring a message. A social system would require interrelated units engaged in joint problem solving to accomplish a common goal. Rogers (2003) based his theory of diffusion on earlier work of Ryan and Gross (1943) studying the innovation-decision process of seed corn farmers in America. He devoted over forty years of study and research in the diffusion field and identified five major stages of innovation-decision process, demonstrated by different actions of individuals occurring over time. Those stages are: i) knowledge - exposure and understanding of innovation, ii) persuasion - forming favourable or negative attitudes towards innovation, iii) decision - engaging in activities leading to choice of adopting or rejecting innovation, iv) implementation - putting a new idea into use, and v) confirmation - seeking the reinforcement to an already made innovation-decision.

For a successful diffusion process to take place Rogers (2003) recognized factors such as: i) adopter characteristics, ii) the social network of adopter, iii) innovation attributes, iv) environmental characteristics, v) characteristics of innovation promoters, and vi) the
process of communicating innovation. In his opinion a diffusion process is assigned to a group within a society, where the adaptation process pertains to the mental process of an individual. Early studies of diffusion were relied on the individuals as units of analysis with later research replacing it and concentrating on the organisation with the influence of structure and management on the process. Wolfe (1994) realised the limits of diffusion theory and argued that the process of diffusion among individuals is very different from that of the organisation and should be therefore treated differently.

Though, innovation diffusion theory presents a complex and dynamic process, the important factor determining an individual’s engagement is motivation to enter the process, which is missing in the Rogers model. That seems to be one of the important gaps identified in the innovation process. Therefore, motivation will be investigated further in this research looking at what role the motivation of the individual may play in innovation participation.

**Innovativeness**

There is an opinion among researchers that organisational research does not produce stable results due to a large number of organisational innovation determinants (Downs and Mohr, 1976). Meyer and Goes (1988) support that view stating that despite investigations about influence of many determinants on organisational innovation, very little is known about relationship between these determinants. However, assimilation of technological innovation may show such relationships that involve a process of evaluation, adoption and implementation. Meyer and Goes study was focused on decision as the unit of analysis, rather than the organisation with knowledge-awareness, evaluation-choice and adoption-implementation stages. The majority of organisational innovation research is concentrated on finding determinants of an organisation’s propensity to innovate with unit of analysis being an organisation (Tang, 1999; Wolfe, 1994). The most common factors investigated are influence of individuals, internal organisational and external environment variables with the emphasis on organisation structures with arguments that structural factors are the prime determinant of innovation (Damanpour, 1988). However, according to Amabile (1988) individual’s creativity in relation to organisational innovation is the prime aspect of organisational innovation and ought to be examined at the level of a whole system.

**Process Theory**

Process as theory involves examination of innovation process with the emphasis on how innovations emerge, grow and develop. The focus of analysis is the innovation process examined through the sequence of activities during development and implementation of innovations. Wolfe (1994) claims that process theory offers far greater stability of findings than the organisational innovation model due to detailed analysis of single stage components of the process, rather than complexity of large number of determinants and interactions among them.

There are two types of approach to process theory. One called Stage Model is framing a series of stages that are displayed over time of development. This model is determined to identify all stages and order in which they are happening. The second type is Process, where the unit of analysis is the process event itself, influenced by the external factors and probability of occurring. The sequential nature of occurring of events is the main research
concern. Wolf (1994) supported the early work of Rogers (1983) stating that for innovations adopted from the external source, stages tend to occur in a predictable order. However when innovation has a complex nature, or is originated inside of the organisation, the boundaries of stages become less clear as they often overlap and complicate analysis. Simple, sequential stage model limits the general use of the theory, as it does not represent other elements of the implementation process Wolf (1994).

Other applicable theories such as systems theory, change theory, complexity theory or actor-network theory could be also adopted for the purpose of researching innovation in the organisation. They will be offered for a review further in this chapter.

**Systems Theory**

A system is an orderly unit or a group, integrated in a common function, where complementary and related tasks are performed (Amabile, 1988; New Webster’s Dictionary, 1992). Each unit within the system can interact and influence performance of other units and the whole entity. There are two system types: a closed one without interaction with the external environment, and open one based and dependent on dynamic interaction with the external environment. From the organisation viewpoint, Hodgetts (1991) defined system as an organised unit consisting two or more interdependent parts, or subsystems, which can be distinguished from the environment by the existing identifiable boundary. Furthermore he classified organisational system into five interdependent elements: i) individual with personality structure who contributes to an organisation and expects to receive something in return, ii) formal organisation with structures consisting individual position of authority and responsibility, iii) informal organisation which demands from individual appropriate behaviour in order to be remained a member, iv) fusion of foregoing three elements with changes to individual elements reflecting on others in the process, and v) physical environment where interactions of individual take place in the organisational setting. Briggs (1992) on the other hand emphasised importance of systems integration as critical aspect of organisational innovation.

Systems researchers see organisation as the identity consisting of interdependent factors of individuals, groups, formal structures, goals, interactions, attitudes, motives, status and the authority (Robins et al, 2000). Todtling and Kaufmann (2002) are supportive of Lundvall’s (1992) opinion that an innovation system is made up of elements and relationships. While they saw the interaction of elements in the diffusion as critical, learning activities with new form of economically useful relationships from knowledge were essential and central to the functioning of dynamic social system. The work of Freeman (1987) set the trend to investigate national systems of innovation as networks of public and private institutions initiating, importing, modifying and diffusing new technologies through their activities and interactions. Recent recognition of the systemic nature of innovations in some countries drew the attention of researchers to study innovation phenomenon as National Innovation Systems (NIS) (Marceau and Dodgson, 1998). OECD (1997, 1999) reports on NIS highlight new direction in research which is focused on the importance of interactions among participants involved in technology development, contrary to previous focus on inputs as research expenditure and outputs as patents. Dodgson and Bessant (1996) recognized earlier the extreme complexity of those relations, where system of incentives had to exist in national systems in order to keep up innovation. New understanding of NIS
phenomena is helpful for enhancing innovation performance, which relies on the knowledge-based economies. In particular the emphasis is on fluidity of tacit knowledge flows through the informal channels between enterprises, universities and research organisations. Stacey (1996) argued that human systems of which individuals, groups, organisations and societies are part of are all non-linear feedback networks of a highly complex whole. Each of those systems has two sub-systems: i) legitimate representing current reality driven by sharing leading to conformity, and ii) shadowy, unseen system driving behaviour by recessive schemas leading to diversity. Balancing proportional existence of both sub-systems within an organisation is paramount to its survival. Organisations constitute people in complex adaptive systems, in a physical and mental sense, interacting with each other to produce surviving strategies for themselves and for the systems, therefore its success depends on managing both (Dodgson and Bessant, 1996). Repressing anxiety within a system caused by the ever-changing business environment may temper down creativity and an emergence of innovation in the response to change (Stacey, 1996). NIS approach emphasises that the flow of technology and information is a key to the successful innovation process. This study would be exploring the presence and influence of both presented sub-systems in order to determine the organisation orientation.

Change Theory
Management in organisations is exposed to two environments, internal and external. They both have different dynamics and require introduction of change in order to mediate between them. Decisions must be made when choosing the past or a future, maintaining stability or deciding to proceed with the process of change. Change can be orchestrated in two ways: by changing people’s attitudes and behaviours, or by changing the organisational system. In the opinion of Drake (2000), technology remains one of the most important agents of change demonstrated by the ways people work, are entertained, seek information and communicate. Innovation process is the most engaging method to bring change in behaviour and improve organisations performance (Hampton et al, 1982). Initiation of change within people usually faces some resistance from organisation members and management. It requires a considerable amount of courage as proposals of change confront a certain degree of rejection. The sense of security is often the cause for rejection by maintaining existing arrangements and protecting established authority and proven order. Admitting to a lack of knowledge about better solutions to a problem carry degree of guilt. Prevention is often better than cure, but it’s easier to say than to do. Not everybody has the ability or time to think about it. Hampton (et al, 1982) agrees with Callahan (1979) observing the importance of the stability in the organisation when managers must sometimes block change to guarantee continuity. He is also supportive of the view that not all innovations are welcomed as individuals and systems have a limited absorption of change (Albanese, 1970). Callahan (1979) describes the need to change as the management dilemma, the choice between altering practices and structures to implement new technology and regulations or maintaining existing, proven procedures and systems with the risk of future economic consequences. Changing attitudes and behaviours of members can be accomplished with greater probability if the change agent possesses power and authority. Hampton (et al, 1982) advocates that striving for change in attitudes may be irrelevant and proposes to change behaviour in more effective way by modifying organisational structure, authority, policy, the ways of communicating, rewards, technology and even a physical look of a place. However he recognises that both methods could be used complementing
each other. Hampton is supportive of Lewin’s (1958) four steps method to change behaviour by: creating dissatisfaction, unfreezing, converting and refreezing process. Satisfied people have no reason to improve performance or change their behaviour, unless they can see signs in the environment. Dissatisfaction can be induced to the system to trigger reaction and the degree of effect controlled by management. A more positive way of initiating change would be articulation of desires for future gains. In order to start a process towards a desired direction, the support for old values and attitudes has to diminish with the increasing communication about benefits of change and minimization of threats against change (Tichy, 1974). Converting takes time and change agents have to convince majority members about advantages of a new model. When converting is achieved new attributes and behaviours become a norm and those converted to a new status quo must be rewarded for continuing their new behaviour (White and Steinbach, 1979). Roger’s (1999) research concludes that better employee-management communications result in more change, especially if supported by more training. Changing the organisational system seems to be more expensive, changing people’s behaviour not as productive either, so instead more proponents argue that accepting people as they are and changing the circumstances around them would be the most beneficial for introducing a change (Wohlking, 1970). Modification to the environment has merits to effective change, as people’s behaviour would be adapted automatically to reflect new conditions and satisfy their needs.

A different viewpoint about organisational change is presented by Kimberley and Miles (1980) approaching the subject from the life-cycle perspective, stating that organisations are born, grow and then decline. Recognition of these phenomena is particularly important to investors as they try to capitalise on the growth phase of the organisation. Hall (1987) supports Hage’s (1980) interpretation of organisational change as involving alteration and the transformation of the form in order to better survive in the environment, but is critical of absence of organisational goals as a driving force. Hage, (1999) recognised a growing need for research to unite organisational innovation theories with change theories that could create a new areas of research in: i) structural contingency, changing environmental demands that reflect on an organisation form with emphasis on innovation and flexibility, ii) political theory, where managers are subject to environmental change, but to the degree which is appropriate to them and they control occurrence of innovation, iii) organisational ecology theory, when adaptation occurs by the creation of a new specific form allowing an organisation to compete, and iv) institutional theory, emphasising the importance of professional associations, foundations and socialisation agents as a source changing organisational form. Change in the organisation keeps its culture in the constant transformation due to increasing competition and market deregulation, therefore careful management of individuals may minimize their resistance to the process (Hodgetts, 1991).

**Complexity Theory**

Complexity theory allows looking at complex systems in the scientific way. According to Lucas (2004), “Complexity Theory states that critically interacting components self-organise to form potentially evolving structures exhibiting a hierarchy of emergent system properties.” Complexity theory is necessary to understand today’s fast changing business environment with diffusing new technologies, increased amount of information and diversity of people involved in the process (Stacey, 1996). It is increasingly difficult to foresee the consequences of all changes happening in the
organisations and predict the outcomes. Fullan (1993) examined relations between complexity theory and the process of change referring to any links of cause and effect as difficult to trace the process of change being a non-linear in nature, full of paradoxes and contradictions, with creative solutions arising out of interactions under conditions of uncertainty, diversity and instability. In order to understand this theory there must be a full range of interdependent and variable components available for analysis. The theory is best viewed with the systems regarded as wholes, without simplification and reduction considered as inadequate techniques (Lucas, 2004). Lucas identified four basic types of complexity models with research concerned to find patterns present in the structure that can be assessed using statistical analysis. Those models are: i) static complexity - related to fixed systems, where structure does not change in time; components of the system have three dimensional properties like size, shape and density, ii) dynamic complexity - created by adding a time to static model, iii) evolving complexity - described as an organic phenomena where systems evolve over time into open ended systems, and iv) self-organising complexity - identity made up of static and evolving system coevolving with its environment; system functions are described in relation to the outside world. According to Lucas (2004) components for complex system analysis are those of the traditional systems analysis that may include: i) connectivity profile – parts on the average have more than one output and input, ii) transition exponent – the difference between average input and output is approximately 1, iii) learning availability – parts are subject to transformation due to learning from experience; their rule sets change and optimise transitions, iv) operation parallelism - most parts act autonomously, in parallel mode enhancing response speed and adaptability, v) interaction variability - parts are able to change those, with which they interact, both on a permanent and temporary basis, vi) feedback loops - outputs have a feed back into the beginning of the process enabling monitoring of the results of actions early in the development, vii) control ability - all variables have control paths for stability, viii) basins of attraction - flexibility of response and creative freedom give multiple ways to approach the same goal, ix) external boundaries - system boundaries are neither closed nor totally open, x) system function - multiple objectives or functions guaranty a multi-dimensional results eliminating single dimensional fluctuations, xii) building blocks - subsystems of various sizes can be located giving a modular, fractal, structure the higher level of characteristics than those seen in the parts, xiii) emergent properties - unplanned, not imposed functions can emerge during operation with modules, which are self-organized from part interactions, xiv) system resilience - most internal or external perturbations give overall stability to function and display a power law spread of fluctuation size and duration, xv) distributed control - overall constraints control local decisions by parts or modules, which are distributed throughout the system, xvi) information flow - stability to chaos is indicated by rate of information flow, and xvii) output variability - positive feedback loops are capable of registering any increasing fluctuations in the system resulting a change towards chaos.

Lucas (2004) believed that having such indicators equips theory users with the benefits of full analysis leading to achieving innovation, survival and adaptability in the complex world. Complexity theory does not present formulas for use, but offers a process for adoption to self reflect in the situation when outcomes are unforeseeable. The essence is to see complex systems as interaction of components changing rules and themselves in the process of learning (Stacey, 1996). Complexity theory is still not well developed and does
not have many followers mainly due to the difficult analysis with prediction of complex structures within simultaneously changing components or aspects. For greater predictability of complexity theory Lucas proposed a multidimensional pattern approach using various reference scales, for example growth.

**Evolutionary Innovation Theory**

This theory assesses innovation as an evolutionary process. Pioneering work of Solow (1956) proved that technological progress was central in the explanation of economic growth. One of the most important factors determining economic growth is the increase in productivity that influences technological progress (Verspagen, 1993). Technological significance to economic growth was recognised by Schumpeter (1934). According to his theory, entrepreneurs are constantly looking for new opportunities, generate new innovations and in the evolutionary fashion at the same time destroy the old combinations and order. Following Schumpeter’s work some authors explored a technological side of innovation, which may involve many aspects of organisational life (Dodgson, 2000; Rogers, 2003). Dosi and Egidi (1991) recognised that uncertainty and imperfect information trigger the evolution of innovation. Contrary to that Lundvall (1992) claims that user-producer interactions and relations induce innovation. Other authors recognised accumulation and diffusion of knowledge in the organisation as one of the important factors enhancing innovation (Nonaka, 1994; OECD, 1996a; Prahalad and Hamel, 1990; Rogers, 2003). In current economic climate of globalisation of trade and industry there is growing need in many countries to make innovation effective at the national level. Hofer and Polt (1998) emphasise the importance of systems approach, which among many factors should include set rules promoting innovation, incentive structures and good relations between participants.

**Actor-Network Theory**

Interactions between science, technology and society form the bases for creation of actor-network theory. Callon (1986) and Latour (1987) hold the credit for early work and effort in the development of theory. They recognised the existence of the common domain between disciplines of science, technology and society, but admitted difficulties in capturing any permanent state adequately in describing the field. The fact that actor-network creates constantly new entities, makes, in Callon’s opinion, a difficult task to establish any permanent interpretation of actor-network relations. In Latour’s opinion there are great divisions between economic views of innovation and sociological aspects of technology to observe existing commonalities. He proposed to analyse relations of the expending or shrinking scientific system, consisting elements of money, workforce, instruments, objects, arguments and innovation and evolving in the circular mode, in order to examine patterns between collaborating scientist and his boss. Law (1986) argues that scientist have capability to negotiate not only about scientific work, but also about social reality. That gives a scientist an advantage to exercise the concept of power on one another and on the society as well. Translation of science into power is expressed in face-to-face contacts by words, objects and gestures in order to create advantage. Law argued that scientifically created artefacts carry the effect of creation onto the user and the network of users, which underlines the prime aspect of actor-network theory. Massage and intention of creator is incorporated permanently in the characteristics of the product. The principle philosophy of the theory lies in the understanding of term actor. Actor is not only an
individual communicating within the network like in the diffusion theory, but also includes nonhuman elements like equipment, communication media, financial resources or a whole organisation.

For the theory to be fully applicable it needs to analyse the complex interactions of all actors impacting on the process of innovation (Trood, 2002). Therefore there is a need to search and identify not only all actors but also relationships between them to conduct analysis for an understanding of complex relations.

Latour (1987) saw the creation of technological artefacts (‘scientific truth’) as the result of complex interactions forming a link between resources, objects and people rather than being viewed as the product of logical construct. Those complex interactions exist as the consequence of engagement and alignment of actors with form and functions of relationship developed during the time of negotiating interests of participating parties. Law (1986) made a case that the stability and a form of the artefacts was a function of the heterogeneous elements shaped and assimilated into a network. Trood (2002) claimed that actor-network theory embodies artefact’s natural, social and changing aspects of a process, enabling to explain continually evolving forms of network construction in the light of the artefact properties. One of the benefits of actor-network theory is the fact that research can lead to the recognition of factors hindering the process of innovation and change.

Models of Innovation
Schumpeter’s theory of innovation has become a standard since the time of its development in the 1930’s. Many researchers followed Schumpeter’s model quite naturally and for a long time looked at innovation process as the linear phenomena. Various existing mutations of that model included either science-push approach in 1950’s and 1960’s, where scientific discovery engineering and manufacturing activities proceeded, resulting in delivery of product or process to marketplace, or later in 1960’s with the demand-pull model and market driving the process (Dodgson, 1998). Further developments from mid 1980’s brought coupling and integrated generation of innovation process with feedback within and between organisations. The latest model, which has been accepted by many organisations, is based on systems integration and networking (Rothwell, 1992), where value creation in organisation is linked with suppliers and customers regulating the process. Vernon (2003) emphasised the existence of two basic models, linear and coupling with latest relaying on numerous interactions and feedback loops combining some of factors influencing innovation such as: i) accumulation of physical and human capital, ii) physical and social structure, iii) economies of scale, iv) regulatory environments, v) improvements in the quality of capital and labour inputs, vi) improvements in the organisation of work, vii) competitive business environment, viii) ease of dissemination for new technology across the economy, and ix) availability of technology receptors. Along Vernon’s lines of classification, Jorde and Teece (1990) also proposed two models: traditional serial model and simultaneous model but with tight linkages and feedback mechanisms between all involved factors. To the contrary, Cooper (1998) believes that innovation must not be differentiated at all into categories, but dealt as one single type identity in the multi-dimensional space of variables. Her multi-dimensional model of innovation accommodates incremental and radical, technological and administrative, product and process innovations defining innovation along innovation attributes, for example, process-administrative-
radical. On the other hand, Cuna and Gomes (2003) saw the parallel developments in product innovation models and changes happening in the field of organisational science. They proposed to follow the evolution in product innovation management from a planned and mechanistic approach towards emergent and organic models reorienting focus from universal to contingent models, invariant practices to flexible ones, avoiding risk to taking advantage of opportunities, planning to learning, exclusive teams to inclusive networks and from structure to structured chaos.

Presented literature review about innovation and theories and models of innovation process are expanded into an organisation related themes that also relate to innovation.
Appendix D

Organisation Issues Related to Innovation

Organisational Theories and Models

Most of the existing literature about organisational theory including publications by Hage (1980), Hall, (1987), Morgan, (1997) or Pfeffer (1982), refers to work of founders in the field and their contribution to the general knowledge. While Marx (1970) is regarded for study of social order and structures, importance of human action outcomes as practical artifacts and as activities themselves transforming societies, Bernard (1938) promoted an organisation as a system of consciously coordinated activities with good communications between motivated members and their willingness to contribute to common purpose. Weber (1947) on the other hand presented bureaucracy and authority as ‘corporate group’ with structurally based associative rather than communal interactions between members of the organisation, where everybody has purposeful goals. Taylor (1911) is remembered as an originator and pioneer of ‘systems engineering’, work aiming for developing understanding of each man capability to the highest state of maximum efficiency, through training and development, so that he and employer may achieve maximum prosperity. Fayol’s (1949) contribution outlined a number of principles such as: division of work, authority and responsibility, discipline, unity in command, unity of direction, subordination of individual interests to general interest, remuneration of personnel, centralization, line of authority, order, equality, stability of tenure of personnel, initiative and esprit de corps, by which organisation might be controlled.

One of the most comprehensive classifications of organisations has been done by Hall (1987), who presented five perspectives to explain a phenomena, distinguishing preference to an inductive approach of contemporary Pfeffer (1982) and a deductive one developed by Hage (1980). Those five Hall’s perspectives on the organisation are:

- Population-Ecology Model (or Natural-Selection) - primarily concerns are with organisational change or transformation to achieve the best fit with the environment, however this model does not include the aspect of choice or active influence, which environment (like customers) can have on the organisation,
- Resource-Dependence Model – decisions and actions are happening within internal power arrangements of organisation; the effects of dealing with the environment are through internally assessed and manage organisation to its own advantage; resources such as materials, finance, people, technological innovations are drawn from external environment; strategic choice is the key element that may include manipulation of environment,
- Rational-Choice Model – effectiveness of the organisation can be ordered to attain it’s goals (as intent and outcome) to meet constraints; an organisation is a rational-choice form of social interaction; dealings with the process and the environment are
based on transitions using bartering or money; there is a purpose for most organisational activities.

- Marxist or Class Model – workers control and employment relationships of social forces are important issues in the evolution of economic systems, where capitalist class takes conscious, rational strategic actions and workers take charge of transformation.

- Institutional Model – built on organisational forms and behaviours shaped by established institutionalised values and beliefs; there are no theories whether rational and technical constrains trigger organisational action or there are other institutional factors; understanding of the complex phenomenon is possible through the integration of various points of view about the organisation.

Despite many differences and similarities in the context of organisational theories, three basic perspectives could be drawn:

- Classical organisational theory – benefits from the knowledge of economics, based on well set goals and controls in the central hands of few managers, with rules and regulations supporting scientific approach to most activities in order to gain production efficiency; emphasis are on competition as the main driving force; possibility of sociological conflict between workers and management is ignored (Hatch, 1997; Thompson and McHugh, 2002),

- Systems approach – integrates social and technological systems; productivity driven approach, examines relations between: individual person, formal organisational units of structure, informal organisation relations, fusion process of individual, formal and informal elements, physical environment where interaction takes place between individual and machine systems, functional and environmental factors, and new incentives rewarding for innovation (Senge and Sterman, 1992; Morgan, 1997),

- Human Relations perspective - focuses on reducing possibility of conflict between management and workers; identifies social needs in workplace by review of outputs in the light of other, previously unplanned activities in the organisation; improves motivation of workers by integration of the needs of individuals and organisations resulting in greater self-control, creativity and productivity (Morgan, 1997).

Whether analysis of an organisation is based on strategic-choice or environment determinants model, Hall (1987) stressed the importance of choosing combinations of theories for a full explanation of organisational actions, without ignoring the issue of resources or outcomes to the social structure. The orientation of research towards organisations analysed as system indicates a need to examine complexity arising from the form of interrelated disciplines like economics, technology, sociology or psychology, by aiming to find out factors making those relations possible (Hatch, 1997).

Thompson and McHugh (2002) argued that most of presently available literature is about work aspects reflecting profit-seeking nature. It seems to be also that current field of the organisational theory has been narrowed into a two-dimensional view of the “unholy alliance forged between managers and the consumers at the expense of the worker or the employee” (Gabriel, 2001, p23). This could be because a birth of ‘enterprise culture’ created two types of fatalities: workers/employees and “armies of those excommunicated
from the cathedrals of consumption and dependant on the state to make choices on their behalf” (Gabriel, 2001, p23). The right to criticize current status of organisational life is worth as it may anticipate future unpredictable discontinuity and change (Gabriel, 2001).

**Types of Organisations**

The concept of modern organisation is constantly changing. Common opinion is that organisations are consciously created arrangements to achieve goals by collective means (Robbins et al, 2000; Thompson and McHugh, 2002). Very often the changing nature of the surrounding environment dictates social, technological and economic changes, which must be embraced by the organisation to consistently meet its goals. The need to understand organisational differences may serve various purposes. Hall (1987) identified stock market, potential employer or political party as examples of the organisations, for which analysis is constantly required in today’s society. On the other hand the view of any ordinary organisation may be far from simple as its features are often bounded by an ‘organisational iceberg’ of formal and informal character (Selfridge and Sokolik, 1975). Visible parts may represent official and the formal organisation with formal reporting about relationships, rules and procedures. Underneath of that formality exists the informal organisation, consisting of what really goes on in the organisation, including beliefs and social relationships (Northcraft and Neale, 1990).

In order to capture a sensitive issues influencing innovation, a degree of generalisation into types of organisations is necessary. Wolfe (1994) broadly categorised them into four categories: public, private, manufacturing and services organisations. Other researchers saw a need to classify organisations into profit and non-profit category to better describe their characteristics (Hall, 1987; Damanpour, 1991). In comparison, Mintzberg (1979) claimed that using structural approach might guarantee success in meeting various unforeseen organisational events. He categorised organisations into five types: i) simple structure, ii) machine bureaucracy, iii) professional bureaucracy, iv) divisionalised form, and v) adhocracy.

According to Mintzberg (1983), environment conditions shape specific type of organisational structures. Modern organisations cannot afford to have fix structures as they are characterised by interweaved activities and functions, with people having several tasks and participating in many different processes (Sundbo, 2001). Organisations of this type often rely on division of labour, but in loosely coupled networks. According to Hall (1987) an understanding of organizations is imperatative if we are to understand and be involved in the society around us.

The type of decentralised organisation, with a degree of freedom for activities of its members, can be characterised as professional bureaucracy and is present in universities and organisations like them, allowing for the independent work without maintaining strong bureaucratic structures and coordination (Mintzberg, 1983). However, it is not uncommon that professional bureaucracies clash with entrepreneurial members of organisations who want to bring change with innovation (Mintzberg, 1983).
**Flexibility of Organisation**

This characteristic of an organisation aroused in the late 1980’s from market and consumer demands for an organisation to respond quicker to their needs. Organisations need to be more responsive and flexible with increasing competition and economic uncertainty (Thompson and McHugh, 2002). On the other hand Pollert (1988) saw frequent organisational changes as the result of short term cost cutting exercise, rather than a new direction towards changing work culture. Despite the temporary uncertainty about the trend towards the flexible work arrangements, the evidence was there that comparing to work structures present in the mass production era for the most of the twentieth century, new flexible arrangements could be things to stay in the times of rapid charges in the society, economy and technology (Thompson and McHugh, 2002). Bramble (1988) saw emerging changes as leading towards flexible work arrangements that could have a positive influence on organisational performance. According to Thompson and McHugh (2002), flexibility of the organisation could be identified and arranged in three distinct ways as: i) functional when job security is maintained in exchange for acceptance to be redeployed between activities and tasks as they are required by product or production, ii) numerical with an ability to vary the number of employees to work requirement depending on the changing demands, or iii) financial when pay and employment costs regulate demand and supply of external labour market supporting numerical and functional flexibility.

In the past, traditionally designed organisations were not capable of handling uncertainty and innovation (Drucker, 1985). Braking of the bureaucratic structures was necessary to create new forms of the organisations (Mintzberg, 1983). Consequently Mintzberg states that structures based on informal and unofficial relationships are capable to realize mutual adjustments as the coordinating mechanisms for the future organisations. However, some formal and informal relationships may be necessary to maintain organisational stability.

**Organisation Design**

Organisations are in many instances represented by their physical entities. According to (Pfeffer, 1982) they define spatial and social distances between individuals and physical forms, where interactions occur. The notion of design is central to the idea of the rational organisation. While structures, tasks or culture are seen as manipulable by management, design seems to be central to the achievement of organisational goals (Thompson and McHugh, 1990, p171). The general form of an organisation may depend on the number of employees, the level and the motivation of these employees, and the nature of the work to be done (Fayol, 1984). As the number of the employees grows, so is the need for the number of organizational levels in its structure and number of people in charge of them. Fayol proposes a formula according to which 15 workers to a supervisor is the basic rule in the organisation. Mintzberg (1983) argues that optimal organisation design parameters should be rather based on the specific organisational functions such as: design of positions, superstructure, lateral thinking or decision-making system. The distances and layout of the physical workspace can also profoundly effect interactions in the organisation from the viewpoint of quantity (Pfeffer, 1982). Pfeffer claims that organisations can be seen as networks of social interactions, with their properties set by the nature of tasks or technological challenges confronting their social entity. He proposed three essential properties to characterise networks such as: i) transactional content, ii) nature of links, and ii) structural dimensions on the basis of Tichy’s et al. (1979) research. One of the important
dimensions not specified in Tichy’s et al. (1979) analysis was the demographic composition of networks described by age, sex, education levels, work experience, nationality or race, which can add up to the complexity of its identity (Pfeffer, 1982). According to Mintzberg (1983), organisations in highly specialised field require horizontal structures supported by professionally qualified individuals.

**University - Industry Cooperation**

The lack of linkages between university and enterprises forecloses opportunities for innovation and governments in countries such as the United Kingdom, United States or Australia have policies to support new research activities and business developments (Australian Research Council, 2001). However, Turner and Callon (1986) observed that a common tendency for government sponsored research identities was to use far more academic than industrial based literature to support appropriateness of their activities. An avoidance of relations leading to market implementation was also common. Slatyer (2000) proposed two directions for development of policy in Australia to promote research and to introduce change. One was by a development and improvement to existing activities without changing their content. The second was by a modification to the content of a field through introduction of new themes of study to create links between previously unrelated sectors of activity or to try promoting new emerging problem areas.

In recent years universities have been under increasing pressures to translate the results of their R&D work into tangible outcomes. Establishment of technological offices at many universities signalled the active change in the pursuit of commercial activities through seeking industrial support. USA example showed that the number of patents from universities in 1992 increased 15-fold compared to increase of about 50 percent in 1968. Henderson (2002) claimed that increase in the university patents reflects an increased rate of technology transfer to the industry and thus enhancing the university research. An excellent example of the cooperation between academia and industry evolved into a creation of Cooperative Research Centres (CRC) engaged in the commercialisation of R&D from various fields of science (Australian Academy of Science, 1993). The emergence of CRC was possible because a huge government effort, financial and administrative support. Earlier university-industry relations had more emphasis on science and technology with the goal of the creation and transfer of knowledge to the industry with minimal business interactions (Australian Research Council, 2001). Australian Research Council (ARC) claims that government policy to reduce public funding motivated research organisations to make contact with business and seek their financial contribution. By 2001 there were about 900 research centres operating jointly by university and business in Australia with nearly half of finance contributed by the industry. Growth in the number of spin-off companies from joint research efforts is the measure of that success (Yencken et al., 2001). Porter (1998) argued that clusters of research organisations reveal greater efficiency in outputs as common efforts and competition may drive research to higher levels. Australian Research Council (2001) claims that one of the main problems to facilitate new businesses is lack of proper interface organisations providing a link between university and business. According to ARC a new trend, which emerged in the form of collaboration between universities and foreign firms is present in Australia.
In contrast, one of the benefits of engaging in international alliances is access to foreign technologies and markets (OECD Observer, 2000). As an example, British Government recognised in the early 1990’s that one of the problems with its economy was lack of excellence in science and technology along with good performance in exploiting economic advantages.

University and industry are different operating systems and therefore may obtain most benefits from relationships if weak ties and flexible interactions are maintained between them. Contrary to Porter’s (1998) business philosophy, growing opinion among academic scholars, industry practitioners and policy makers around the world is that successful cooperation rather that outright competition presents more benefits, prosperity and survival of organisations in the future (Carayannis and Alexander, 1999).

**Science and Technology Relationship**

Common opinion in the past about what is science and technology was driven by philosophers distinguishing it on the analytical ground that science is about the discovery of truth whereas technology is about the application of that truth (Pinch and Bijker, 1990). The phenomena of science and technology have different boundaries. While science is open and focuses on all scales of observation to search for the universal laws and truth, technology is relatively closed and seeks a practical application of laws into products and processes (Metcalfe, 2000). The outcomes of science are publications, which can be diffused widely even within international cultures, while technology has greater rewards for outcomes and therefore is very closely guarded. Metcalfe also claimed that while science often opens new opportunities for technology, the demonstration of technology could lead up to discovery of new natural principles. Most of innovation research recognises that quality innovations often originate from basic science or technology (Dodgson, 2000). Analysis of economic data among OECD countries suggests that changes in technology influence productivity growth (OECD Observer, 2000). In addition, due to technological developments there is an observable shift in Europe’s employment moving within manufacturing sector from low to medium and higher technology jobs.

Despite many generalisations and views on science and technology, there is one common perception that this relationship is sociologically constrained, with both disciplines drawing from each other resources of knowledge (Dosi, 1988; Pinch and Bijker, 1990). Following the same line of reasoning, Van Berkel (2000) argues that especially technology will play an important role in the future sustainable developments. It can also be argued that economic developments and innovation have as much influence on science and technology as socio-cultural national factors (Ney, 1999). In comparison Besley (1998) saw the argument about science and technology as a bit irrelevant as the vast majority of technology employed in Australia is imported and more effort should be concentrated on adaptation of foreign technology into innovative products than on creating it. Various technology aspects were not considered widely in the early studies of innovation determinants such as: size of R&D, management strength or marketing capabilities, as they were mainly viewed as economic parameters (Pinch and Bijker, 1990). That resulted in a simplistic view of technological innovations and the assumption that they were a result of a linear relation. Contrary to this view, a wider and unified sociological approach is required to study science and technology that may give a unified approach (Pinch and Bijker, 1990).
Organisation and Change

Organisations are complex and dynamic identities, which like many other forms of societal creations, are subject to change (Kanter, 1983). Change in the organisation depends on two major factors: changing people’s attitudes and behaviours, and changing the organisational system (Hall, 1987). An examination of organisations from the multiple perspectives perceives benefits of pluralism to understand the complex phenomenon of change (Van de Ven and Poole, 1995). The science and cultures of the ancient worlds of China and Greece have much to offer to contemporary debates in many fields including change (Lloyd, 2004). Pettigrew et al. (2001) suggested that in order to develop better understanding of change an even attention should be paid into six areas: i) multiple context and level of analysis ii) the inclusion of time, history, process and action, iii) the link between change process and organisational performance, iv) international and cross-cultural comparisons v) receptivity, customisation, sequencing, pace and episodic versus continuous change, and vi) partnership between scholars and practitioners. According to Edwards (2000), integration of structural components of an organisation with participating individuals may produce an interactive perspective of innovation and change. The difficulty in describing factors involved in a process of change lies in the complexity and the number of potentially present factors that could be specific to each individual and to each process (Apter, 1999). Therefore change might be seen as deliberate product of conscious reasoning and actions or it could emerge spontaneously in an unplanned way. While acknowledging that change can never be fully isolated from the effects of serendipity, uncertainty and chance, Dawson (1996) saw organisational change as a process that can be facilitated by perceptive and insightful planning, analysis and well crafted implementation phases. In comparison Weick and Quinn (1999) introduced the perspective of the individual observer within episodic (infrequent, discontinuous and intentional) or continuous change (evolving, cumulative and ongoing). Weick and Quinn suggest that while some organisations may have people sympathetic to change, a managed approach is always required. On the other hand, referred by some authors as first order or incremental change, this continuous change can be characterized by people constantly adapting and editing ideas acquired from various sources (Orlikowski, 1993). At a collective level, accumulated changes through continuous adjustments can often create a substantial change in time across an organisation. Orlikowski (1996) argues that capitalization upon flexibility to accommodate and experiment with everyday contingencies, breakdowns, exceptions, opportunities and unintended consequences of organisational life, places them on the path of continuous change. Though three types of change: developmental, transitional and transformational may be the most common, transitional change seem to capture most of the attention in the organisational literature (Beckhard and Harris, 1987; Kanter, 1983; Nadler and Tushman, 1989). The transitional approach to change requires the presence of three distinct conditions: present state, transitional state and future state, but it seems that only desired future states need clear goal specification and involve a degree of choice in decision-making (Beckhard and Harris, 1987). Beckhard and Harris argue that transition process is about overall management of complex organisational processes. The model of transitional change has its foundations in the work of Lewin (1958) who conceptualised change as a three-stage process involving: unfreezing the existing organisational equilibrium moving to a new position and refreezing in a new equilibrium position. Exploration of this model by Schein (1987) leads to further expanding of three stages. He suggested that unfreezing involves disconfirmation of expectations, creation of guilt or anxiety and a provision of
psychological safety that converts anxiety into motivation to change. Refreezing could only proceed when the new point of view is integrated into the total personality and concept of self and new relationships. Transformational change requires a shift in assumptions of people. Schein (1987) claims that transformation may affect structure, processes, culture and strategy of organisation, but continuous learning must be implemented to warrant positive effects. A similar approach has been suggested by Peters and Waterman (1982) who captured seven interdependent variables into 7S framework that puts emphasis on ‘hard’ (strategy, structure and systems) and ‘soft’ (style, staff, skills, and shared values) factors affecting change. Like in the other theories of organisational change, strategic change model proposed by Pettigrew and Whipp (1991) suggests that a success could result from the interaction between the content of change (objectives, purpose and goals), the process of change (implementation) and the organisational context of change (the internal and external environment). Though Pettigrew et al. (1992) developed and extended the original model further, they reminded that change taking place in the organisation must be assessed in a historical, cultural, economic and political context to be implemented effectively. In contrast, Beckhard and Pritchard (1992) proposed the framework for fundamental change and described five integrated and general themes of culture, ways of work, relationships to key stakeholders, identity (outside image) and mission (reason to be) as critical, (apart of vision) when assessing management of change. The essence of this theory is in acknowledging that all organisations are part of a social system and therefore like the environment around them are naturally a subject to change. It seems to be that the most efficient way to bring change into an organisation and behaviour of its people, is by engaging them in the innovation process of improving an organisation’s performance (Hampton et al, 1982). In comparison, accepting people as they are and changing the circumstances around them, instead of changing people’s behaviour or environment may be beneficial way for introducing a change (Wohlking, 1970). For Kanter (1983) the process of change stays very close to the idea of innovation, where it “involves the crystallization of new action possibilities (new policies, new behaviours, new patterns, new methodologies, new products or new market ideas) beased on reconceptualized patterns in the organization. Sensible management of individuals may minimize their resistance to the process of change by gradual transformation of their culture (Hodgetts, 1991). However, a comprehensive understanding of human behaviour is essential to a successful organisational innovation. Organisations, which are successful in implementing a change depend more on an organic approach, rather than planned ‘top down’, ‘bottom up’ or both methods combined (Hoverstadt, 2004).

Organisational Learning
One of the ways to maintain the competitive advantage of organisations is by creating conditions for learning and retaining knowledge. Learning in the organisation is “tied to refining the process by which individuals are socialised into the behaviour patterns required” (Thompson and McHugh, 1990, p255). Most people learn through observation, interaction and questioning of other. An individual’s identity at work is exhibited through choices they make, continually rehearsed and manipulated in order to fit with what is required from them (Thompson and McHugh, 2002). Organisational learning needs to be transformational in a development and should be used to change and improve performance. According to Argyris and Schon (1978) problem solving and learning are the most common and essential human cognitive activities. Organisational learning could be adaptive or
generative and may lead to transformational change. Argyris and Schon suggested that most individuals appear to operate automatically within four rules of organisational context: strive to be in unilateral control, minimize losing and maximize winning, minimize the expression of negative feelings, and be rational. They have also observed that those rules are often enforced through a set of behavioral strategies such as: to advocate own views without an inquiry and remain to be in unilateral control and hopefully win; to unilaterally save own and other people’s face through minimizing possibility of upsetting others or making them defensive (Argyris, 1992).

The new concept of the ‘learning organisation’ is becoming increasingly popular and may be used to nurture innovation (Kanter, 1989; Peters and Waterman, 1982; Senge, 1990). In order to excel the organisations need to capture created knowledge and turn it into outcomes (Prahaland and Hamel, 1990). However there is little evidence of the effects of the organisational learning theory in practice. For example Argyris and Schon (1996) claimed that they are unaware of any organisation that has fully implemented generative learning system or one that engages employee’s hearts and minds in a harmonious way to achieve better results (Redding, 1997). Senge (1990) proposed that learning relying on continual expansion of capabilities or nurturing patterns of thinking and learning may lead towards better performance. The other authors including Beckhard and Pritchard (1992), Nevis et al., (1995) and Pedler et al., (1989) confirmed that some of the common factors such as: clear goals and rules, rewards for following norms, performance evaluation, planning, training and communication strategy may influence learning. Collateral or parallel learning that operates in many organisations to enhance and guide existing processes could be used as an effective alternative method (Bushe and Shani, 1991; Zand, 1974). Parallel structures often help people to break free of the normal constraints imposed by the large bureaucratic organisations (French and Bell, 1999). Further more, parallel learning often results in better decision making, employee satisfaction and organisational effectiveness. It could be assumed that efficient capitalization on a process of learning might be the biggest challenge for future organisations (Farouque, 2003; Gittins, 2002; Hamilton, 2003).

Role of Tacit Knowledge

Intellectual capital and knowledge management have become one of the major sources of organisational competitive advantage in the last ten years. Bassi (1997) claimed that intellectual capital refers to human, structural and customer capital as its major components in the organisational context and is more complex than knowledge management field. The growing interest in the intelectual capital derives from the business desires to tap into knowledge of experts in the various fields of science and technology. Eraut (2000) states that understanding of tacit knowledge must include, at least, understanding of people and situations, routinised actions and the tacit rules that underpin intuitive decision-making. Comparing knowledge management with management of tacit knowledge is still relatively unexplored (Leonard and Sensiper, 1998). Creation of complex products and systems requires a better understanding and management of individuals. Leonard and Sensiper argue that unless there is an incentive created, there is no reason for an individual or group possessing tacit knowledge to give it away. Value added products and processes in the organisations come increasingly from intangible information possessed by knowledge-workers and they are generally attributed to human capital (Stamp, 2000). The matter of
Managing intellectual capital according to Dzinkowski (1999) should be based on the facts that value creation comes from people, ideas are source of competitiveness, and organisational growth has dynamic nature deriving from transfer of skills. McInerney (2002) firmly believes that one of the great mistakes in studying knowledge sharing is that of a body, which is separated from the mind. She recognized intuition, emotion and experience as contributors to the depth of tacit knowledge, while Saint-Onge (1996) saw beliefs and perspectives as enhancing its content. Zack (1999) proposes that organisations need to determine which knowledge should be made explicit and which it should leave tacit. He argues that balance between two types of knowledge should also be managed as it may affect an organisation’s performance.

Organisational Arrangements

Many management and organisational psychologists traditionally apply the same behavioural perspectives to analyse groups and teams (Thompson and McHugh, 2002). However, groups and teams are two different organisational identities in the way they are built and operate, though the differences between them are not always clear (Robbins et al., 2000). While socialisation is stronger with group arrangements, teams tend to seek ways to fully re-engage its members with the benefits in innovation (Thompson and McHugh, 2002). A shift from group to team environment requires training and support or selection process that includes interpersonal and technical skills that could help organisational innovation (Robbins et al., 2000; Von Stamm, 2003). The other factors such as: organisational reward systems, gender and group or team size are also effective to innovation (Tyson, 1998; Von Stamm, 2003). Innovation in work groups is not much different from organisational innovation as mainly individuals create ideas or start up innovations and groups make collective decisions (Gilson and May; 2005; Jelinek and Litterer, 1995; Styhre et al., 2002).

Thompson and McHugh (2002) state that groups in the organisations serve socio-psychological as well as instrumental functions and are often involved in performing production tasks based on their decision making. Individuals who enter organisational life often learn the process and values by being associated to a group. Thompson and McHugh described motivation for belonging to a group as related to personal, social and material rewards available through the association. Shaw et al. (2001) reports on positive effects of team-based rewards on performance and states that they are fast growing practices currently used by about seventy percent of US organisations. By belonging to a group an individual’s personal and social identities are transformed or aligned with the common values. Thompson and McHugh (2002) argue that networks or coalitions are often seen as the extension of individuality with the similar values applied into informal settings within formal structures of the organisation. Thompson and McHugh claimed that, though the domination of the organisation over the individual is strong through the threat of the job security, a power of the individual over the organisation through the self-limitation and constraint is far more effective.

In a certain sense teams have opposite values to what groups represent. Robbins et al. (2000) argues that positive synergy in team environment results in a level of performance that is greater than the sum of individual inputs. He goes further saying that teams can enhance individual’s commitment towards common shared goals and at the same time
could give its members a sense of security, while Martins (1999) insists for commitment and enthusiasm to be a key team ingredient. The feeling of people that they belong as the integral, connected part of a unit is one of the factors that help teams to work successfully (Kanter, 1983). However, Kanter warned about certain issues, which may drive the wedge between individuals and team such as: emotional seductiveness of the hierarchy, related to previous position; knowledge and information gaps between members; personal resources as skills, attractiveness, personal contacts and interests; seniority/activity gap between new members and old; internal politics of team as competition if self serving interests are present; team myth, everyone is equal in a team is not a reality, contributions give ranks; friendships preventing open and honest evaluations. In addition Kanter states that probability for cooperation and reduced politicking among team members is higher when individuals acting there represent only themself. The importance of teams is significant to the reform of contemporary work arrangements (Thompson and McHugh, 2002). The effectiveness of teams in innovation is highly recognised by many organisations, which form special ‘innovative teams’ when contemplating development of a significant new project (Von Stamm, 2003). Von Stamm described teams as a backbone of innovation. Tidd (1997) recognised their significance and value as a body that combines different solutions in solving problems. Despite many positives about teams, Robbins et al. (2000) identified some drawbacks such as: more time and resources required to operate, increased demand for communications, additional management of meetings and conflicts.

Quite often teams in organisations are characterized as self-managed, when in the fact they are only self-administrating. For teams to be self-managed they need to have decision-making power (Thompson and McHugh, 2002). Robbins et al. (2000) believe that performance and member’s satisfaction are shaped by: team functions in terms of communication and coordination between members; resolution of conflicts and problems; generation and implementation of task-relevant decisions. Pearce and Ravlin (1987) indicated that teams often influence productivity, costs and quality of work in the organisation, while Beekun (1989) found that self-managed teams could also contribute to the decrease in absenteeism. It is also possible that reinforcement of team performance may come from individual team members engaged in self-management practices independent of team activities (Uhl-Bien and Graen, 1998). Chan (2003) has found that individual learning could be used as a predictor of team learning, while D’Andrea-O’Brien and Buono (1996) saw a need for teams to develop generative learning patterns based on individual’s skills.
Theories of Motivation
The development of motivation theories originated in the early 1950’s and was driven by the need to explain employee motivation at work. Some of the popular theories are: hierarchy of needs, goal-setting, reinforcement, equity, expectancy, cognitive evaluation, motivation-hygiene and ERG (existence, relatedness, growth) (Robbins et al., 2001). It may not be possible to draw on one theory to explain a person’s motivation, however Hersey and Blanchard (1988) proposed that relationship between motives, goals and activity with goal-directed or goal activity could serve as driving mechanism of human behaviour. Quite opposite Csikszentmihalyi and Csikszentmihalyi, (1992) argue that engagement in activities may be exclusively for the enjoyment that an experience provides.

Need Theories
Most motivation theories confirm that satisfied need is not a drive of human behaviour. One of the ways to motivate employees in an organisation is to understand their needs (Pfeffer, 1982). However, work behaviours are often the results of direct work characteristics, environment, fulfilment of needs and consequential attitudes influencing it. Another need theory presented by McClelland (1961) is build on three basic elements of: i) need for achievement driven by the personal ambition to succeed by excelling to a set of certain standards or beyond, ii) need for power influenced by a desire to have an impact, to be influential or to control others, and iii) need for affiliation coming from a desire to be liked and accepted by others. Maslow’s (1954) theory recognises hierarchy of human needs, which as they are satisfied, they change each person’s dominant need to a higher level. According to the Maslow’s theory individuals may pursue self-actualisation only after their all other needs have been met (Northcraft and Neale, 1990), but sometimes those higher order needs are more important as people mature (Hersey and Blanchard, 1988).

Expectancy Theory
This is probably the most known motivational theory. It originated from the work of Vroom (1964), who built it on two components determining individual’s behaviour: i) expectation of behaviour leading to various outcomes, ii) evaluation of the attractiveness of those outcomes. Vroom theory suggests that an individual may consider the outcome related to various levels of performance and select to pursue one that will represent the greatest reward. Hersey and Blanchard (1988) saw motivation as effective if a person perceives a positive relationship between effort and performance and argue further that motivated behaviour is increased if there is a positive relation between good performance and rewards for outcomes. Peters (1977) noticed that there are links between expectancy and other cognitive theories of motivation leading to elements of observed behavioural responses, where an individual’s belief system could make the strongest connection.
Motivation-hygiene Theory
This theory has been established by examining a relationship between job satisfaction and productivity. Herzberg (1987) claims that people have motivating and hygiene categories of needs, which are independent of each other. He found that good feelings about a job were related to a job itself, while dissatisfaction from people’s jobs was related to work environment. Achievement and recognition were the highest positive ranking factors affecting job attitudes with an organisation’s policy, but administration and supervision could affect it the most in the negative sense. Hampton et al. (1982) claims that good feelings at work are important and can lead to improved job performance while dissatisfaction may result in lower effort and outcomes.

Exchange Theory
It is possible that the division of labour brought also into societies an increased uncertainty and risk. “We are rich, not as individuals, but as members of a rich society and our easy assumption of material sufficiency is actually only as reliable as the bonds that forge us into a social whole” (Heilbroner, 1975, p9). According to Heilbroner, the success of many undertakings depends on the ability of social institutions to mobilise human energy for productive purposes. He goes further claiming that the efficiency of any system depends solely on the distribution system to provide rewards, which may mobilise people to perform the necessary tasks. Adam Smith (1904), the famous economist noted that humans have a natural propensity to truck, barter and exchange one thing for another. He argued that the act of exchange is central to human economic life. Historic analyses of civilisations make no doubt that humans are born to trade (Douglas, 2004) and that exchange is at the heart of modern free market society (Heilbroner, 1975). Modern social exchange theories borrowed some principles from economics and in particular from the marketplace, where actions are characterised by ‘giving and reciprocating’ with costs and benefits high on the agenda (Uehara, 1990). In addition Uehara states that despite some norms and rules that guide social life, individual’s choice and decision-making process are prime in social exchanges. In the opinion of Molm et al. (1999) all forms of exchange share a common sets of concepts about such things as: actors, resources, structures and process. Molm (2003) categorised exchange behaviour by how actors use power and the type of risk and uncertainty they take. In addition she distinguished two types of exchange reciprocal and negotiated. Exchange theory at work is very visible in the context of the relationship between leaders and subordinates (Northouse, 2004). Northouse argues that effective leaders recognise psychology of groups as a valuable tool and reward members with more opportunities and freedom for their extra effort in advancing group goals. Northouse warned about some dangers in using exchange theories, as it is difficult to measure the effects of people work, when age, gender and abilities are interlinked within a culturally diversified workforce. Shrum et al. (1985) states that various forms of exchange can also be observed at organisational macro level, where firms may prefer an exchange of tangible resources for targeted contributions rather than the exchange of productivity for recognition. However, Coleman (1966) reminds that during exchanges, individuals and social groups always strive to maximize their gains. He saw that exchange often takes place when partial control of something that has little interest can be traded for something of more interest with the greater control over it. Molm (2003) claims that social exchanges unlike economic ones depend often on bonds between individuals or groups of people. Knowledge has been recently recognised as the competitive advantage and valuable resource, which can be
exchanged during innovation (Janssen, 2000; Nahapiet and Ghoshal, 1998). Nahapiet and Ghoshal go even further saying that it is often like a knowledge market where knowledge sellers calculate whether it is worth sharing their knowledge with knowledge buyers who also think what they can offer in exchange. Rupp and Cropanzano (2002) claim that those employees who are fairly treated during exchanges tend to perform better. Bonacich (1995) argues that regardless of the way in which exchanges take place, they are subject to four types of dilemmas: i) prisoners dilemmas when people without power agree to a course of actions imposed by their exploiters, ii) assurance games in unstable exchange networks by forming a pair with someone who offers stability, iii) chicken games when people in relatively equal positions bargain cooperatively or aggressively; and iv) coordination games with ad hoc selection of partners and naturally emerging patterns that help to clarify exchange.

**Individual’s Attributes to Innovation**

Individuals may be seen as passive recipients or objects of the structural process in the organisation, but in the reality they are constructively engaged in securing their own identity in the workplace. Though individual’s identity is developed through the process of learning, perception and socialisation, certain types of behaviour may go with particular positions or roles in the organisation (Luft, 1984). Individuals in a complex and changing social environment require a great deal of flexibility and adaptability to operate. The most efficient way of gaining work identity is through the interaction and association with others by means of the social and cultural groupings (Thompson and McHugh, 2002). The nature of an individual can also be explained by the way that an individual interacts with the group. It can be generalised that an organisation or group characteristic originates from the attributes of an individual (Tyson, 1998). Tyson recognised individual’s age, gender, racial background, temperament, maturity, cognitive style, attitudes, self-concept, sociability and emotional stability as the most influential personal traits that could radiate to other systems in the society.

**Personality**

Accumulated habit patterns or conditioned responses to various stimuli under similar circumstance can be described as personality (Hersey and Blanchard, 1988). The interest in personality is driven by need to predict the behaviour of individual (Robbins et al., 2001). It is often assumed that behaviour is inherent in the individuals personality (Thompson and McHugh, 2002), however Hodgetts (1991) claimed that genetics, environment, situations, social and cultural factors shape the personality of an individual in the most effective way, with the socialisation bringing the longest lasting values. From a practical viewpoint, personality can be seen as a reaction and interaction with others (Robbins et al., 2001). Another view presented by Digman (1990) and Raymark et al. (1997) states that only five dimensions such as: i) sociability (comfort level with relationships), ii) agreeableness (propensity to differ from others), iii) conscientiousness (a measure of reliability), iv) emotional stability (ability to withstand stress), v) intellect (innovative approach and fascination with novelty), underlay significant variations in human personality. Robbins et al. (2001) view is that while there are about one thousand known different personality traits only three of them have a significant application in the work environment: i) risk taking involved in decision making, ii) Machiavellianism (pragmatic, emotionally distant approach with belief that ends can justify means), and iii) Type A/B (A type - aggressively
involved with achieving more and more with less and less time; B type - never suffers form
time urgency and can relax without guilt). Some of the practical applications from
personality analysis may include matching a person to a job or increasingly in recent years
matching people to an organisation (Robbins et al., 2001).

Attitudes
It could be assumed that attitudes are a reflection of predispositions that a person may
possess. Hersey and Blanchard, 1988 compared that attitudes are often consistent with a
person’s behaviour, but others saw closer relationship between attitudes and job
performance (Hodgetts, 1991). In addition, Hodgetts stated that attitudes are not permanent,
can be positive or negative and generally they reflect on person’s predisposition towards
other people, objects, events or activities. He argues that in reality a person’s attitudes often
reflect the combination of affective (emotional response triggered by the object of attitude),
cognitive (beliefs about the object or event) or conative (behavioural disposition exhibited
towards the object of attitude) factors. Thompson and McHugh (2002) conclude that
attitudes often embody psychological functions of an individual such as: adjustment, ego
defence, value expression and knowledge, with a tendency to be more sensitive to public
commitments than to private ones.

Communication
Communication is the process of transmitting meanings from sender to receiver. Development of innovation requires special attention to communications and participation
(Kanter, 1983), specific decisions for coordination (Zaltman et al., 1973), breaking of
boundaries (Tushman, 1977) or diffusion of innovation (Rogers, 2003). Interpersonal
channels of open communication have special importance to everybody during innovation
(Ebadi and Utterback, 1984; Ebadi and Dilts, 1986; Johnson et al., 1995), while other
authors dedicate this function to selected gatekeepers (Tushman and Katz, 1980). Formal
communications in an organisation are affected by the formal structure but they take more
informal patterns they could be associated with groups, responsibilities, power or status
(Tyson, 1998). The issue of communication in developing new products has a special
meaning to organisations, which try to develop loyalty from its knowledge workers (Smith
and Rupp, 2002). Smith and Rupp argue that organisations striving for excellence need to
develop the environment of conviction and passion with the quality of oral communication,
not quick email or voice-mail encounters. Kivimaki et al. (2000) claims that while intra-
organisational communications such as encouragement of initiatives and critical evaluation
of performance can effectively improve innovation performance, the high levels of
interactions with clients are more beneficial for generation of intellectual property. Various
other authors claim that oral communication skills are the backbone of organisational life
(Hersey and Blanchard, 1988; Putti, 1987), with Mintzberg (1973).

Personal Outlook on Creativity
Differences between individual and situational factors are two main determinants often
quoted as influencing creativity of individuals. The other often-quoted saying is that
necessity is the mother of invention (Simpson, 1999). Creative individuals are those people
who are capable of viewing the situation from multiple perspectives (Csikszentmihalyi,
1997a). Therefore creative individuals are important to organisational innovation,
especially if they can use lateral and analytical thinking (de Bono, 1995; 2000). The need
for creative expressions is mainly embedded in the habits of individuals, than in the domain
of the organisation, thus neither desiring nor requiring disruptive change (Ford, 1996).
However, most organisations engaged in innovation depend on their own employee’s
creative abilities. Two types of such individuals can be found in some well performing
organisations. They are innovators and entrepreneurs. Though both types are creative, they
can be distinguished by different skills and abilities. While entrepreneurs display their
originality with the abstract and non-physical elements of structure in the relation to ideas
and opportunities, innovators are more creative with tangible form such as product or
process. Regardless whether for innovator or entrepreneurs the nature of the organisational
environment may have the strongest influence in a development and shaping of creativity
(Yamin and O’Connor, 2002). Possibilities to increase an individual’s creativity could be
enhanced by altering work environment in the way that gives more sense of control over
one’s own work, creates challenges, provides sufficient resources and supervisory
encouragement, forms group supports with open communications and encourages
organisational culture supporting and rewarding creative work (Amabile, 1996; Amabile
and Conti, 1996). Csikszentmihalyi (1996) claimed that most of creative people often share
common opposing qualities integrated with each other in a form of subtle tension. Those
opposing personal qualities can be characterized by: i) great deal of physical energy, but
also often being quiet, withdrawn and at rest; being smart yet naive at the same time,
ii) combination of playfulness and discipline, or responsibility and irresponsibility,
iii) alternating between imagination and fantasy, and a rooted sense of reality, iv) being
both extroverted and introverted, v) being humble and proud at the same time,
vi) escaping rigid gender role stereotypes, vii) by being both rebellious and conservative,
viii) by be extremely objective and passionate about their work, ix) openness and sensitivity
often exposing them to suffering and pain, yet also to a great deal of enjoyment.

Most of the literature about creativity deals with behavior patterns, recognizing superior
attributes of the individual as the creator. Ford (1996) draws on perspectives of psychology
and sociology to present a theory of individual’s creative actions in the multiple social
domains. He argues that human ability determines creative outcomes. Individuals may
display creative behaviors if they possess some of the personal attributes such as: i) sense
making of the searched information that is followed by action, ii) motivation to pursue
desired goals, iii) goal recognition serving to desire outcomes that provide focus, attention
and action, iv) receptivity beliefs allowing for behavior based on the future positive
consequences v) capability beliefs based on expectations regarding abilities to successfully
undertake specific action, vi) emotions supplying the energy for motivated behavior, vii)
domain-related knowledge available prior to creative activity, viii) behavioral abilities
needed for good communications and performance, ix) creative thinking abilities allowing
for divergent thinking about open-ended problems. Studies of creativity confirm that
predominantly personal factors reflect on the multiple dimensions of creativity (Ford,
1996). Isaksen (1988) formulated a view that creative behaviour results from integration of
skills, motivation and abilities. Creative outcomes are preconditioned to individual’s
creativity. Similarly to Isaksen, Amabile (1988) recognised: i) domain-relevant skills as the
base for proceeding any performance, ii) creativity relevant skills utilizing cognitive
abilities and iii) task motivation representing motivational variables determining
individual’s approach to given task. Though, those three knowledge dependent components
function at different levels of individual behaviour, it is possible to be creative and operate
only within one of the domains (Amabile, 1988). Furthermore, each of the components can be influenced by organisational environment (Amabile, et al, 1996).

**Decision Making**

“Decisions are responses to problems – differences between what is and what could or should be” (Northcraft and Neale, 1990, p179). Putti (1987) identified three types of conditions, which determine decision-making: certainty, risk and uncertainty. His analysis revealed types of decision such as: routine, non-routine, personal, organisational, strategic, operating or administrative. Putti concluded that common steps such as: identification and definition of the problem, analysis of the problem, development of alternative solutions, evaluation of alternative solutions, selection of the best solutions, implementation of the solution, and review of the effectiveness of solution could be followed for all types in the decision-making process. Analysis of R&D environment conducted by Abernathy and Yost (1967) revealed the existence of need uncertainty and technical uncertainty, which both may have equal implications for management of innovation. Although group decisions may be more costly to administer, their popularity is driven by the anticipation that people are more willing to accept and implement those decisions in which they participate (Hampton et al., 1982).

**Incentives at Work**

Some authors claim that importance of self-esteem has shifted in recent years from being a psychological need to the economic determinant driven by higher requirements of an individual’s knowledge and skills. Hesselbein et al. (1997) saw new developments in the organisation as demand for greater capability to innovate, self-management and personal responsibility. He argues that demands and pressure on an individual to deliver results grows proportionally to greater desire for the recognition. The role of rewards is to build commitment to an organisation and to motivate employees to work hard to achieve their tasks (Hage, 1980). Incentives should be a common mean in the modern organisation to improve performance and therefore profitability, but types of incentives, which should be used in an organisation to have a desired effects are of major concerns (Pfeffer, 1982). Recently some of the rewards aim to encourage knowledge sharing in the organisation, however this can be culturally sensitive (Pettigrew and Fenton, 2000). In order to improve productivity an organisation must accommodate additional employee’s involvement practices with compensating contributions (Therrien, 2003). It is possible that employee perception about the fairness of effort-reward in an organisation may encourage innovative behaviour (Janssen, 2000). However, very often recognition for the innovative efforts are best received when they come from peers (Thomas, 2000). Development of long-term strategies supported by a compensation system should be based on innovation and performance rather than on longevity and compliance (Rosenberg, 1992). Examples of Japanese approaches to compensation practices that allow sharing organisational gains and provide employment assurance can be pointed as the best practices to foster innovation (Quinn and Rivoli, 1991). In contrast to all these opinions there are some indicators that most R&D professionals value R&D work that leads to innovation more than any other rewards (Kochanski, 2003). However this is not uniform in the ethnically diverse R&D organisations, especially among foreign-born employees who preferred extrinsic rewards to any other form of recognition (Chen et al., 1999). There is growing concern in many countries, including Japan that the conventional approach to manufacturing alone may not
to provide continuous innovation and growth. Existing small financial rewards could not be enough to compensate innovators who contributed to the substantial organisational growth in the past and some radical changes might be needed to retain gifted employees to be loyal (Josephberg et al., 2003).
Appendix F

Organisational Innovation Issues

Organisational Aspects of Creativity

“Organizational creativity is defined as the creation of valuable, useful new product, service idea, or process by individuals working together in a complex social system.” (Woodman et al., 1993). Development of successful new products is often attributed to creative individuals (Amabile and Conti, 1999). Success may lay in the exploration of an individual’s creative behavior and organisational innovation (West and Farr, 1990). Woodman et al. (1993) claims that organisational creativity is complex, evolving and integrated as it includes: the creative process, the creative product, the creative person and the creative situation. However, creative actions have a chance to occur, when creativity is more attractive to individuals than routine tasks (Ford, 1996).

The attributes of creative organisation are not commonly known, nor have they been widely publicized. Japanese experience shows that many new products come to the market due to creative capability of organisations, such as Canon, Honda or Sanyo. Those organisations exploit creations by experimenting with combinations of theories concerning products, products themselves, and with the methods of production when implementing them (Kono, 1988). Promoting free exchange of information, diversity of opinions, challenging or questioning assumptions may also encourage creativity in the organisation (Blayden and Miller, 2003; Nonaka, 1991). Contrary to that Stacey (1996) argues about diversity of disciplines, types of personnel or diversity in thinking that can contribute to the variety of different new ideas being created. New evidence points out to the conclusion that creativity is also influence by emotions (Ford, 1996; Simonton, 1997). Amabile (1998) claims that centralise decision making and holding on to rules and regulations reduce intrinsic motivation and effects creativity as well as the flow of information and well-being of individuals in the organisation. Environment of trust and mutual support creates conductive environment for divergent thinking required for creations to eventuate (Isaksen, 1988; Stacey, 1996). Most of managers in organisations believe that creativity belongs to R&D and marketing department (Amabile, 1998). The capture of individual’s creative habits presents a test to the organisation desiring creative capability (Ford, 1996). Organisations are the only mean for many individuals to materialize their creative actions, but they do not recognize potential of presented opportunity. For example, many inventions from around the world used to get manufactured in USA, due to more conductive entrepreneurial business climate. Among known organisational factors influencing creativity Ford recognized effects of groups/subunits, organisational culture and markets as critical, with diversity playing a positive role in all of them. In addition organisation’s absorptive capability and aspiration levels are important factors determining utilization of new information to productive outcomes (Ford, 1996). Csikszentmihalyi (1997a) confirmed some of those attributes recognizing creativity as the social phenomenon integrated within
three subsystems of: person, the field of people involved and the common domain of rules, language and customary practices. It may be argued that culture of the organisation plays significant role in the creativity and innovation. Other authors proposed that knowledge or innovative culture might help to create new ideas but not necessarily innovations. Additional principles such as sharing, responsiveness or desire are necessary to take new ideas and turn them into innovations (Thomas, 2000; Wilson, 2002). Creativity in an organisation is the most competitive weapon as it can produce new ideas (Amabile, 1998).

In the case of scientists working within R&D environment stimulants and obstacles constitute two-third of all variables present in an organisation as the major contributors to creativity that derives from personal qualities such as talents, experience, personal traits and work environment factors (Amabile, 1988; Gryskiewicz, 2000). Amabile and Gryskiewicz categorised obstacles and stimuli which had equal frequency of appearance into three groups: i) organisational climate and culture (attitudes towards risk-taking and innovation, organisational structure, evaluation systems, communication channels, rewards procedures), ii) management style (project and organisational type), and iii) resources (materials, money, people, time). Among factors hindering creativity few are worth mentioning, especially: constant evaluation pressure, constraints in choosing methods for carrying out tasks and a narrow corporate approach to achieving organisational goals. Organisations can benefit from its employees creativity by introducing them to challenging work, minimizing fear of failure, rewarding for taking risk and delivering solutions, by setting up communications encouraging creation and exchange of ideas (Amabile, 1998; Nelson, 2000). Good systems of innovation require diversity. Negroponte (2003) argued that stronger cultures (national or organisational) are less likely to harbour creative thinking. Furthermore, creativity is required to exploit a change. Vision, foresight and ‘the most magical’ – networking or communication are three out of six, principle elements that 3M company identifies to foster creativity and innovation (Thomas, 2000). “If innovation is creating value by exploiting change, then we need to know what changes are coming and when they will arrive” (Thomas, 2000, p12). The ability to foresee unarticulated needs requires a great deal of creativity and is like being able to invent the future (Thomas, 2000).

Open and trusted communications in all directions based on interaction is necessary to increase the opportunity for spread of ideas and knowledge within the organisation. For example, an organisational culture that encourages organisational members to think creatively with the knowledge they have is a key element in the innovation. Furthermore an innovative culture is facilitated by practices that reward or formally recognize staff that contributes ideas (Thomas, 2000).

Creativity potential is virtually untapped but unreachable with most of organisations practicing planed and control style of management. The secret lies in the organisational ability to reach into unanticipated creative acts of its employees (Stern, 1998). Schepers et al. (1999) argued that people who have the idea are often not the ones who can turn it into a successful business. He presented a case study of Simens organisation, which learned from its 1996 Idea Competition that building a communication bridge over the innovation gap between idea creation and implementation was the most important outcome. During the competition the organisation was able to collect 245 idea submissions and through the selection process identify 6 award-winning projects. The Siemens Case Study is presented in detail in Appendix H.

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The ability to identify new connections between seemingly unrelated objects or events requires creativity. EIRMA (1992) proposed some factors, which may unify innovation process in the organisation such as: i) culture of the organisation, ii) human resources (mixing people’s tasks and reward systems), iii) commitment for long term research, iv) support from top management, v) participative management (contacts with the market), vi) competition or cooperation with other organisations, vii) protection from stop-and-go (clear objectives), and viii) effective communications. Braking old hierarchical structures in the organisation encourages networking among employees and therefore creates a greater flow of ideas. The law of complexity supports the claim that providing more opportunities for random encounters enhances the creative process (Lewin and Regine, 2003).

Management in organization can influence workplace practices and conditions for every individual’s creative abilities by tapping their expertise, creative-thinking skills and motivation (Amabile, 1998). Organisational creativity could be a function of group creativity with contextual influences from individuals (Woodman et al., 1993).

Managing Innovation

Management of innovation and change in the organisation is one of the most difficult and vital tasks for present-day businesses (Tushman and Nadler, 1986). Some of the difficulties may lie in the ability to acquire information about technology, competitors or market while maintaining use of gained knowledge. Tushman and Nadler claim that process of generating and processing information is costly, chaotic and can be disruptive, but individual, organizational, informal arrangements or combination of all of them provide an approach to manage them effectively. In addition, recognition for taking a lead in an organization combined with a degree of risk, and presence of a system for rewarding achievers could result in building an innovative culture capable of handling innovation and change (Tidd, 2001). It could be suggested that uncertainty and complexity have the greatest influence on managing innovation and require different attention in the organization. Tidd claims that uncertainty is the function of the rate of technology and product-market changes, while complexity is the function of organizational and technological interdependencies. These scenarios could be defined as: differentiated (low uncertainty, low complexity) requiring marketing competency product support with multidivisional structures, present for example in fast moving consumer products; innovative (high uncertainty, low complexity) relying on scientific or technological competencies supported by functional structure, for example pharmaceutics; networked (low uncertainty, high complexity) requiring high management skills and competencies supported by professional structure, for example like in construction industry; complex (high uncertainty, high complexity) requiring high flexibility, adaptation and ability to learn, for example industry. Another view is that innovation is fundamental to the strategic management of organisation (Brown, 1991), but many barriers such as pressure for quick volume sales, big reliance on market research, failure to recognize technological opportunities, systems of rewards which do not promote entrepreneurial risk taking, and organisational structures often prevent it from happening. In comparison Sundbo (2001) presents innovation as a partly rational, but likely unpredictable phenomenon that requires special strategy to manage it. Sundbo argues that innovation management strategy does not have to be strictly rational and should rely on loosely coupled networks. In Sundbo’s opinion one of the most important requirements for managers is the ability to read the
environment in order to foresee the future. To accommodate innovation successfully in the organisation the phenomenon needs to be seen as challenge to exploit a change by all employees, not as the other function of management (Harte, 1997).

In order to thrive in the growing knowledge economy organisations need to learn how to manage its intangible assets (Leonard-Barton, 2003). Globalisation of trade and emergence of multicultural work groups requires from management a radical change in management style to accommodate different behaviors and cultural preferences of individuals (Appelbaum et al., 1998). One of the most difficult things for managers to accomplish is to know when they should ‘let it go’ to an old versions of themselves and establish practices, but this is a form of the difficult balancing act and certain type of art (Nadig, 1999). Moreover the change process requires a multiple approach to take place within a person’s attitudes and mindset to be ready for innovation (Quinn, 1985). Some of the determinants of change may not be always clearly visible. Entrepreneurial individuals who can foresee opportunities should be therefore rewarded to satisfy their economic, psychological or career needs for innovation to eventuate (Nadig, 1999).

**Organising for Work and Innovation**

Organisations that can be self-critical and are prepared to learn from today’s experience with the aim to improve tomorrow’s work have a chance to be successful in the future (Tushman and Nader, 1986). Though this may be a simple formula for innovation, Christensen (1997) noticed that many organisations face the dilemma, whether to concentrate on current work and make profit today or to think about the future and to innovate. Tushman and Nader believe that management has two important tasks to perform: one is to have strategy about organisation and second is about organising for work, which transforms strategy into outputs. Tushman and Nader saw building congruency in the organisation as important transformational process to prevent a danger of creating the sense of internal stability that might resist changes, innovation and other organisational activities. In many instances to deliver what is required from organisations they need to be dynamically integrated and flexible. Kanter (2001) suggests that they should have a theme, which allows them to improvise but prevents from going into chaos. Another view on that subject is presented by Brown and Eisenhardt (1997) who described organisations as semi-structures, which have minimal structures and coordination devices in place that help to focus activities of people around a set of common goals and deadlines, but without limiting their discretion on how to achieve these goals. Successful organisations require a degree of improvisation like in jazz to quest for discovery and exploration along social, economic and technical dimensions of innovation (Kamoche and Cunha, 2001). Work pressures often demand that employees have a few tasks to perform simultaneously. Von Stamm (2003) admits that some people are capable of handling a few projects, but allways with compromise in efficiency. It may be nothing mysterious about innovation, but they just don’t happen and may require first of all strategic management and visionary leadership (Tushman and Nader, 1986).
Appendix G

Management Issues Related to Innovation

Management Practices
Management practices are commonly related to a decision-making process in an organisation. Volkema and Gorman (1998) claim that in recent years a cognitive style, also known as problem-solving style, has gained an increased attention with continual emphasis on group and team activities. According to Volkema and Gorman, cross-functional teams, autonomous work groups or quality circles are praised for their abilities in cognitive decision-making. Additionally, Vroom and Jargo (1988) stressed that decision acceptance, its quality and time may be influenced by the composition of groups. In contrast Thompson and McHugh (2002), argued that most decisions in the organisation are defined by common managerial functions such as: acting as figurehead and leader of an organisational unit; liaison by the formation and maintenance of contacts; monitoring, filtering and disseminating information; allocating resources; handling disturbances and maintaining work flows; negotiating; innovating; planning; controlling and directing subordinates. Conversely Mintzberg (1973) presented managerial functions characterised only by three basic roles: interpersonal, informational and decisional.

The difficulty in the decision-making process lies mainly in the technical and need uncertainty of organisation and employees (Abernathy and Yost, 1967). Other authors emphasised culture, risk, fear of unknown or choice as factors determining decisions (Branscomb, 2001; Economist, 1999; Tudge, 2003). The problem with evaluation and selection, especially in the case of technology often results from the number of available alternatives and criteria’s used for selection. Torkkeli and Tuominen (2001) presented four variables such as: procedures, project management, participation and point of entry, to be used in the process of selection and stressed at the same time the importance of engaging all people concerned in the process. Thompson and McHugh (2002) observed replication and interchangeability between many descriptions of managerial roles within current literature. On the other hand, Mintzberg (1973) noticed that work of an efficient manager is reactive, fragmented and concerned with fixing problems, quite often relaying on informal structures, gossip and speculation.

Hales (1986) believes that managerial task is to control the organisation in the labour process with effectiveness of own work and that of subordinates. However, current managerial practices are not always affected by sweeping democratic changes about communications in a work place, with some managers still preferring command to motivation (Putti, 1987). In addition Putti claims that those in charge of the organisation and labour have a number of measures to express their power such as: i) reward, which can include means such as money, promotions, social recognition to pay for achieving target outcomes, ii) coercive capability to enforce discipline through presence of fear for
psychological or material punishment, such as humiliation in front of peer group, loss of overtime or bonus, iii) referent identification of staff with attractive personal characteristics of manager and his charm, iv) acceptance of subordinates by legitimate authoritarian power of manager in order to influence them, and v) expert power expressed through the knowledge or other expertise, which others feel obliged to accept. Expert power especially may have the positive and informal influence on an organisational performance, as it doesn’t present a direct threat to established organisational power structures (Thompson and McHugh, 2002).

Managing Knowledge in Organisation

“Knowledge is the awareness of what one knows through study, reasoning, experience or association, or through various other types of learning” (McInerney, 2002, p1009). Polanyi (1983) argues that people often know much more than they can say or express. Knowledge Management in the organisation refers to the process of creation, collection and application of knowledge for performance improvement (Bassi, 1997). Bassi highlights a problematic issue of organisational knowledge management as it resides in the human mind and cannot be easily altered or manipulated. At present, knowledge despite being intangible in nature is recognized by many organisations as their most valuable asset (Botha, 2000; Covin and Stivers, 1997). The outcomes of intangible input can comprise into products, processes or newly created knowledge. McInerney, (2002) claims that one of the ways to capitalize on knowledge is by sharing it with others, but warns that implementation may require good communications, trust and right culture in an organisation.

Term Knowledge Management emerged in the business world around 1995. Its life was short, important, but often undervalued (Tuomi, 2002). The early emphasis in studies of knowledge management was on information systems, organizational development, intellectual capital management, competence management and towards the end of the 1990’s, on social learning, organizational sense making, and systemic innovation and change management. Tuomi argues that in the knowledge management theories goals of lifelong learning and educational systems in a world are not addressed and relations of workers, knowledge workers and employers remained vague.

Research on organizational cognition emerged from the information processing view and cognitive theories of human mind developed by Knight and McDaniel (1979) and Tushman and Nadler (1978). Early studies were focused on top management decision-making process (Ungson et al., 1981). In comparison Daft and Weick (1984) and Weick (1995) highlighted the fact that organizational knowledge is not something that can be objectively recorded and stored in databases. They argued that organizational knowledge is an active process where people try to make sense of their environment. The most active process of knowledge creation became visible in organizational innovation studies, where outcomes could not be easily predicted (Leonard and Sensiper, 1998). Innovation may appear as chaos or as something that many managers do not understood and want to avoid at all costs. A key contribution to organizational innovation research came from the Japanese experience. Nonaka (1991; 1994) and Nonaka and Takeuchi (1995) reminded that human knowledge couldn’t be treated like the mainstream mechanized information processing in the organization. Nonaka’s innovation studies were complemented by research on organizational learning where he recognized a unique role of
tacit and situational knowledge in learning and knowledge generation. There may not be many clear distinctions between codified and tacit knowledge (Nonaka and Takeuchi, 1995), but Stevens (1998) described codified knowledge as one, which can be reduced to information about ‘know-what’, and tacit knowledge about ‘know-how’ that includes skills such as insight, creativity and judgment. For Polanyi (1962) scientists are in the position to gain deep subconscious learning by a process of explicating the tacit intuitive understanding of matters. Polanyi’s notion of tacit knowledge reaches beyond conscious knowledge and into the sub and preconscious modes of knowing. Following Polanyi’s theory, many researchers like Nelson & Winter (1982), Nonaka and Takeuchi (1995) or Plotkin (1994) argued that organizations and societies evolve by adapting the body of knowledge shared by their members and that process takes place at the tacit level. While the individual knows the explicit knowledge, the tacit knowledge resides in his ‘genetic level’, which lies beyond the individual's conscious decision-making. The interaction of the explicit and tacit modes of knowledge is central to Nonaka and Takeuchi's (1995) theory of organizational knowledge creation that can happen through social interactions of ‘knowledge conversion’. Nonaka and Takeuchi defined tacit knowledge to be personal, embedded in individual experience, context-specific, and involving intangible factors, such as personal beliefs, perspectives, and values and one that is hard to formalize or pass it on. Explicit knowledge, on the other hand, refers to knowledge that is transmittable in a formal, systematic language. Nonaka and Takeuchi (1995) claimed that knowledge could be created inside an organisation through four modes of: socialization, externalisation, combination, and internalization. Transformation can happen between tacit knowledge into tacit knowledge through socialization; tacit knowledge into explicit knowledge through externalization; explicit knowledge into explicit knowledge through a combination; and explicit knowledge can transform into tacit knowledge through internalisation. Additionally Nonaka and Takeuchi claim that an individual can acquire tacit knowledge from others without using formal communications such as language. This can happen through observation, imitation or practice. Simon (1991) supports Nonaka and Takeuchi recognition of individual as a supreme knowledge creator, but dismisses the notion that an organisation as a whole has also capability to create and disseminate knowledge. On the other hand McInerney (2002) states that interchange between explicit and tacit knowledge creates like a spiral effect with the created energy driving the knowledge to innovation. Drucker’s (1998) view of knowledge is more practical as he regards the concept as one, which proves itself in action and results.

While OECD (1996) refers to the production, distribution and use of knowledge as main concern, other authors emphasized on an exchange of knowledge (Howitt, 1998). The efficiency of knowledge management makes sense when includes continuous organizational change developed in parallel with management practices, measurement systems, incentive, tools, and content management (Tuomi, 1999). Tuomi argues that future knowledge management should have stronger links between knowing and action. That link may allow for more flexible and effective thinking in an organisation and in return could produce more knowledge-based artifacts, providing that creations would be supported by a social setting of open communities and innovative cultures (Ursin, 2000). Knowledge has also certain inherited social and cultural values that distinguish it from all other media of exchange. It can be transferred easily between individuals or organisations, but unlike currency once transferred it is available and can be shared by all (Carayannis and
Alexander, 1999). In addition Scarbrough and Swan (2000) argue that other types of social networks such as communities of practice are better equipped to share knowledge and experience in the process of innovation. The role of organisational reward system are effective to encourage knowledge sharing at individual or group level, particularly when stock options or profit sharing are included (Bartol and Srivastava, 2002).

One of the greatest future challenges in the field of knowledge management research is probably to find predictable ways of managing knowledge and to resolve unpredictable nature of innovation (Tuomi, 2002). There is an opinion among researchers that knowledge can be embodied as the capital in the technological progress and carried for example as spillover infrastructure (Kumaresan and Miyazaki, 2002). Blankenburg (2000) points out that the same organisational, technological or economic forces drive technological progress, with human choice being important, but not a well-recognized factor. She adds further that it may be truth what corporate liberals claim about laws of the trade being stronger than the laws of men, but in the knowledge-based economy the fact can be that the laws of knowledge may be stronger than the laws of man. Fox (2004) reports about De Bono who reinforces this statement arguing that while the laws of science and technology can eventually be worked out, it is always difficult and unpredictable with humans.

**Evolutionary Management System**

The unprecedented success of Japanese industry and its status as one of the most innovative countries is mainly due to the national culture and use of an evolutionary management system. The main objective of evolutionary management systems is the integration of techno-economic and cultural aspects of work relations (Urabe, 1988). Urabe claims that effective management systems must be adaptive to allow for the transition of environmental changes to evolve. Cultural aspects are one of the most important factors for management of an organisation in selecting appropriate choice of strategy. Urabe saw management as an integrated joint participation of management/labour relations, which rely on bargaining, cooperation, mutual trust, respect and open communications. The success of Japanese industry is mainly due to the efficient implementation of incremental innovations with the use of its traditional social model, where sense of belonging is strongly integrated (Colombo, 1997). It is probably an incremental innovation in Japanese experience, not a radical one that has got greater potential of success due to relatively low degree of risk during implementation. “The more radical the product innovation, the greater the uncertainties” (Urabe, 1988, p19). Finally, Urabe argues that entrepreneurship is required during implementation of innovation, regardless whether incremental or radical, to cope with the variety of difficulties during an entire process. Contrary to many advantages, Japanese systems relying on the stable wage are incompatible with an appropriate levels of risk taking and rewards, which are necessary to induce entrepreneurship. Colombo (1997) saw that the over disciplined education system like in Japan often stifles initiative and individual creativity and may effect greater national performance.
Theories Applicable to Management

Path-Goal Theory
The major aim of this theory is to find out ways to accomplish organisational goals. The selection of an appropriate path is not only related to knowing the right methods, but also involves the ways of motivating people in the organisation to undertake desired tasks. Northouse (2004) argues that this theory is about enhancing people’s performance and their satisfaction at work by involving them through motivation. In addition he claims that the path-goal theory derived from expectancy theory principles, which are based on the assumptions that employee’s effort to work will result in certain outcomes, providing that the payoff for doing so is worth it. According to Northouse the basic principles for the success in using path-goal theory rest in identifying goals, clarifying path, removing obstacles, and providing support. Major components of path-goal theory are related to leader behaviour, subordinate characteristics and task characteristics that could produce combination of complex relationships. The successful application of this theory, rest in a clear and structured presentation of tasks, giving the opportunity for those involved in work to display a degree of their own initiative and innovation. As a number of components for this theory relate to human behaviour, that issue is addressed separately in the literature review about organisational behaviour.

Contingency Theory
Two important considerations need to be taken when managing the organisation: ability of managers to match appropriate situations (Northouse, 2004) and ability of the organisation to adapt to environment (Morgan, 1997). Contingency theory is one of the most commonly used theories to address organisational concerns of management styles and situations. Organisational well being depends on its adopting abilities to changing technology, social values or market conditions. Open and flexible approach of management in organisations is required to continue operations, when change becomes the norm of the day (Morgan, 1997). From a management viewpoint contingency requires different approaches in style for different situations. Northouse (2004) distinguished three styles of approach and characterised them as: i) leader-member relations with group atmosphere reflected by confidence, loyalty and the attraction to the leader, ii) task structure where clear, well explained tasks give leader more control or vague described once reduce his influence, and iii) position power when authority is proportional to a position in the organisation with ability to reward or punish subordinates. According to the theory, task motivated individuals will be affected in the extreme situations when things work well or they are out of control. Northhouse (2004) states that in this case relationships of motivated people may be affected only in the situations when there is some degree of uncertainty. Valuable interpretation of leaders failure due to mismatched situation has been provided by Fiedler (1995), who saw stress and anxiety of leader under pressure reverting to less mature coping style, which may result in poor decisions, consequently leading to less desired work outcomes for the organisation. Important issues of organisational fit to the environment, ability to adapt to changing circumstances or organisational health and development are clearer in the context of contingency theory proposed by Morgan (1997). He thought that using contingency viewpoint could resolve some of the issues in the organisation such as: balance of internal needs, establishment of organisational form to reflect task and environment, achievement of alignment and ‘good fits’, and flexible and open approaches

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in management to promote new opportunities. For development of ‘good fits’ in the organisation, Morgan highlighted importance of factors such as: environment type, employed strategy, used technology, kind of people employed, dominant organisational culture, organisation’s structure and dominant managerial philosophies. The use of a contingency theory in the light of organisational needs can provide the basis for detailed analysis of the organisation, as they are interested to have successful, task-oriented managers, who get tasks accomplished (Morgan, 1997). Fiedler’s (1995) theory may be helpful to examine management practices in the organisation, however there is a criticism that some factors like training and experience are not included in his analysis (Patrich, 2005).

Work Identity
The oldest record about work comes from the Bible (Jones, 1996). Jones reminds that God imposed work on Adam and Eve as a punishment for their disobedience. He goes further saying that Greek’s myths have a similar story of disobedience and consequent work (‘ponos’) imposed on people as pain and punishment. According to Jones ancient Greeks may have the right attitude and worked till joy ran out of it.

Changes in technology and mechanisation of work bring uncertainty to a number of working people. Probert (1989) claims that an increase in work productivity causes the biggest changes of all. She argues by the example of changes in agriculture and the factory work during the early Industrial Revolution. In her opinion the extensive division of labour was probably the major source of increased work productivity through specialisation, growth of workers skills and knowledge on a job. However, Probert emphasises that in the capitalist economy it is a contract between a worker and an employee who hopes that he is buying the physical and mental skills of the worker. She goes further by saying that worker abilities and efficiency at work are rather intangible things and they depend on many factors which modern organisation may not be capable to fully extract. In addition Thompson and McHugh (2002) say, “If society is characterised by the involvement of individuals in organisational structures, then organisations are characterised by their attempts to control the performance and behaviour of the individuals of which they consist” and continuing that “Identity is the basis of individual involvement in organisations, and the basis for manipulation achieved through negotiated transactions between organisational strategies of control and individual strategies for securing identity” (Thompson and McHugh, 2002, p 339). Employees may participate to change their work behaviour, objectives and outcomes, providing that the organisation gives them a degree of discretion and flexibility (Rauner et al., 1988). According to Rauner et al. six factors influence a shape of a dynamic workplace: i) time structure, as discreitional use of timing and planning by individual or groups when work pressures are imposed on them, ii) space for movement, as a degree of formalisation versus free choice, governing worker’s movements within and between job functions, iii) social relations, as a degree of formalisation versus informal possibilities in workplace interactions and organisational communications, iv) responsibility and control flexibility, as possibilities of self-management and control given scope and degree of responsibility, v) qualification, as a form learning and personal development that influences abilities for various tasks and work activities, and vi) stress control, as a degree of control over physical and psychological pressures relating to work organisation and human-machine interactions. The framework presented by Rauner et al.
(1988) allows for analysis of restrictiveness in the workplace (humane work conditions, degree of flexibility and discretion influencing well-being), using subjective factors to analyse personal experience, which may influence appropriate workplace design and outcomes.

Many work places in our times still operate within the illusion of ‘scientific management’ originated by Taylor (1911) in America and do not realise that workers had learned through the bitter experience that despite working harder and more efficiently they may not be rewarded for extra effort (Probert, 1989). According to Probert during the twenties century a further division of labour happened that separated tasks to mental and manual ones with the emergence of managerial class running the enterprises. Types of job, nature of work and a number of people employed changed during last two centuries with the emphasis shifting from agriculture to manufacturing and than to services (Jones, 1996). Jones points out to the new phenomenon of unpaid voluntarily work adding the value to economy at the cost of participants. Today a different paradigm, though not always clearly visible governs modern work relations, where employees in many organisations aren’t part of machinery, but they have status of ‘knowledge workers’ (Drucker, 2001). Despite many positive changes, the nature of the modern organised work still carries a fair degree of regimes, rhythm and powerlessness (Probert, 1989). The future of work may mainly depend on social and political factors and individuals power to change it by strategic political intervention or active communal involvement. It is a strange phenomenon that while “work appears to be economically, psychologically and perhaps even physiologically necessary for most people, and withdrawal from work – while welcomed by many – is dreaded by most” (Jones, 1996, p203). Contrary to that, new signs are emerging in Australia that while people may still want to work it is no longer a must situation for them. Hamilton (2003) and Farouque (2003) reported on the growing trend among people between 30 and 59 years of age, who made the financial sacrifice and voluntarily reduced their working hours for the higher quality of life. While ‘downshifters’ as they are known, have made very brave decisions in their working life, they proved that even in the materialistic world like ours, when it comes to the serious decision, the choice is with people. On the other hand the faceless multinational corporations which dominate the Australian economy and the prevailing colonial mentality of many people in the position of national power change the face of the labour market, depress research and development, make higher education pointless and consequently lead to a ‘brain drain’ of able graduates to USA and Europe (Jones, 1996). The role for organizations is to recognise that employees are not simply human capital or company assets. They invest themselves in an organisation and therefore expect an equitable return from their effort (Fortune, 1998). In addition Jones claims that constant push for higher economic growth without considering current social and environmental impact and expectation that people should work harder instead of smarter may contribute in the longer run to loss of identity, dignity and consequently any meaningful work in the country.
Appendix H

From Idea to Business

Siemens Case Study

For many organisations a path from an innovative idea to a profitable outcome is often long and difficult. It is not uncommon in large organisations that good ideas will never be realized because there is no bridge between the operational units or different departments. People who have the idea are often not the ones who can turn it into a successful business. Siemens Corporate Technology had realized that shortcoming and held an idea competition to help bridge this gap. As the result of the idea competitions, it identified several factors that make such competitions successful, as well as some risk factors hindering the innovation process. Furthermore, it learned that “Besides collecting many different ideas from around the company, idea competitions can establish a network of competencies that will help to keep innovation alive long afterwards” Schepers et al (1999, p26).

During the competition run between February and November 1996, fourteen hundred employees from R&D departments participated in submitting ideas for new products, processes, systems or services that could be realized within two or three years. Submissions for evaluating ideas were evaluated by the Checklist as in Table B1.

Customer
- Who is the potential customer?
- What are the needs of your customer?
- What are the obvious benefits for the customer?
- Will the customer pay for it?

Market
- How big is the potential market?
- Is the market just starting/rapidly growing/saturated/decreasing
- Is there a strong competition in the market?
- Which market position seems to be possible?
- Is the market free of entry barriers?
- How universal is the innovation?
- Are there alternative solutions to satisfy the customer’s needs?

Competencies
- Which business groups or organisational units will benefit from the organisation?
- Is there sufficient competence in the company to realise the innovation?
- Are the base technologies available?
- Can the business be realised by the business groups?
- Can existing marketing, sales and service structures be used?

Time scale
- Can a prototype be realised within 1-2 years?
- Will the project get financed by business groups or international companies after one year?
- Will the first product release be available in time for the market window?

Strength and Weakness
- What are the greatest advantages of the innovation?
- What are the greatest disadvantages of the innovation?

Table B1. Checklist for evaluating ideas.
The prize from competition was seed money to commercialize idea. The organization was able to collect 245 idea submissions and through the selection process identify 6 award-winning projects. Idea Competition Stages in schematic Figure B1.

Figure B1. Idea Competition Stages.

Process of selecting ideas was conducted accordingly to Siemens Innovation Process as per Figure B2.

Figure B2. Siemens Innovation process.

In addition to tangible outcomes, competition contributed to the knowledge of factors essential to the successful innovation process. Ten such factors have been identified ranging from cultural to strategic and from organisational to strictly technical. They were sorted into two basic groups of success factors: motivation factors for employees and management, and rules for implementation and organization. Selected factors displayed following aspects:

- **Sense of Urgency.**
  There must be common understanding as a precondition, that innovation is an essential and vital prerequisite for the future of the organization. Organisational culture must be shaped by a vision that shows a future in which innovations and innovative products play a central part. This vision must begin at the management level and be adopted at all levels throughout the organization.

- **The Right Moment.**
  Timing for running an idea competition is critical for its success. It must not collide with the other important activities or current programs. Nevertheless it does not need to be an isolated event. Ideally, a competition could be a natural outgrowth of a creative culture supporting its objectives.
• Management Commitment.
The importance of innovations must be clearly stated and supported by the management from the preliminary stages of the competition. An open call for participation directed to all employees, and management’s support for the process can motivate many people. Opportunity for subsequent implementation of the best ideas must be presented including coaching and backing up.

• Submissions and Submitters.
The effort required to submit an idea should be without any formal restrictions and as painless as possible. Guidelines need to be provided to help submitters get started. Suggested topics, including technical description, benefit to the company, market position, competitive analysis, and implementation proposal must be available to encourage employees to think about various aspects of the innovation process that might have been previously unfamiliar to them. Individual or team entries should be encouraged as they are beneficial for sharing knowledge and encourage creativity. The program committee should guide submitters to avoid similar ideas and suggest the ways and directions for reworking them. Motivation, communication and cooperation can increase a quality of submitted ideas.

• Awards.
The prospect of realizing one’s own idea and being recognized for that accomplishment is the strongest motivator for most people. It encourages participation. Types of awards are important for the numbers of submissions. Expectation of seed money and a project leadership after winning competition attracts to competition. However, small prizes for the participants as well as official awards should not be neglected.

• Assessment.
The criteria for evaluation should be clearly stated in the call for participation including technical and economic data. A clearly defined pre-evaluation checklist (Table B1) and help from experts to refine ideas through cooperative discussions with the authors must be available. For each idea, there should be a recommendation to submitters for further actions after the evaluation process is over. Only top selected ideas should be presented to the management for selection of the winners.

• Feedback.
Direct and immediate feedback should be available to the authors as this may encourage them to make further submissions. A short critique at the beginning can encourage reworking and enhancement. The author must have an easy access for advice during all stages of competition. The responsibility for an idea must remain with the author throughout the process. Feedback about all stages of the process should be available as it encourages communications and overcoming the inherent innovation gap and promotes good future relations.

• Realization.
Regardless of whether the prize is seed money or some incentive, the opportunity to begin implementing the idea must be guaranteed in the period following the competition. Appropriate resources and project management assistance must be available to continue the innovation process.

• Tools.
Efficient ways of handling variety of ideas must be selected to permit a fair and thorough analysis of technical and economic parameters in respect to market
value and risk potential, as shown in Figure B1. Consideration of the jurors rather than use of computer programs for the final ranking of ideas should be preferred.

- **In-Person Final Presentations.**
The authors of winning ideas should have an opportunity to present their projects in the organisation. This opportunity confirms the importance that management places on the process and the person engaged in the creative endeavour. During a presentation management has the occasion to learn about the person and future business. Those additional contacts between authors and business partners may enhance new future ventures.

Winning projects have received the seed money to cover the budget for the first year of the project. After the first year, management committed financial support for further development for four out of the six winning projects.

The idea competition was an important event, building organisational culture and reinforcing communications among employees. Despite a successful program, the lessons learned were to avoid some pitfalls such as: to promote a program with realistic outcome expectations, to have resources for continuing the development of ideas or to make enough effort to cross-multicultural and language boundaries.

The repetition of such an event should be well thought and carefully planned event. Promotion of new ideas needs to be embedded in the culture of the organisation and have a continuous momentum. This type of event can help to establish innovation as a regular process. Pooling ideas does not work if the organisation does not have a process for implementation. Otherwise, idea pools become idea graves and good ideas will never get a chance to be implemented. The owner of an idea should remain to be responsible for it, even after the competition is over, giving far greater chance for pushing it farther through the process of implementation. There is very little that the organisations can do to encourage people to participate in such an event, than to motivate them to submit ideas. Professional product development and real market penetration require that ideas must go through further feasibility and market analysis. In this way the innovation process if extended beyond the scope of the initial idea competition has a probability to mature. Because of the various kinds of proposals that could be submitted, a different method for handling ideas is necessary. A categorization to: general improvement, evolutionary product developments or new corporate ventures may be necessary for proper handling of defined innovation processes.

Finally a role of entrepreneur, who is responsible for turning the idea into a business is more essential, as is the funding model that provides the money for the initial investments. Altogether, the process must be fast and flexible given the process guidelines in Figure B2.

Spinouts or joint ventures may result from this process in order to bring a new business quickly and directly to the customer. To keep an overall innovation process alive, all employees in the organisation must provide a steady stream of new ideas. The most important outcome of such a competition is the communication bridge that is built over the idea generation and innovation implementation gap, which should become the permanent organisational feature.
Appendix I

Australian Industry is Different!

Comparisons of Australian Industry not only with those of the major industrial powers such as USA, Japan, Germany and the UK, but also those whose economies are more similar to our own, such as Canada, Sweden, Holland or even Finland, reveals the following critical differences:

- A lack of any major companies developing competitive products on a world wide basis, eg Nokia, Phillips, Ericsson, Bombardier
- A lack of "mentored" networks of small companies developing specialised products in conjunction with major on-going partners
- Many SMEs are the "local office" of overseas enterprises at best aimed at adapting products to the local region
- The fragmented nature of Australian business, best typified by the Defence Industry sector
- The "build-to print" heritage of much Australian industry
- The small size of companies, below the critical mass to support on-going product and service development or the employment of people with experience related to the application of innovative ideas
- The inevitable concentration on the short term "bottom-line" by senior management, created by the investment industry's concentration on profit rather than viability, and the poor standard of longer term planning in industry.
- The lack of management understanding of how to assess and control the risks involved in innovation application
- The lack of overall awareness in Australian industry, at all levels, of the benefits that can come from a continuing innovative approach.
- The reluctance of Australian companies to work together in alliances and networks to overcome the size problems.

In particular, most Australian industrial companies are small when compared to their counterparts in developed countries. The result is that many companies,

- Do not have the critical mass that is essential to aspire to compete with larger corporations at home or in overseas markets
- Cannot afford the financial needs or risk to innovate and develop new products, processes and systems in spite of latent capabilities
- Do not have available the "spare resources" in capabilities and skills to undertake innovation, being concerned with day-to-day survival
- Being small and often privately owned are cautious when considering ideas such as alliances or networks as a means to overcome their weaknesses
- Australian manufacturing industry does not exude an "Innovation Culture". Too many companies are still the "branch office" of overseas principals. Technology for new or improved products is transferred directly to them for manufacture under licence with Australian innovation limited to customising the product for local conditions and market needs (Jeal and Wroe, 1999).