

**THE ROLE OF THE SOCIAL FACTORS IN GENERATING  
INNOVATION WITHIN MATURE INDUSTRY SUPPLY  
CHAINS - A CASE STUDY**

**Kevin Burgess**

Bachelor of Social Work (1981) University of Queensland  
Master of Business Administration (1992) University of Central Queensland  
Graduate Certificate of Social Science Research (1996) University of Queensland

This thesis is submitted to fulfil the requirements for the award of  
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## **DECLARATION**

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university and to the best of my knowledge and belief, contains no previously published or written material by another person, except where due reference is made in the text of this thesis.

.....  
Kevin Burgess

14<sup>th</sup> August 2007

## **DECLARATION OF ACCESS**

Due to the extremely confidential nature of this thesis, its access and use is totally prohibited for a period of one year from its date of publication. It is to be stored in a secured area of RMIT University.

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Kevin Burgess

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## GLOSSARY

ABC	Activity Based Costing
ACCC	Australian Competition and Consumer Commission
Acro	Transshipment Yard owned by Firm C
AEI	Automatic Equipment Identification
AMR	American Market Research
ANT	Actor Network Theory
ASX	Australian Stock Exchange
B2B	business to business
B2C	business to commerce
BPM	Business Process Management
BPR	Business Process Reengineering
CAPS	Center for Advanced Purchasing Studies
CEO	Chief Executive Officer
CGT	Core Group Theory
CRC	Cooperative Research Community
DSS	Decision Support Systems
EAI	enterprise application integration
ECM	Enterprise Commerce Management
EDI	Electronic Data Interchange
EDMS	Electronic Document Management System
ERKS	Electronic Record Keeping System
ERP	Enterprise Resource Planning
ERPS	Enterprise Resource Planning System
e-commerce	electronic commerce
e-learning	electronic learning
eSCI	electronic supply chain innovators
e-supply	electronic supply
Firm A	Manufacturer of Steel Rail
Firm B	Interstate Transport Company for Steel Rail
Firm C	End user and installer in track of Steel Rail
GMF	Governance and Management Framework

GOC	Government Owned Corporation
GUI	Graphical User Interface
HR	Human Resources
IDEFO	Method to model the methods, decisions and activities of an organisation
ICT	Information and Communication Technology
IGO	Intergovernmental Organisations
ION	Interorganisational Network
IOS	Interorganisation Systems
IS	Information Systems
IT	Information Technology
JIT	Just in Time
LAN	Local Area Network
MRP	Materials Requirements Planning
NCP	National Competition Policy
NT	Network Theories
OB	Organisational Behaviour
OD	Organisational Development
OL	Organisational Learning
OR	Operations Research
Oztrack	National rail track organisation which sells access to Firm B
QA	Quality Assurance
R&D	Research and Development
RBT	Resource-based Theory
RBV	Resource-based View
RM	Relationship Marketing
RT	Road Transport Company - owns half of Firm B
SAP	The brand name for a specific ERP software package
SCC	Supply Chain Council
SCA	State Competition Authority
SCM	Supply Chain Management
SCOR model	Supply Chain Operations Research model
SS	Shared Services
SSM	Soft Systems Methodology
StCo	Stevedoring Company – owns half of Firm B

STS	Socio-technical Systems
TAB	Track Access Business
TCE	Transaction Cost Economics
TLM	Track Laying Machine
TOC	Theory of Constraints
TQM	Total Quality Management
WAN	Wide Area Network
WWW	World Wide Web
Yanbo	Rail Welding Facility owned by Firm A.

## ABSTRACT

Supply chain literature has increasingly argued that supply chains are being used by a wide range of industries to generate innovations which deliver competitive advantage, and that social factors such as trust and collaboration play a key role in making effective supply chain management (SCM). Closer examination of the research suggests that much of this literature is based on studies of industries which deliver consumer products and these studies are predominantly conducted within a positivist research framework. This research bias has resulted in far less attention being paid to studies of mature industrial markets. This case study seeks to redress such bias by posing an overall question regarding the role of social factors in innovation within a well established supply chain which existed across three mature, capital intensive industries – steel manufacturing, transport and railroad track construction and working outside the positivist paradigm by using a multidisciplinary research approach within a “critical realist framework”.

In responding to the overall research question, three subordinate questions were explored. Firstly, how well suited are present corporate governance structures of individual organisations to deal with the newly emerging interconnected organisational structures in order to support the generation of innovations within supply chains? Secondly, what has been the impact of the widespread adoption of information technology in generating innovation in supply chains? And thirdly, what is the role played by interorganisational social networks in generating innovations within supply chains?

The overall findings were that the social factors played a far more important role than had hitherto been acknowledged in either supporting or inhibiting innovation within supply chains. Corporate governance was seen to generally inhibit innovation between organisations. The claims of much of the SCM literature which asserts a strong link between IT and innovation in supply chains was not supported. In fact, it was found that the majority of subjects preferred to get information through social systems. The role of interorganisational networks (IONs) was found to be most effective at generating incremental innovations aimed at maintaining operational efficiency. The multidisciplinary approach was also found to be an effective approach for exploring the inherent complexity in a supply chain. In particular, a critical realist research approach

was able to uncover some difficulties associated with a purely positivist research paradigm which restricts investigation to the empirical level of ontology. The critical realist approach was able to explore causal mechanisms and structures which were not as readily accessible at the empirical level of investigation. It was found that multiple realities existed across the supply chain, and that the positivist assumption of a mono reality which underpins much of the enterprise resource planning (ERP), process management and governance approaches was in fact inhibiting the ability of the social system to be innovative and ultimately driving up costs. In fact a process management approach supported by information technology and operating within present corporate governance structures created conflicting goals which increased complexity. A key finding of this study was how the open social system of the supply chain used dynamic relationships to overcome the rigidities and complexity of a closed systems logic embedded in the formal governance and information systems.



# CHAPTER 1

## 1 INTRODUCTION

The environment for business in Australia has changed rapidly over the past two decades. Factors such as globalisation and removal by the Australian Government of protectionist policies mean that the private sector now has to compete locally and internationally against aggressive global companies. In parallel, the sweeping reforms of the National Competition Policy (NCP), which commenced in Australia in the 1980s, generated massive public sector reforms in the 1990s. State governments have given up their monopoly rents and have either corporatised or privatised their utilities. Nonrevenue producing government agencies have resorted to reducing costs by outsourcing noncore activities to shared services (SS) and some core activities to the private sector. Powerful bodies such as the Australian Competition and Consumer Commission (ACCC) have been established to ensure there is no regression from competitive practices. To survive in such a dynamic competitive environment, organisations have to be able to continually innovate. This involves developing an organisational form which can rapidly respond to, and take advantage of, the interdependence of modern organisations.

Within the new environment, organisations initially have achieved improved performance by implementing a wide range of transaction-based outsourcing strategies. However, many organisations are now seeking to generate even greater improvements by working more closely with suppliers and customers in ways that place a strong emphasis on long-term collaborative relationships built around trust and the willingness to openly share information. This new approach to supplier and customer relationships is commonly known as “Supply Chain Management” (SCM). It is considered superior to previous purchaser-provider practices in that it helps organisations to develop and exploit their relationships with each other in order to gain competitive advantage. Links have been made between SCM and innovation but, while there is little debate around the merits of adopting SCM, there is still considerable speculation about how to implement SCM in ways that will ensure ongoing innovation.

Innovation is a broad concept that has been conceived of in a variety of ways. A widely used definition of innovation is the adoption of an idea or behaviour that is new to the organisation (Hage, 1999). Within the business setting, innovation is often taken to be

a major source of strategic change by which a firm generates positive outcomes, including sustained competitive advantage (Christopher, 1998; Dyer & Singh, 1998; Gowen & Tallon, 2003; Handfield & Nichols, 1999). Schumpeter (1939) defined innovation as “creative destruction” whereby resources and resource use were reconfigured for new purposes and to increase efficiency. Organisational innovation can be classified into three broad types – technical, organisational and market (Tidd, Bessant, & Pavitt, 2001). It is widely accepted that SCM has considerable potential to assist in achieving all three types of innovation (Chapman, Soosay, & Kandampully, 2002).

Supply chain theorists predict that forces of the so-called new economies will result in all industries adopting SCM in order to generate many of the innovations needed to continually improve performance to meet the new challenges (Ensign, 2001; Gowen & Tallon, 2003). There are difficulties in defining SCM for reasons which will be explained in Chapter 2. However, for introductory purposes, SCM “is generally associated with advanced technologies, rapid and responsive logistics service, effective supplier management and increasingly with customer relationship management ... and (is) synonymous with collaboration [across organisations]” (Fawcett & Magnan, 2001, p. 340). Other definitions include that of Premkumar (2000) who considers SCM as a strategy to effectively link all trading partners and ensure cost-effective and timely movement of materials from the raw material supplier to the final consumer of the finished product. Interorganisation systems (IOS) provide the technological infrastructure to facilitate the flow of information along the chain and thereby ensure the smooth flow of goods. According to Zheng, Harland, Johnsen, and Lamming (1997), SCM encompasses all logistical activities, customer-supplier partnerships, new product development, inventory management, warehousing, transportation, order processing, product scheduling, and customer services.

In spite of the wide acceptance by all industries of the strategic importance of SCM, few companies are actually engaged in extensive supply chain integration (Akkermans, Bogerd, & Vos, 1999; Harps, 2000; Harps & Hansen, 2000; Whipple, Frankel, & Daugherty, 2000). While there is an enormous research effort going into SCM, there are poor understandings of the theoretical underpinnings of successful SCM methodologies (Andersen, Fagerhaug, Randml, Schuldmaier, & Prenninger, 1999; Basnet, Corner, Wiser, & Tan, 2003).

The reasons for this apparent lack of understanding about how to apply SCM concepts are not entirely clear. However, an important clue lies in the fact that the social

dimensions of SCM are not well understood and are far more complex to manage than initially anticipated. The literature has repeatedly identified social factors such as trust and collaboration as critical variables in the relationships required for ongoing improvements (Morgan & Hunt, 1994; Sahay & Maini, 2002) but the SCM research agenda has not widened correspondingly to seriously investigate the social aspects of supply chains. Ho, Au and Newton (2002) claim that the dominant SCM models have focussed mainly on practice-performance relationships and have overlooked context-practice relationships, yet various streams of sociological thought have highlighted the critical role played by context in understanding social relationships (Brown & Duguid, 2000).

Criticisms of the innovation literature itself also provide some clues as to why the uptake and successful implementation of SCM has struggled. The most common criticism is that the literature has focussed largely on a single firm model of competitive innovation (Gaimon, 1989; Reinganum, 1982). There have also been warnings against the growing tendency in the literature to place emphasis on rational elements, drawing attention away from the “softer”, people dimensions involved in generating innovation (Bolton & Thompson, 2000).

A similar criticism is that of declaring technology to be the critical enabling factor in SCM. Much of the SCM literature places considerable emphasis on information technology (IT), claiming that organisations now have access to seamless flows of information across space and in real time which gives them the capability to create new strategic positions (Linnarsson & Werr, 2004). However, this technological determinist argument is at odds with much of the knowledge management literature, which makes distinctions between explicit and tacit knowledge and the role each plays in innovation. While technical systems can deal with explicit knowledge, tacit knowledge is contained in social systems (Nonaka, 1994) and is deeply embedded in the social context of the community which creates and reproduces it (Berners-Lee, 2000). The interplay between SCM and the social systems within supply chains is an underresearched area, and is not well understood.

The present lack of theoretical understanding on how contextual factors interact with each other in supply chains in ways that generate innovation leads to the following overall research question:

**What is the role of social factors in generating innovation within supply chains?**

Supply chains often have to work across differences in technologies, geographic dispersal and cultures, as well as political and legal systems. How various actors in the social network of a supply chain interpret and act upon such complex variables (let alone how these variables lead to innovation within a supply chain) is an area of intense speculation. It is far from clear just who makes what decisions (and using which criteria) about an innovation which may impact upon the performance of an entire supply chain. How relational variables, involving factors such as trust and power, influence decision-making in respect to supply chain innovation also needs to be clarified. Researching such a complex array of variables presents a considerable challenge with respect to choosing a research methodology, as these kinds of variables are notoriously difficult to explore from any single research paradigm (New, 1997).

There is a considerable volume of literature – coming from sociological research theory in particular – which questions the adequacy of a positivist research paradigm to investigate social systems. Present positivist research biases seem at odds with the emergence of the “relationship paradigm” (Sahay, 2003a), concerning the creation of long-term relationships (Chandra & Kumar, 2000; Zineldin & Jonsson, 2000). The positivist paradigm – with its emphasis on “hard” systems issues, such as the movement of materials and information, technological innovation and mathematical modelling – has dominated SCM research to date and has also involved a fairly limited range of industries – most notably retail, auto and private sector organisations (Cox, 1999).

Research paradigms such as critical theory and postmodernism, which have high credibility in the so called “soft” or social sciences, are rarely used in SCM, even though these are highly effective approaches for exploring the contextual relationship variables which need to be well understood if we are to make sense of how innovation is being developed and diffused. Dominant research approaches are almost certainly too narrow in focus – and too shallow – to capture, reveal and analyse the multiple array of factors which interplay in a manner that generates product, market and process innovations. The intangible elements of social systems operating in supply chains may not be accessible to nonparticipating observers (McCarthy, 1984). The limitations suggested in researching social dimensions may account for the apparent lack of rapid uptake of SCM, as the knowledge needed cannot be easily accessed through explicit means. There is, therefore, a clear need to widen the research agenda and approaches in order to generate fresh insights about SCM.

Viewing SCM innovation as a dynamic arrangement involving legal, technical and social dimensions moves the research focus from exclusively on technology to more on human interaction. The research epistemology agenda must be widened accordingly, from the closed system perspective of positivism to an open systems approach (Bhaskar, 1989a; 1989b). Interpretativist studies may help uncover richer explanatory insights into end-user beliefs, attitudes, reactions and behavioural reactions to innovation in supply chains than those that would be evident from using quantitative methods. An interpretative approach is suited to exploring the highly complex and dynamic factors which interact and influence innovation decisions in a supply chain, such as language, experiences, history, culture, processes, understandings, interactions, interpretations, routines, information and knowledge. Findings gathered from such an approach may help explain why the industries which claim to value SCM are sluggish to implement it as a strategy.

In seeking to broaden the scope of research into innovation in SCM, three subordinate questions are posed which flow from the overarching research question – **What is the role of social factors in generating innovation within supply chains?** These are:

**Subordinate Question 1:** How well suited are present corporate governance structures of individual organisations to support the generation of innovations within supply chains?

**Subordinate Question 2:** What has been the impact of the widespread adoption of IT in generating innovation in supply chains?

**Subordinate Question 3:** What is the role played by interorganisational social networks in generating innovations within supply chains?

As the research places emphasis on social factors in supply chains, the order of the above three questions may appear out of sequence. However, the order is deliberate for reasons which will be developed in the literature review and research methodology chapters which highlight the need to understand the wider contextual factors which shape social interactions prior to examining those interactions.

This thesis explores the research question using an Australian case study of a supply chain involving three large organisations – a steel rail manufacturer (Firm A), a transport provider (Firm B) and, finally, a publicly-owned transport company (Firm C) which uses the steel rail for construction and maintenance purposes. The manufacturer is a publicly listed company that was spun off from its parent company in 2001, but

maintained its contractual arrangements set up by the parent with the interstate rail transport provider. The transport provider is a private joint venture company equally owned by two publicly listed companies, while the public utility is a government owned corporation (GOC) that has been in existence for over a 100 years, but was transformed when corporatised in the mid-1990s under the Government Owned Corporation Act (1994).

There are several compelling reasons why this type of research is needed and can potentially make a contribution to the SCM body of knowledge. Firstly, as Australia has a resource-based economy, its economic performance is strongly linked to the price sensitivities of not only a commodity itself, but the also all associated logistics costs (Little, 2007). However, Sachan and Datta (2005) claim that the research into SCM has been dominated by US and European research, and that there is an urgent need to widen the geographical content of the research. The focal firm studied in this supply chain is directly connected to these key resource industries through the transportation of export coal which accounts for over 80% of its revenue.

Secondly, Bagchi, Chun Ha, Skjoett-Larsen and Soerensen (2005) argue that “the conventional wisdom of the past two decades that long-term buyer-supplier relationships would increase the efficiency and service level in the supply chain” (p. 289) needs to be more critically challenged. Afuah (2000) and Bagchi et al. (2005) suggest that this conventional wisdom may work against innovation.

Thirdly, as corporations are using SCM to extend beyond their legal boundaries as a normal way of organising and forming competitive networks of companies, they have to develop new competencies and capabilities around governance frameworks and policies in order to answer questions such as why and how to invest in these new organisational forms, and how to manage the associated risks.

Fourthly, Bagchi et al. (2005) suggest that the research focus of IT as a form of innovation has been too narrow claiming that “social and organizational sources of complexity in IT implementations have thus far attracted little research attention from logistics and supply chain scholars” (pp. 102-3).

Fifthly, Sachan and Datta (2005) expand this line of thinking beyond IT by arguing that “SCM and logistics research has been heavily biased toward operational and financial aspects of supply chains. There is now a need to advance the research toward problems involving behaviour and underlying factors like culture, relationship, trust and power” (p. 675).

Sixthly, an increasing body of literature suggests that the SCM research has been heavily biased by the positivist research paradigm. Positivist approaches have been widely recognised as being more limited in how they can effectively research social variables; therefore continuing to limit research to this method may well be inhibiting the development of SCM theory (Burgess, Singh, & Koroglu, 2006; Skjoett-Larsen, 1999; Storey, Emberson, Godsell, & Harrison, 2006).

Finally, Kovacs and Spens (2005) argue that it is not only the positivist bias which is limiting the development of SCM, but that the modes of reasoning are also limited. They make a case for SCM research to expand to the use of methods which involve abductive reasoning. As will be shown through this thesis, all the aforementioned underresearched areas in SCM will be covered by this case study.

The case study described in this thesis covers the six areas above which have been identified as underresearched areas in SCM. While no one study could hope to address all of these areas in great depth, the case study allows some exploration of each area. With respect to the first three areas, the buyer-supplier relationship in this supply chain has been in place for over 20 years and involves Australian firms with different governance structures. In relation to the fourth area, all firms in the supply chain have invested heavily in IT. This study explores the underresearched social issues involving generating innovations within the supply chain, mentioned as the fifth point. Finally, the case study research is conducted within a critical realist framework in an attempt to generate insights outside of those available to a positivist paradigm.

The overarching research question and the three subordinate research questions will be explored within three contexts in Chapter 6 – the macro, meso and micro – as will the potential interplay and relationships between these three contexts. The reason for exploring the subordinate questions across these contexts is that supply chains can be complex in both horizontal and vertical structures, and are subject to a wide range of influences – from government policies through to initiatives at the local work-group level. These three contexts have been chosen as they tend to cluster around well-established layers of activities. The macro context refers to environmental factors including regulatory frameworks which impact on all organisations, the meso context covers the level of interfirm interactions where SCM is most commonly conceptualised and, finally, the micro context addresses activities within the firm.

A summary of the chapters in this thesis follows:

Chapter 2 initially presents a thematic analysis of the innovation and SCM literature. This analysis suggests that SCM is fragmented from a theoretical perspective. Much of the present practice is being directed by management and academic consultants increasingly promoting prepackaged and prescribed solutions. However, far less is known about what theory, if any, informs this practice. As the SCM literature is drawn from many disciplines, it was difficult to make sense of it as a coherent body of knowledge. To gain a greater insight into this complex and still-developing literature (Cousins, Lawson & Squire, 2006), a systematic literature review of the state of SCM theory, the areas it covers and the research methodologies that are used is included in Chapter 3.

Chapter 3 aims to identify why there is a case to widen the SCM research agenda in order to enhance theory development. It is broken into three major portions. The first portion seeks to make sense of the SCM literature by examining what types of theories, perspectives and research paradigms have been employed, with a view to identifying potential blind spots. The conclusion reached in the first portion is that despite the wide range of theoretical perspectives and different research methodologies reflected in the literature, there are distinct biases in the field which may be inhibiting theory development. The next major portion discusses the ontological and epistemological implications of the SCM research developed within these biases. A case is made to move beyond the traditional research approaches in order to generate new insights into SCM. It is argued that supply chains comprise both physical and social systems and there is considerable debate in the research literature suggesting that these systems are so different in nature that they require different research methodologies. To this end it is argued that a multidisciplinary and, to a lesser extent, a multimethod approach is required in order to understand the complexity of the SCM subject matter and to gain new insights. The final portion outlines the reasons for choosing a critical realist research paradigm as being best suited for use in this study on two grounds. Firstly, it can cover many of the issues associated with a system as dynamic and complex as a supply chain. Secondly, it provides a novel research perspective to SCM which has the potential to provide fresh insights.

Chapter 4 details the case study. It is exploratory rather than confirmatory in nature and therefore uses a basic qualitative case study methodology. It includes descriptions of the organisations involved in the supply chain and demographic information about the subjects. The case study methodology required by critical realism is described. This includes the use of a multidisciplinary team assisting in undertaking the



initial research (under the direction of the author) in line with the need to examine and analyse the data gathered from several perspectives. The data sources, data capture approaches and treatment methods are revealed. Ethical considerations are also addressed in this chapter.

Chapter 5 presents the findings and analysis, and covers two broad areas. Firstly, it discusses how the data were analysed to generate the findings. Secondly, the actual findings are presented under themes which emerged from the data. This chapter presents a framework developed from the data analysis. The purpose of developing such a framework is to further summarise the findings at an empirical level and to highlight key relationships found in the data, which subsequently guide the discussion in Chapter 6.

Chapter 6 – the discussion – explores the implications of the research findings in relation to this case study, and explores possible implications for other SCM scenarios. This chapter takes the framework devised in Chapter 5 and analyses it across three contexts – macro, meso and micro. The intent of this analysis is in line with critical realist primary research interest, namely to investigate the generative causative mechanisms and structures which gave rise to the findings of events and regularities at the empirical level described in Chapter 5. The framework sets a wider context to understand the generative tendencies which influence the supply chain. The major themes covered are the multidisciplinary nature of SCM and the requirements for developing research methods reflective of this situation.

Chapter 7 provides the conclusions reached and covers two basic issues. Firstly, it defines the contribution this study makes to the body of SCM knowledge. Secondly, it suggests a way forward for future SCM research based on the framework developed in this thesis.

# CHAPTER 2

## 2 LITERATURE REVIEW

### 2.1 OVERVIEW

This chapter examines the literature which relates to the overarching research question and the three subordinate questions. The nature of these questions guided the review to focus its examination primarily on historical and theoretical explanations drawn largely from economic and sociological literature. The overall intent of the review was to give primacy to the sociological dimensions in both the innovation and SCM literature. Section 2.2 starts with a thematic review of the literature on innovation, and some themes relevant to SCM are identified. Later in this section there is an examination of the overlap between innovation and SCM to inform why organisations may choose to work together. This is followed by a review of the literature on SCM, which is found to be a young field, lacking a coherent theoretical foundation. Section 2.3 is a summary of the thematic literature review in which it is concluded that it is necessary to undertake a systematic analysis of SCM's theoretical underpinnings. The systematic analysis is described in Chapter 3.

### 2.2 THEMATIC LITERATURE REVIEW

#### 2.2.1 Innovation

##### **Definitions and theories of innovation**

The body of literature on innovation is enormous. It is also not homogenous, having been developed from a very broad range of theoretical perspectives and investigated by a multitude of disciplines. Different theories tend to place emphasis on different facets of innovation. Furthermore, innovation is such a large movement that it has been described from perspectives other than those which specifically use the term "innovation". These include, inter alia, knowledge management, learning organisations, and social networks. While these perspectives are separated in the literature, they are inseparable because they inform and influence innovation. Throughout the chapter, then, various perspectives and associated concepts of innovation are discussed but not necessarily under the heading of innovation. This section, therefore, provides a review of

the wider framing literature on innovation and how that literature links to key themes of SCM.

Numerous taxonomies for defining innovation have been developed. These include technological and nontechnological innovation, major and incremental product innovation (Corso & Pavesi, 2000; Dougherty, 1992; Garcia & Calantone, 2002; Wang & Ahmed, 2004), behavioural innovation, economic innovation (Thagard, 1999), strategic innovation, technological innovation (Coopers & Zmud, 1990; Wang & Ahmed, 2004) process innovation (Cassivi, 2006; Davenport, 1993; Dyer, Cho & Wujin, 1998), organisational innovation (Yliherva, 2004), construction innovation (Stewart & Fenn, 2006), relational innovation (Ring & Van de Ven, 1994; Handy, 1995; Zaheer, McEvily, & Perrone, 1998), structural innovation (Bodewes, 2002), outsourcing innovation (Quinn, 2000), social innovation networks (Tautila, Suomala, Siltala, & Keskinen, 2006); business model innovation (Pohle & Chapman, 2006), innovation diffusion (Kautz & Larsen, 2000; Rogers, 1995), and transformational, radical, architectural and incremental innovation (Chapman et al., 2002). Tautila et al. (2006) concluded that innovation is such a widely studied subject, and there are so many different approaches to describing the phenomenon, that the term loses its meaning.

Despite the extensive research on this topic, the development of innovation theory has been plagued by numerous difficulties. The extant innovation literature often does not arrive at consensus over many issues. This leads to confusion in the innovation research arena (Wang & Ahmed, 2004). Inconsistencies in defining, operationalising and measuring innovation have added to the instability of findings (Bodewes, 2002). An example of such confusion is found in an area of immense interest in the literature - product innovation. The confusion arises from: differences in perspectives between the various product innovation-related disciplines (marketing, engineering, and the new product development); multiple definitions of the types of product innovation resulting in ambiguities in the new product development literature (Garcia & Calantone, 2002); a propensity in the literature to incorporate various other perspectives of innovativeness under the heading of product innovation as the concept is closely connected to marketing innovation and these are inevitably treated as being intertwined. Product innovativeness approaches have also been criticised for placing emphasis on the outcome-oriented innovative capability and thereby undermining the importance of underlying causal factors of product innovation, such as behavioural changes, process innovation and a strategic orientation toward innovation (Wang & Ahmed, 2004).

Confusion around how to classify and apply innovation concepts applies to all definitions. For example, most studies consider process innovation as a subelement of technological innovation (Wang & Ahmed, 2004). This makes it difficult to determine if identified causal interactions should be examined using multifactor analysis or if they are simply the result of describing the same constructs under different innovation labels. This circumstance is compounded by the lack of a validated measurement scale for an organisation's overall innovative capability. Where scales have been developed they often adopt a particular innovation perspective such as product or process (Wang & Ahmed, 2004). While there has been considerable effort to develop measures around various technical innovations (Moore & Benbasat, 1992; Narvekar & Jain, 2006) consensus remains elusive. Despite the confusion many empirical studies have concluded that the interaction of different types of innovation can have synergistic effects. For example, a study of a telecommunications firm concluded that "process and relational innovations are enhanced by the development of electronic collaboration activities" (Cassivi, 2006, p. 256).

From among the list of aforementioned innovation theories, diffusion theory warrants special note because it has dominated the innovation research (Allen, 2000). While there are a variety of definitions on innovation diffusion (Rhodes & Wield; Afuah, 1998), it is commonly taken to mean the communication about new ideas, technologies or processes. Diffusion theory explains and predicts the influence of a wide range of factors on the innovation adoption and implementation decision. The predictors include the factors from the focal system (individuals such as targeted adopters, managers and champions as well as the organisation's structure and culture), the perceived nature of the innovation itself (its advantages, compatibility and complexity), communication channels (e.g., formal and informal, resource intensive or inexpensive) and time (e.g., the rate of diffusion over time). This theoretical framework is over 50 years old and has its roots in rural sociology where it was used to explain and predict how agricultural innovations were diffused. It has been applied in over 4,000 studies of innovation adoption across a wide range of scholarly disciplines, including communications economics, policy, sociology, marketing, organisation, technology and medicine (Kim & Galliers, 2004)

With respect to technological innovation, and particularly the adoption and diffusion of innovations, diffusion theory has become the dominant approach to explaining adoption, implementation, and usage issues in Information System (IS) research. Newell, Swan, Galliers, and Pan. (2000, p. 246) claim "ICT innovation is

heavily dependent on the context of application” and that the differences and lack of consistency across industry sectors and across countries in ICT diffusion arises from the contextually-sensitive nature of the innovation processes. Hence some authors have concluded “the most consistent theme in the ICT innovation research is the research findings have been inconsistent” (Wolfe, 1994,p. 405).

While there is a rich tradition of cross-cultural studies of diffusion, relatively little attention has been paid to the potential of multiple social systems or subcultures within a total system. In particular the multiple contextual variables found in demographic, economic, social, cultural and other miscellaneous differences make it difficult to fully comprehend all the variables involved in diffusion. (Parthasarathy, Jun, & Mittelstaedt, 1997). Hall (1976) highlights the role played by contextual cues and shared ties in diffusion. Numerous studies have demonstrated the role played by word of mouth communication and credibility based on established interpersonal relationships in the decision process to adopt. (Price & Feick, 1984; Rogers, 1995). Of interest to a supply chain perspective are Biemans and Woodside’s (2005) view that successfully managing diffusion and adoption requires managing relationships and social networks, while Gatignon and Robertson (1985, p. 857) claim “any study of social systems should consider the characteristics of the immediate social system and its interaction with other social systems”. The full process of the diffusion of innovation is composed of many factors. This area is so rich and complex that no single study has ever tested every factor. Despite this lack of testing “(I)n diffusion studies, adoption is often conceived as the dependent variable” (Russell & Hoag, 2004, p. 106).

Russell and Hoag (2004, p. 105) claim that Williams and Rao (1998) “introduced the logistics and management community to diffusion” through a study to explain the adoption of automatic equipment identification (AEI) software among North American railroads. They go on to claim that Williams and Rao’s (1998) contribution is important as it “demonstrated that questions in supply chain and logistics research agenda could be addressed with adoption theories” (Russell & Hoag, 2004, p. 106).

While diffusion theory is undeniably popular and useful, this traditional approach to innovation adoption and diffusion has well-understood limitations that have been identified by innovation researchers themselves (e.g., Drazin & Schoonhoven, 1996; Gatignon & Robertson, 1985; Rogers, 1995; Wolfe, 1994). Much of this research has focussed on the process of technological innovation. This literature is developing arguments about the technological innovation process that challenges traditional adoption

and diffusion theory. While it would be naïve to suggest that one set of assumptions about innovation is “right” or “wrong” for all possible research projects, enough work has been done to suggest that the traditional approach to innovation research should not automatically be seen as the source of correct assumptions. IS research is a case in point of technological innovation where the findings do not neatly align with diffusion theory (Allen, 2000).

Other methodological limitations of diffusion theory include:

- (i) Difficulties in defining technological characteristics that allow cross-study comparisons (Wolfe, 1994)
- (ii) Proinnovation bias of adoption and diffusion research (Rogers, 1995) that is, assuming that technological innovation is positive and will be adopted by a target population over time.

This bias tends to lay the ‘blame’ of poor adoption on adopting individuals and organisations, rather than on systems or situations, and does little to help IS research understand the crucial problem of trying to learn which innovations will be of benefit, and which will not. (Allen, 2000, p. 213)

- (iii) The difficulties of recalling past adoption decisions accurately (Rogers, 1995)
- (iv) Inconsistency of previous research findings (Wolfe, 1994)
- (v) Lack of attention to community and population-level dynamics (Drazin & Schoonhoven, 1996)
- (vi) A prime interest in existing literature to investigate innovation activities and their associations, where adoption of one or more innovations is examined as the dependent variable and linked to attributes of the organisation, the individual respondent and the innovation itself. (Gallivan, 2001).
- (vii) Other restrictions that have been identified include the relative lack of attention to the adoption and diffusion stemming from the conceptualisation of fixed, unchanging innovations being diffused from producers to adopters. (Allen, 2000).

Process innovation is another innovation theory from the earlier list which has a strong potential relationship to SCM due to its association with a process management approach. According to Davenport (1993), process innovation combines the adoption of a process view of the business with the application of innovation to key processes. Davenport argues that what is new and distinctive about this combination is its enormous

potential for helping any organisation achieve major reductions in process cost or time, or major improvements in quality, flexibility, service levels or other business objectives. Davenport's essential claim is that the term process innovation is more appropriate for encapsulating an ambitious innovation and change program for a number of reasons.

Davenport (1993) distinguishes process innovation from re-engineering arguing that the latter is only part of what is necessary in the radical change process; it refers specifically to the design of a new process. The term process innovation encompasses the envisioning of new work strategies, the actual process design activity, and the implementation of change in all its complex technological, human and organisational dimensions. He outlines a framework for process innovation which consists of five steps:

- (i) identifying processes for innovations;
- (ii) identifying the change levers;
- (iii) developing process visions;
- (iv) understanding existing processes;
- (v) designing and prototyping the new process. (p. 24)

Hlupic, (2003) argues that Davenport's Framework shows many similarities with the work of Porter and Millar (1985) and McFarlan (1984), not to mention business process re-engineering (BPR) as advocated by Hammer and Champy (1993), since it invites managers to carefully consider their innovation and change management strategies. BPR was a very strong movement in the 1990s but has waned due to many identified weaknesses which have included:

- The rate of failure is over 50%.
- Inability to predict the outcome of a radical change
- Difficulty in capturing existing processes in a structured way
- Shortage of creativity in process redesign
- Level of costs incurred by implementing the new process
- Inability to recognise the dynamic nature of the processes. (Hlupic, 2003)

Davenport's process innovation claims to overcome these weaknesses of BPR. Davenport's framework is similar to previous authors in being prescriptive since it advocates that senior managers should engage in "process oriented thinking". Yet unlike the previous studies, the framework places greater emphasis on perceiving business activities as a series of interrelated processes, with the recommendation that firms should

examine their processes to eliminate or develop new processes. “One of the attractions of process innovation is that recent developments in information and communications technologies have led to functional integration between and within companies, suppliers and customers” (Hlupic, 2003, p. 39). Process innovation has spurred a practitioner led movement barely over a decade old known as Business Process Management (BPM) (Lee & Dale, 1998).

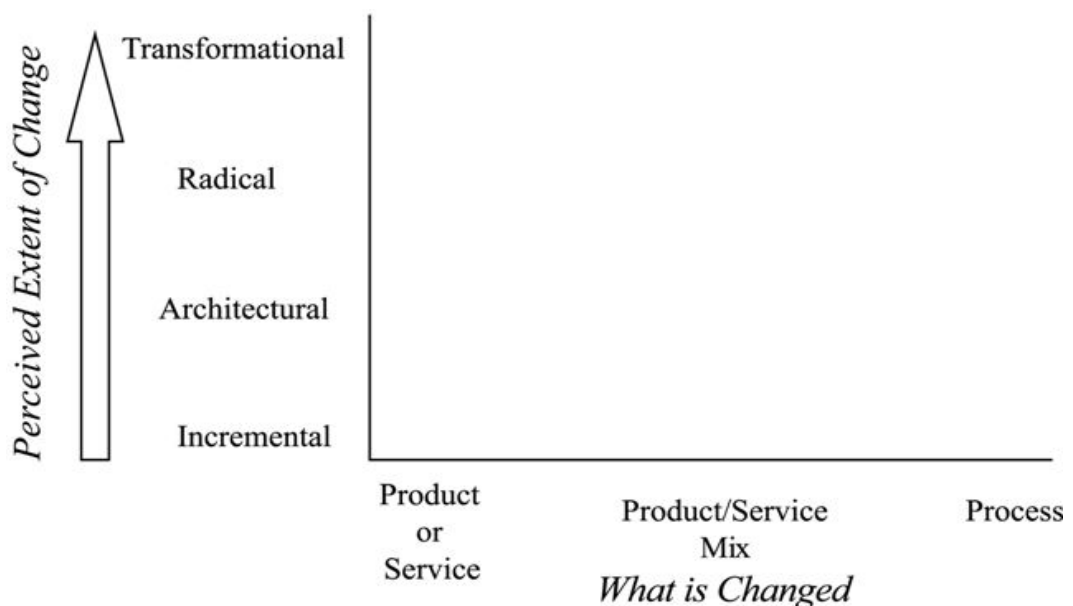
Business model innovation is a more recent movement but early indications are that it delivers significant results. In 2006, IBM conducted a world-wide survey involving 765 corporate and public sector leaders around three types of innovation: (a) product, services and market (go live to market activities); (b) operations (improving the effectiveness and efficiency of core processes and functions); and (c) business model innovation (altering the structure and/or the financial structure of the business). The firms were broken into underperformers and out-performers based on operations over 5 years compared to competitive peers. The research concluded that out-performers were placing almost twice as much effort into business model innovation and far less into product and operations innovations than the underperformers. The reasons suggested for this success that global connectivity reduced collaboration and transaction costs and that as a result, out-performers were able to take advantage of the expertise and scale that lay outside their organisations and across the globe. Cost reduction and strategic flexibility were reported as the main benefits by over 50% of the out-performers (Pohle & Chapman, 2006). Business model innovation aligns with the concept of strategic innovativeness – a fundamental reconceptualisation of what the business is all about that, in turn, leads to a dramatically different way of “playing the game” in an existing business. The business model is consistent with other literature suggesting that new forms of interorganisational relationships are becoming more common including joint ventures, networks, consortia, trade associations, and interlocking directorates (Barringer & Harrison, 2000). “Empirical research on strategic innovativeness is extremely limited” (Wang & Ahmed, 2004, p. 306), however the initial findings do provide some support for the role of SCM in supporting innovation.

Most innovation research has been at the level of the firm, with far less attention paid to interorganisational innovation (Elliot & Loebbecke, 2000). A brief description follows of the different types of innovation, as well as analysis of what factors may be at play in the case of innovations involving more than one organisation.



## **Major types of innovation**

Technological innovations comprise new products and processes as well as significant changes to existing products and processes. An innovation has been implemented if it has been introduced to the market (product innovation) or used within a production process (process innovation) (OECD, 1996). Product innovations are broken down into two types, substantially new products (major) and minor improvements (incremental), of existing products (OECD, 1996). Process innovation involves changes in equipment and/or production organisation. Non-technological innovation involves the introduction of advanced management techniques, changes in the structure of the organisation, changes in corporate strategy and of course, a combination of all three (Cooper, 1998). Tidd et al. (2001) developed a framework to examine three types of innovation outcomes across all industries. Chapman et al. (2002) added an additional level called “architectural innovation” which sat between the “incremental” and “radical” levels of the original Tidd et al. (2001) framework to examine innovation in logistics. Figure 2.1 below illustrates the enhanced framework.



**Source:** Adapted from Tidd *et al.* (2001)

**Figure 2.1. Sources of Innovation and Outcomes in Logistics.**

The cause of such change is classified under three distinct headings of product, service or process while the outcomes are measured at four levels. Incremental innovation covers minor improvements but rarely generates any competition. Architectural

innovation is generally characterised by improvements across a supply chain by a reconfiguration of existing assets or process redesign to improve either intra or interfirm supply chain processes to deliver products faster, at superior quality or to a wider range of markets (Henderson & Clark, 1990). Radical innovation is associated with very large step improvements in product or process often as a result of a large investment in new technology. The least common of the four is transformational innovation, which represents change on such a scale as to completely alter the nature and structure of an industry and even society itself.

The literature has tended to concentrate at the level of the firm with regard to impacts and antecedents of innovation (Burns & Stalker, 1961; Lorsch & Lawrence, 1965; Lawrence & Lorsch, 1967; Oakey, 1991). Few studies have focussed on both firm and industry level change (Baum, 1996; Cohen & Klepper, 1996).

Many studies relate innovation to the business size of manufacturing firms (Acs & Audretsch, 1991; Baldwin & Scott, 1987; Scherer & Ross, 1990) and generally report a positive effect between firm size and innovation activity. Reasons given for this relationship are firstly, that capital market imperfections are a source of competitive advantage for large firms and help sustain the relationship between size and innovation. Secondly, firm size positively influences research and development (R & D) projects (Yin & Zuscovitch, 1998). Other innovation literature tends to refute this relationship, arguing firm growth can result in decreased efficiency in R & D activities because of loss of management control (Scherer & Ross, 1990). Also, other studies have shown that small firms can achieve high innovation rates in relation to size, and this may in part explain why large firms often choose to outsource (Acs & Audretsch, 1991). Generally, there has been far less research done on innovation in service firms of all sizes (Arais-Aranda et al., 2001; Gadrey et al., 1995). SCM often involves service components such as third party logistics providers (van Hoek, 2001b).

### **Operating context for generating innovation**

Why and how firms choose to work together to generate innovation has not been extensively studied. One example is Bozdogan, Deyst, Hault, and Lucas (1998, p. 168) who suggest that “the co-operative customer-supplier relationships most conducive to the fostering of architectural innovations are those that are, at the core, characterized by shared responsibilities in design and configuration control, within a virtual team environment”. Additionally, Bruce and Moger (1999) suggest incremental innovation as

the least disruptive and the form most likely to emerge through copartnership networks. However, they warn such arrangements may exclude radical opportunities from outside the network because of the focus and effort needed to make such arrangements work.

The R & D literature offers rational economic reason why firms enter into partnerships, especially in regard to product innovation. R & D “is central to the development of markets and achievement of competitiveness” (Bonaccorsi, Pammilli, & Tani, 1999, p. 65). Radical innovation in products is rare compared to the effort. Therefore, it is rational even for large firms to reduce the considerable associated risks and costs so they can innovate in both an effective and efficient manner (Blaydon, Keogh & Evans, 1999). Radical innovation in products is so random that it is unlikely to emerge from a calculated patterned response to collaboration. Powell (1998, p. 288) argues “when uncertainty is high organisations interact more, not less, with external parties in order to access both knowledge and resources. Hence the locus of innovation is found in networks of learning rather than individual firms”. Bonaccorsi et al. (1999) provide some empirical evidence that there are limits to the types of innovation that can emerge from such arrangements. Innovative networks also generate some disadvantages including increased dependency for weaker partners and concomitant dominance of the stronger, higher coordination costs, increased management time and potential loss of secrecy over innovative developments (Biemens, 1992). Generally new and complex governance arrangements are required to manage such risks. Japanese firms appear to use strategic business communities and *keiretsus* where firms are independent in function but the network in which they interact also has overlapping ownership arrangements (Kodama, 1999). The strategic alliance literature shows empirical support for firms increasingly entering into joint ventures, partnerships and strategic alliances in order to generate innovative ways to improve shareholder wealth (Bidault & Cummings, 1994; Elmuti & Kathawala, 2001; Ireland, Hitt, & Vaidyanath, 2002; Stuart, 1997).

Small firms typically lack the specialist resources needed for innovation and therefore need to acquire them externally. “Management of interorganisational relationships, and networking in general may well be critical for successful innovations by small firms” (Dickson & Hadjimanolis, 1998, p. 5). The role and importance of social networks is a recurring theme in the innovation literature, not only in terms of stimulating creativity but also in imitation which works on the diffusion of ideas (Rogers, 1995). Without the intellectual, social and human capital within the firm, new product processes and ideas cannot be easily diffused into the firm, as adaptation to the firm’s specific

design, structure and needs generally still requires creativity and effort. Culture has repeatedly been found to be a critical factor in the successful implementation of new ideas and technology (Andriopoulos, 2001; Roffe, 1999; Steel & Murray, 2004). Researchers are therefore increasingly interested in exploring and identifying the enabling ecology or operating context in which innovation occurs (Baptista, 1999; Dvir & Evans, 1998; McElroy, 2000; 2002).

The operating context in SCM clearly involves working with other organisations. The number of other partnership firms with which a focal firm should join to generate innovations is unclear and may vary across industries. Powell (1998) claims “successful firms position themselves as hubs at the centre of overlapping networks, stimulating rewarding research collaboration among various organisations to which they are aligned and profiting from having multiple projects in various stages of development” (p. 229). Powell goes on to argue that firms should build long-term relationships with numerous partners based around a series of sequential and thematic projects. However, such relationships are far more likely to emerge with high-technology firms developing specialised sophisticated components of high value to the focal firm, than with firms using routine technologies. The benefit of having such a positioning strategy is that “heterogeneity and interdependence are greater spurs to collective action than homogeneity and discipline” (Powell, 1998, p. 230). Such a strategy appears at odds with the lean manufacturing literature which favours close long-term relationships with fewer firms.

Industrial clusters as postulated by Porter (1998) provide another view on interfirm activities which generate innovations. These clusters are concentrations of expertise among closely linked industries and companies in which extensive investment in specialised factors of production triggers a positive growth spiral. Clusters have been applied most consistently to regional and economic development policies and programs (Corso, Martini, Paolucci, & Pelligrini, 2003; Hill & Brennan, 2000; Kempainen & Vepsalainen, 2003). There is mounting evidence that clustering and networks helps small and medium-sized enterprises to raise their competitiveness (Dickson & Hadjimanolis, 1998). The European Union has policies in place to develop megacorridors or euro-corridors which are designed to exploit the cluster concept, albeit in a slightly different way, in order to generate growth (CEC, 1999). Sohal, Perry and Pratt (1998) have indicated that Australian research has identified four drivers in the evolution of clusters. These are restructuring (working more efficiently and effectively); reengineering

(changing means and focus of production; mutating (creating a new hybrid) and coevolving (fusion between technology fields). These four factors interact upon each other in nonlinear ways, thereby altering the clusters over time.

### **Models of innovation**

The linear model of innovation (Arrow, 1962) which dominated research for much of the last century “is almost a fiction” (Sanchez, Chaminade, & Olea, 2000, p. 312) as it assumes a distinct chain of events from concept through to implementation (Gadrey et al., 1995). This model was largely restricted to technological innovation and tended to ignore the interactive model of innovation (social and technical) that is much closer to reality (Kline & Rosenberg, 1986). Innovation literature tends to be dominated by two bodies of literature: the theory of technical change and human capital theory. Technical change mainly has focussed on R & D activities but more recent studies suggest that the innovation process has more to do with the recombination of existing knowledge than with the creation of brand new knowledge through R & D (Ducharme, 1998; Freeman, 1986; Pavitt, 1984). This topic is covered elsewhere in this review under organisational learning and associated activities such as knowledge management and intellectual capital.

Mature industries, such as those selling commodities, often tend to use routine technologies and therefore their product innovation is frequently low. Nonetheless, such firms enter partnership arrangements with other firms in order to generate process innovation particularly where there are decreasing profit margins. For example, profits in the oil and gas supply chains have been squeezed so tightly as to necessitate large scale improvements (Blaydon et al., 1999). The logic of this strategy is discussed under core competency and outsourcing literature in this review.

Innovation is a complex topic in its own right. While many disciplines have explored innovation it has been most extensively theorised in the economic and sociological literature. Despite present day differences, both disciplines have been concerned with developing theories for rational economic action. Weber’s (1930) economic sociology described the “ideal type” of rational economic action from a managerial perspective. Economic theorists have been increasingly drawing insights from sociological perspectives in order to develop more “real world” analysis of “value adding” in supply chains. The two theories have demonstrated increasing convergence around innovation generated through interorganisational activities. Granovetter’s (1985) work demonstrated that firms are not isolated islands but embedded in socioeconomic

networks, regardless of whether or not they are engaged in innovation. Jarillo (1988) argued that network relationships that are intentionally managed and developed will have a more noticeable effect on innovation than a less intentioned and more informal network. Sociologists tend to define innovation as a matter of change in organisational practice which several or all stakeholders believe represents some form of improvement. Under this definition, SCM is itself an innovation which has the potential capability to deliver advances such as process improvement efficiencies, new product offerings and new markets with either existing or new services or products. Desbarats (1999) uses the term “the innovation supply chain” (p. 7) to describe a way of organising, managing and improving what is seen as an existing reality. The rest of this literature review therefore does not seek to explore innovation per se, as it is accepted that SCM is an innovation. The focus now moves to the various theories, disciplines and historical factors which have influenced and shaped SCM.

## **2.2.2 Supply Chain Management**

### **(a) History of Supply Chains**

#### **Defining SCM**

Despite numerous literature reviews aimed at defining SCM (Lamming, Thomas, Zheng, & Harland, 2002), little consensus has been reached (Svensson, 2002). Kathawala and Abdou (2003) argue supply chain definitions come largely from a manufacturing framework and can be placed on a scale ranging from quite simple through to very complex concepts. Simple concepts focus on the flow of information and materials to and from customers and suppliers in order for suppliers to get closer to customers and improve profitability. Such definitions are so simple that they could be applied to any industry without adjustment. Many authors claim the traditional linear pipeline metaphor associated with SCM does not accurately reflect the wider and richer range of complex concepts involved. This group have opted to use terms such as value networks (Gadde & Hakansson, 2001), virtual value chain (Christopher, 1992; Rayport & Sviokla, 1995), virtual enterprise (Berry, Evans, Mason-Jones, & Towill, 1999), value chain (Ensign, 2001; McGinnis & Kohn, 1998), and value net (Bovet & Martha, 2002). Distinguishing features of definitions, which are richer in concept, include greater emphasis on the role “soft” issues play in activities such as collaboration, trust and innovation; sustainable competitive advantage; and core competencies.

Mentzer (2001) argues that the definitions of SCM can be classified into three categories of a management philosophy, the implementation of a management philosophy and a set of management processes. New (1997) claims the use of the term “supply chain” is neither consistent nor straightforward but that three dominant meanings exist. These are: supply chain from the perspective of an individual firm; an individual product; and finally, a handy synonym for purchasing, distribution and materials management. Kathawala and Abdou (2003) provide an apt summary on definitions when they conclude that the term SCM “has been poorly defined and there is a high degree of variability in people’s minds about what is meant” (p. 141). There have been attempts to develop typologies of supply chain configuration in order to reduce confusion over terms and thereby enhance research which can more easily build on previous work (Lejeune & Yakova, 2005).

### **Historical Developments**

Historical analysis suggests the term SCM also appears to lack consensus as to its origin. Cox (1999) claims SCM evolved from the Japanese management of the 1970s, primarily in the auto industry and was later known as “lean manufacturing” (Womack, Jones, & Roos, 1990). Lean principles were pioneered by Toyota and included other key techniques which came to be associated with SCM such as “just in time” (JIT) and partnerships sourcing (Whiteoak, 1994). New manufacturing techniques, especially from Japan, provided the means to deliver enhanced economic benefits. In the period 1946 to 1968, Japan had transformed itself from a state of postwar ruin to the second largest economy in the western world. Post-1945, large Japanese firms were in such disarray that they could no longer continue with the practice of making everything in-house. Instead, they developed a system of subcontracting work out to small and medium firms, and maintaining long-term relationships with them in order to facilitate production (Nakamura, 1989). In a drive to replicate such success, Japanese management principles were rapidly taken up in the west over the same period as evidenced by the rise to world status of total quality management (TQM) gurus such as Deming and Juran. The diffusion of Japanese management practices and principles embodied in concepts such as process management, JIT and lean manufacturing have, to varying degrees, been globally diffused and are now standard concepts in SCM.

Lamming (1993) links SCM with lean manufacturing and delivering innovation. Christopher and Towill (2001) argue lean manufacturing only leads to one type of supply

chain and that its principles could be traced back to 1915 in the US. Others (Lummus, Krumwilde & Vokurka, 2001) claim SCM evolved from logistics strategies developed back in the 1960s which identified the interdependencies of the material flow process, the problem of optimising the individual functions at the expense of the overall system, and the lack of coordination among logistics functions. Numerous authors cite the seminal work that Jay Forrester (1961) and to a lesser extent Jack Burbidge (1983) did in the 1960s as giving “birth” to SCM. The “Forrester effect” refers to amplification of materials in supply chains due to poor information while the “Burbidge effect” refers to the “noise” caused by multiphase ordering (Fransoo & Wouters, 2000; McCullen & Towill, 2002). Forrester’s work was built on control theory but subsequently also helped highlight the strong link between operations management and systems theory. Sterman (1989) made a significant contribution by developing the mathematical models to support Forrester’s work. Scott and Westbrook (1991) built upon this work to try to smooth the fluctuations in materials flow at the interfaces between channel actors. Lee, Padmanabhan and Whang (1997) further advanced Sterman’s work and coined the term “bullwhip effect” which is now most commonly used to refer to the Forrester effect. Nearly 50 years on, the bullwhip effect has still been found to be a major source of expense in supply chains across most industries with empirical evidence found with machine tools (Fine, 1998), retail products, (Holmstrom, 1998) and packaged meals (Fransoo & Wouters, 2000). As distortion in information is seen as the main cause of the bullwhip effect, many writers suggest modern IT, with its ability to provide real time information, is the best solution to this and an associated range of problems in SCM (Li, Lin, Wang, & Yan, 2006).

### **The role of IT in SCM**

Advocates of IT in SCM often imply that technological determinism is the historical cause of SCM. Technological determinism is a term “often used to describe the hypothesis that technology is the force that shapes irrevocably the way we work” (Ettlie, 2000, p. 14). Technology is defined as “the theoretical and practical knowledge, skills and artefacts that can be used to develop products and services as well as their production and delivery systems” (Ettlie, 2000, p.14). Technological determinism is supported by arguments around the introduction of technology which has resulted in discontinuous change (Christensen, 1997). Technology can be embodied in people, materials, cognitive physical processes, plants, equipment and tools (Brugelman, Madique, & Wheelright,



1996). Technological determinist theory is refuted by process management methodologies such as the sociotechnical design school and workplace redesign (Betz, 1998). Jacobs (2001) argues that this view discusses technology as being autonomous and that the theory describes a reality where technology influences us rather than us influencing technology. Still others take an interactive view between technology and social systems (Tushman & Rosenkopf, 1992; Williams & Edge, 1996).

The logical extension of this theory is found in electronic commerce (e-commerce) which many claim is fundamentally changing the way in which business and society operate, overriding traditional geographical barriers, and enabling business to business (B2B) and business to commerce (B2C) operations (Darch & Lucas, 2002), traditional organisational functions such as marketing (Driver & Louvieris, 2002) and in how government does business and provides services to citizens (Saxena, 2006). “In logistics and supply chain management, information technology (IT) innovation has become pervasive in everyday practices” (Russell & Hoag, 2004, p.102). The recurring argument is that the capability of such technology to instantly share information across space and time has liberated supply chains inefficiencies such as Forrester’s bullwhip effect which manifests in variables such as excessive over- and understocking and increased capacity which is then underutilised (Cachon & Fisher, 2000; Chen, 1999; de Búrca, Fybes, & Marshall, 2005; Kwan, 1999; Lee et al., 1997; Lehtonen, Småros, & Holström, 2005; Mason-Jones & Towill, 1997; McLaughlin & Motwani, 2003; Sanders & Premus, 2002; van Hooft & Stegrave, 2001).

A common example offered in support of technological determinist theory is e-commerce. E-commerce embraces the ability to exchange information with partners and customers, and includes the adoption of supply chain management tools (Lefebvre, Cassivi, Lefebvre, & Leger, 2003; Noekkentved, 2000). Cassivi (2006) uses the term “e-collaboration” and argues that the supply chain environments continuously evolve and now use electronic collaboration tools to manage and execute complex supply chain activities. With sophisticated e-commerce and collaboration tools, firms share information and collaborate with partners to support supply chain activities (Geary & Zonnenberg, 2000). Much of the literature suggests, to varying degrees, that there is a direct link with innovation and IT in supply chains (Al-Mashari & Zairi, 2000; Badii & Sharif, 2003; Bendoly & Schoenherr, 2005; Biehl, 2005; Cassivi, Leger, & Hadaya, 2005; Chey, Fan, & Lo, 2003; de Búrca et al., 2005; Franks, 2000; Møller, 2005; Oliver et al., 2003; Tarn, Yen, & Beaumont, 2002). Australian research of 962 companies on new

product development found that while appropriate utilisation of technology was an important factor, innovation was seen to be more closely associated with a participative management style (Power, Sohal, & Rahman, 2001). For information to be of worth in a supply value it must quickly be collected and aggregated. Franks (2000) claims that tools such as electronic procurement (e-procurement), electronic auctions (e-auctions), electronic market places and supplier development, certification and performance measurement programs may be ways to stop relationships becoming stagnant and therefore still continue to generate improvements.

While there is high agreement around the benefits of Information and Communication Technology (ICT) in SCM there is a far wider range of views as to how effective the application of such technology has been to date. Reasons given for ICT's inability to meet its full potential in SCM include resistance to the adoption of Electronic Data Interchange (EDI) (Suzuki & Williams, 1998); poor EDI diffusion due to sociopolitical processes (Ramamurthy, Premkumar, & Crum, 1999); the need to use open EDI to increase interorganisational integration (Prosser & Nickl, 1997); the complexity associated with integrating all aspects associated with customers and suppliers such as technology, communication channels, time and social/organisational systems (Chan & Swatman, 2000); the lack of electronic supply (e-supply) chains (van Hoek, 2001a); failure to recognise the network implications and use ICT to reengineer accordingly (Lambert & Cooper, 2000); poor appreciation of how to use the internet technology to establish a competitive position (Porter, 2000); inadequate information and decision support systems (Muckstadt, Murray, Rappold, & Collins, 2004); poor quality data (Raman, DeHoratius, & Zeynep, 2001; Reid & Catterall, 2005); restricting technology to the demand side of the supply chain (Power, 2004a); lack of reflection on how ICT and globalisation are changing supply chains (Leek, Naude, & Turnbull, 2003); the growth in ICT has not yet affected the management of relationship and hence the sluggishness of reforms in SCM; current limits of demand chain theory in an extended enterprise (Williams, Maull, & Ellis, 2002); inappropriate cultural accountabilities (Stewart & O'Brien, 2005); failure to understand how ICT alters business relationships (Leek, Turnbull, & Naude, 2003); misalignment of enterprise resource planning (ERP) implementation to competitive strategy (Hsiuju & Chwen, 2004; Yen & Sheu, 2004); lack of sophistication in using the theory of constraints (TOC) (Goldratt, 1990) with ERP implementation (Ioannou & Papadoyiannis, 2004); poor understanding of the absorptive capacity needed to generate user engagement and satisfaction of enterprise resource

planning systems (ERPS) (Galy, 2007); underestimating issues associated with multisites (Markus, Tanis & Fenema, 2000); use of linear, mechanistic ERP strategies inside dynamic nonlinear self organising systems (Lengnick-Hall, Lengnick-Hall, & Abdinnour-Helm, 2004); benefits of such investments acquiring at top of the supply chain (Wyld, 2004); the heavy customisation requirements of ERPSs (Alshawi, Themistocleous, & Almadani, 2004); placing too much faith on the mere presence of ERP and not making the strategic links of B2B (Bendoly & Kaefer, 2004); ERP project failures jeopardising core operations (Huang, Chang, Li, & Lin, 2004); need for management to identify critical elements at each phase of an ERP implementation (Loh & Koh, 2004; Nicolaou, 2004); issues associated with trust (Manchala, 2000); finding the right balance between power and trust (Hart & Saunders, 1997); not addressing associated difficult organisational issues and barriers associated with the required change (Power & Sohal, 2002); concern with security violations and lack of sophistication on how to measure e-risk (Scott, 2004); the need to develop a new paradigm in order to manage the complex and dynamic integration of e-business processes in a way which can take advantage of the next generation of e-business (Segev, Patankar, & Zhao, 2003); not addressing the clear links established between effective management of human resources and effective implementation of e-commerce by engaging in more limited strategies such as only providing training (Power, 2004b); and the lack of understanding of the role deep structures play in ICT implementation (Heracleous & Barrett, 2001).

The major technologies cited as driving e-commerce include, EDI, extranets, enterprise resource systems and the internet. EDI has for a number of years allowed high speed secure communication across such boundaries (organisational, geographical, etc.). For several reasons, EDI has only been adopted by the largest manufacturers (and their suppliers where they have insisted on its use for communication). It seems to have been regarded as too expensive and unfriendly. EDI is being replaced by Web-based information service technologies such as Extranets which can overcome these problems of EDI. "Extranets are a natural evolution, taking advantage of the Internet Infrastructure and previous Internet investments to focus communications to exchange information and share applications with business partners, suppliers and customers" (Dawson, 2002, p. 192). More advanced manufacturing firms are using a combination of "classic" manufacturing software such as ERPs which can integrate quite separate and distinct support systems for activities such as procurement, manufacturing and distribution within a firm. While ERPs are effective at internal integration they are expensive. External

integration is achieved with Web-based technology, for example, Web-based catalogues, e-commerce transactions and payment systems and so on. (Franks, 2000). Electronic connectivity afforded by the Internet is now expected to drastically change supply chain control (Serve, Yen, Wang, & Lin, 2002). It is predicted that innovative companies, termed by American Marketing Research (AMR) as e-supply chain innovators (eSCIs), will gain control by reconfiguring their supply chains, using new Internet technology to connect to trading partners in real time (Del Vecchio, 2000).

The aforementioned shifting patterns in technology suggest that ERPs may have become outdated. Al-Mashari (2002, p.165) claims that “enterprise resource planning systems can be regarded as one of the most innovative developments in the information technology (IT) of the 1990s”. This claim is supported by a wealth of academic and industry literature that concludes that implementing ERPs leads to large process improvements and therefore supports both BPR and SCM (Biehl, 2005; de Búrca et al., 2005; Connolly, 1999; Markus & Tanis, 2000). Conversely, Kallinikos (2004) argues that while ERPs have given organisations better control of everyday operations it may be at the expense of losing other important sources of innovation, exploration and learning that confers them a distinct benefit. The rise of optimistic projections for e-commerce and extended enterprise applications supported by a ten fold increase in B2B transactions in 1997 has given rise to wide speculation that the ERP as an innovation is past its zenith. (Al-Mashari, 2002; Bendoly & Schoenherr, 2005; de Búrca et al., 2005). Yet ERP repeatedly tops the list of themes in major academic IS conferences (Al-Mashari, 2002). An emerging body of literature suggests that rather than seeing ERPs as being superseded, the present decade in the e-commerce revolution has created strategic choices for firms – specifically, to utilise the e-commerce packages developed by ERP vendors or to invest in non ERP packages developed by vendors in the e-commerce space (Al-Mashari & Zairi, 2000; Bendoly & Schoenherr, 2005; Møller, 2005). Biehl (2005) has developed a sophisticated formula to help firms select the right balance between internal (ERP) and external (electronic marketplaces) functionality. The emerging trend around the blending of both technologies in order to better manage future SCM challenges has been named ERP II (Beheshti, 2006). The term describes a strategy which is credited as being coined by Gartner Research in 2000. The strategy involves building customer and shareholder value by enabling and optimising enterprise and interenterprise, collaborative-operational and financial processes. AMR spoke of a similar concept with the term enterprise commerce management (ECM). Since the 1990s, software developers

have created ERP/ERP II software, a fuller suite of applications capable of linking all internal as well as interorganisational processes (Beheshti, 2006). “Today all the major vendors (ERP) have adopted the ERP II concept” (Møller, 2005, p. 489) and continue to develop capabilities to reach out into internet, web and portal technologies. The ERP II strategy which Møller (2005, p. 448) describes “is essentially componentized ERP, e-business and collaboration in the supply chains” appears to be a rapidly growing movement.

Empirical support for the ERP II concept is suggested by Bendoly and Schoenherr’s (2005) study of 61 firms which found that ERPS implementation can facilitate and increase the effectiveness of e-commerce projects, such as B2B e-procurement. Worely, Castillo, Geneste, & Grabot (2002, p. 161) claim that “industrial information systems are nowadays mainly implemented through Enterprise Resource Planning (ERP) systems”. ERPSs are the most widely used IT infrastructure to facilitate the flow of information between supply chain processes in an organisation (Al-Mashari & Zairi, 2000). SAP R/3 has emerged as the dominant leader in ERPSs and is now one of the most widely used tools to re-engineer supply chain processes (Keller & Teufel, 1998). Biehl’s (2005) theoretical formula on the cost benefit analysis of both systems also suggests the greatest benefits accrue from an integration of both. Okrent and Vokurka’s (2004) comment on the true cost of ERPs also supports the case for integration rather than separation of technology when they make the point that

ERP does not come without a price. That price includes, in most cases, an extensive IT (information technology) infrastructure. Because most of the transactions are near real time, a reliable Intranet or local area network/wide area network (LAN/WAN) needs to be in place.... In addition to the communication backbone (LAN/WAN), PC workstations and printers need to be available to all employees that need to access or enter information. Or require hard copy output. (p. 693)

A notable counter example to the suggested ERP II trend is offered by one of the most frequently mentioned examples of a supply chain innovator – Dell. In 1994 Dell implemented a SAP R/3/ project only to abandon it 2 years later and replace it with their “G2 strategy” based on open, flexible architecture and enterprise application integration (EAI) middleware strategy. Other examples of large leading firms aborting ERP implementations include Allied Waste and Applied Materials while FoxMeyer attributed

its bankruptcy to a failed ERP implementation (Beheshti, 2006; Møller, 2005). While such failures will continue to impact on SCM through the growing interest in loose coupled and network oriented perspectives (Christopher, 1998), in the short-term at least “there are no signs that the enterprise is giving up on their corporate ERP strategy” (Møller, 2005, p. 494). An historical analysis of the development path and future trajectory that ERPs appear to be taking tends to support the merging technology view and the view that ERPs will continue to have strong links in the evolution of SCM.

It is widely accepted in the literature that ERPs evolved from Materials Requirements Planning (MRP) systems in the 1970s to MRPII in the 1980s to ERPs in the 1990s. (Beheshti, 2006; Møller, 2005). An ERP is much more than a MRP because it encompasses all the resources within a firm including product design, information warehousing, material planning, SCM, capacity planning, human resources, finance, accounting, and web-front sales management to form an enterprise system (Ptak & Schragenheim, 2004). Newell and Huang (2004) claim that many possibilities of an ERP system emerge from its potential to combine information across processes that have traditionally been independent especially in highly diversified and geographically dispersed organisations. Mason and Ragowsky (2002, p. 161) found empirical support in manufacturing companies for the widely held view that “information systems (which) are known as ERPs” can generate substantial reductions in inventory holding costs by minimising the amount of inventory, reducing working hours, and lowering response time to market demands. Imra, Murphy and Simon, (2000) claim that ERPs have been developed in response to the need to manage across global businesses. Swenseth, Southard, & Lee (1999) claim the origins of ERPs emerged from an interest in developing IOSs, rather than intraorganisational systems. Davenport and Brooks (2004) argue that early ERPs were not primarily focussed on the supply chain, but rather that the businesses that were able to extend their enterprise systems into the supply chain with “bolt on” SCM systems have experienced substantial benefits.

ERP systems have traditionally been used by capital intensive industries but are now moving into other industries. ERPs are now considered the standard technology upon which, many organisations are operating their business (Al-Mashari, 2002) and industrial information systems are mainly implemented through ERP systems (Worley et al., 2002).

Wood and Caldas (2001) conducted a study on why firms persevered with ERPs given their high cost and failure rates and concluded that most respondents seemed to agree that there was no alternative to the ERP trend. Having embedded an ERP system

into an organisation makes switching costs so expensive as to also favour integrating with emerging technologies. Such embeddedness and integration add to the ERP cost which includes, in most cases, an extensive IT infrastructure. Kallinikos (2004) takes the complex tangle of technological interdependencies even further arguing that each component of technology is embedded in a complex network of other technologies, commercial interests and social practices external to the organisation. The dichotomous Web versus ERP split therefore appears overly simplistic and at odds with some empirical, theoretical and technological findings. An integrated perspective which sees ERPs as an integral part of the ICT equipment used in SCM therefore seems more relevant for SCM analysis.

Since the 1990s, most industries have invested heavily in information technologies such as ERP systems. An AMR research study (Carlino, Nelson, & Smith, 2000) projected that the ERP market would reach US\$79 billion in 2004. Just what impact, if any, the information revolution has had on society as a whole, let alone SCM, is an area of intense speculation.

What characterises the current technology revolution is not the centrality of knowledge and information, but the application of such knowledge and information to knowledge generation and information processing/communication devices, in a cumulative feedback loop between innovation and the users of innovation... For the first time in history, the human mind is a direct productive force, not just a decisive element of a production system. (Castells, 1996, p. 32)

Castells (1996) views IT as a transformational innovation and supply chains are but one of many activities which have subsequently changed. SCM is now able to link the creativity of the social system through IT such as the World Wide Web (WWW), and portals which provide the means of spanning organisational boundaries in a “seamless supply chain” (Towill, 1997, p. 38) and, as a result, generate more innovations at a faster rate.

### **Work Place Design**

“The importance of knowledge integration to innovation processes has been made explicit in a number of literatures” (Hislop, 2002, p. 160). A number of studies have conceptualised the innovation process as involving the integration of external and internal knowledge. In particular the ability to identify and utilise external knowledge (Alter & Hage, 1993; Ebers & Jarrillo, 1997; Galy, 2007; Koza & Lewin, 1998; Powell, 1998,

Tidd et al., 1997). Modern developments suggest that the global expansion of large organisations has created the “problem” of managing dispersed knowledge. Some literature suggests an organisation is not a coherent entity and can be more accurately represented as a distributed knowledge system (Blackler, Crump, & McDonald, 2000), and that the knowledge base is likely to be somewhat segmented due to the diversity of specific contexts within which, and activities through which, knowledge in organisations develop (Becker, 2001). Combining fragmented organisational knowledge is of growing importance and urgency as a result of empirical changes in the structuring of organisations (Becker, 2001). Recent innovations in structuring of organisations such as the move toward networking and virtual forms, can be seen as an attempt to induce what Fenton and Pettigrew (2000, p. 24) call the “decline of the rigid compartmentalism”, through transcending traditional business boundaries and facilitating greater levels of intraorganisational knowledge. (Castells, 1996; Jackson, 1999). However, some recent theoretical developments suggest that knowledge bases are highly fragmented, diffused and dispersed (Grant, 1996; Touskas, 1996), being made up of diverse, but interrelated communities of knowledge (Brown & Duguid, 1998) and that the knowledge is inseparably embedded in the specific local activities that individuals and work groups undertake (Baumard, 1999; McDermott, 1998). These theoretical developments suggest there may be severe limits to how much knowledge can be transferred in social networks using ICT (Maguire & Redman, 2007). For if “tacit knowledge is embedded in physical and cybernetic structure in routines, and in connectivity provided by physical lay out” (Hall, 2006, p. 181) then the role of space design in innovation and SCM cannot be so easily swept aside by advances in ICT.

Space design has been inhibited by the lack of a theoretical framework for analysis and the use of the most basic and mundane measures of productivity (Haynes & Price, 2004). Cairns (2003) suggests that the major problem in developing a comprehensive theory of knowledge of the workspace has been the lack of engagement at a meaningful and theoretical level between physical space and organisational behaviour (OB) and that “there is currently a lack of any wide consideration of the physical context of work within organizational theory” (p. 96). Cairns suggests that studies such as Mayo’s Hawthorne study and the diffusion of innovation studies lead to the wide acceptance that social factors are more important determinants of employee satisfaction and productivity than the physical environment. He concludes that the research methods used to date have not helped theory development and that “if we are to develop a theory of the workplace, it



must be one that embraces the different socially constructed realities” (Cairns, 2003, p.103). More recent writers have given greater acknowledgement to the physical environment. Herzberg’s (1966) theory places the physical environment as a hygiene factor, in a dichotomous relationship with social/psychological motivators. Gagliardi (1992) argues that physical features of an organisation serve symbolic and expressive purposes as much as instrumental ones. He suggests that organisational space provides benchmarks for organisational knowledge in that it evokes images, sensations, memories and thoughts in the people who work and live in such space, as well as control over people through artefacts which work at the sensory and subliminal level. Cairns (2003) poses an interesting question by asking of the literature’s claims that knowledge is the basic currency of contemporary life, that interaction plays a big part in the creation of that knowledge and that interaction is affected by physical space, then “why so little effort?” (Cairns, 2003, p. 95).

It is claimed that an employee’s workplace accounts for 24% of job satisfaction and can effect staff performance by up to 5%. There is already a considerable body of evidence linking poor workplace design to lower business performance and higher stress levels and conversely that good workplace design can enhance high performance (Becker & Steele 1995; 1990). It has been estimated that by 2006 30% of the world’s top companies will have adopted a highly mobile work style model with 35% having a workforce located outside the boundaries of the conventional office (British Council for Offices, 2005). It is widely accepted that “cross-functional communication, by means of internal communication or cross-functional teams, enables people to become involved in all parts of the organisation and makes innovation useful to everyone” (Nonaka & Takeuchi, 1998, p. 230). Such communication is supported by, among other things, workplace design. The emergence of a new mobile work force no longer bound by space and time raises many, as yet, unanswered questions about what future workplace design will support the social communication needed for innovation.

### **Integration movements in SCM**

The IT and systems literature suggests organisations have been seeking operational and strategic benefits through improved business efficiency. More detailed research into the most expensive form of such technologies – ERPs – found intangible benefits including internal integration, improved information and processes and improved customer service. Tangible benefits being sought related to cost efficiencies in inventory,

personnel, procurement as well as overall productivity, cash order management and overall productivity (Irving, 1999; Jenson & Johnson, 1999). Such goals are generic to most businesses and SCM literature claims to deliver similar outcomes.

While some writers seek to make a link, no conclusive evidence of a clear aetiology appears to exist. A fairer assessment is that IT developments have greatly enhanced potential supply chain capabilities (Shapiro & Varian, 1999). Research findings are contradictory on how well such potential is realised. The META Group (1999) found negative returns on ERP investments of US \$1.5million per firm. Other studies (Benchmarking Partners, 1998) reported better than expected results in overall productivity. Irrespective of the conflicting results, firms are expected to continue making massive investments into such systems (Kraemmergaard & Rose, 2002).

It was not until the 1990s that the term SCM captured the attention of senior managers in numerous organisations (Coyle, Bardi & Langley, 2003). By the 1990s, total integration was seen as the next logical step as it would drive down costs even further, improve customer service and assist in developing long-term sustainability. While the vision of total integration had existed for decades, most theorists claim the reality was made possible by the revolution in IT. New telecommunications and computer systems made it possible to link suppliers, manufactures, distributors, retail outlets and customers with real-time information across the entire supply chain, irrespective of location (Christopher, 1992; Handfield & Nichols, 1999). Numerous studies have provided some empirical support for the benefits of an integrative capability (Vickery, Jayaram, Droge, & Calantone, 2003; Zailani & Rajagopal, 2005). This capability is believed to enhance creativity in decision-making (Ford & Gioia, 2000). Alterations around the physical design of buildings, offices and workspaces in line with the new IT are also seen as beneficial (Heiskanen & Hearn, 2004). While correlation is not proof of causation, the emergence of SCM as a distinct body of activity has coincided with the rapid uptake of information technologies by major organisations worldwide.

### **The influence of global reforms on SCM**

SCM also coincided with sweeping global political economic reforms which took shape in the 1980s. This line of reasoning highlights that the “central role of innovation both at macroeconomic and microeconomic reform levels is now well established” (Poolton & Hossam, 2000, p. 795). Globalisation literature has argued that the social and political reforms commonly defined under the term “Neo Liberalism” in the west, but

including Perestroika in the former Soviet Block, combined with various free trade agreements provided a catalyst for a range of innovations of which SCM was one. While such reforms may have assisted SCM, the whole phenomenon may have started earlier. From the 1960s through to the 1980s organisations worldwide were integrating inbound logistics functions in order to reduce costs and improve overall control. Coyle et al. (2003) suggested the chronological development commenced in the late 1960s when companies started to address the fragmentation of the various factors of production such as production planning, warehousing, materials handling, inventory holdings, transport and order price. By the 1970s, Bowersox (1978) had spoken about the unification of logistics functions.

The 1980s saw the methods applied to the inbound supply chain mirror-imaged to the outbound logistics for basically the same reasons associated with economic efficiency. Integration mergers and acquisitions were also starting to increase in intensity, especially as governments either sold off or corporatised many of their utilities and agencies. SCM emerged at the time of the liberalisation of markets, which resulted in greater market competition. Integrating customer requirements into outbound logistics not only replicated the benefits gained from inbound logistics but also provided a platform from which to address the pressures from increasingly discerning and demanding customers (Desbarats, 1999). As a result, many industries appeared to have adopted SCM at around the time they moved from “push” to “pull” strategies.

Several potential fallacies with this historical analysis include omission of critical variables, the most common in historical analysis - *post hoc ergo sum* - the chicken and egg dilemma whereby emerging management theory was either developing from new approaches or simply a retrospective rationalisation. Finally, how the aforementioned variables such as understanding the bullwhip effect, technology, and political and economic reforms effected SCM is difficult to determine. What does seem apparent is that because SCM involves a vast array of activities its historical development has been shaped by a wide variety of influences.

## **(b) SCM Theories**

### **Competitive Advantage of the Firm Theories**

SCM is frequently claimed to be key to sustainable competitive advantage. Of the authors who define competitive advantage, the majority tend to locate their arguments within three major theories – transactional cost economics (TCE), the resource-based

view (RBV) also known as resource-based theory (RBT) of the firm and, more recently, organisational learning (OL) (Amundson, 1998).

### **Transaction Cost Economics (TCE)**

TCE reasoning dominates the SCM literature and often overlaps with the outsourcing literature (McIvor, 2000). The conceptual basis for outsourcing is Williamson's (1975) theory of transaction cost analysis. TCE argues that the goal of the firm is to ensure maximum efficiency by minimising the costs of its transactions or exchanges. This is achieved by the firm's governance mechanism that determines whether to "buy" transactions (in an external market) or to "make" in-house (Williamson, 1993). Between these two extremes it is conceded that asset specificity may lead companies to enter into bilateral arrangements which involve a range of long-term cooperative agreements, referred to by many under the term SCM. The prime motive of such arrangements is to avoid excessive investment to obtain the lowest unit cost (Doig, Ritter, Speckhals, & Woolson, 2001).

A criticism of TCE is that while it is acknowledged that transaction costs occur in social networks, such costs are seen as embedded and are largely ignored (Dasborough & Sue-Chan, 2002). However, social forces such as trust do influence the cost of economic exchanges (Barney & Hesterly, 1998). TCE also appears to be so general that it can be merged into other theories. For example, it has been used to justify the "core competencies" theory of Prahalad and Hamel (1990) as well as Porter's (1985) value chain approach. Explanations of both these theories follow. The SCM literature overwhelmingly discusses its aim in capitalist terms of shareholder wealth creation (New, 1997). The inherent logic of TCE provides a logical analytic framework to support such an aim and, therefore, may well explain why TCE is so pervasive in SCM literature.

### **Resource-based theory**

The RBV of the firm has arisen primarily out of the strategic management literature and also goes under other titles, most notably core competencies. The RBV view holds that firms are bundles of resources that have the potential to provide competitive advantage and, in some cases, sustainable competitive advantages. A resource is defined as all assets, capabilities, organisational processes, attributes, information, knowledge, etc., controlled by a firm that enable it to conceive and implement strategies that improve its efficiency and effectiveness (Wernerfelt, 1984a; 1984b, Armistead, 1999). In an attempt to avoid the criticism of resources being so

vaguely defined as to be tautological, other researchers have proposed more precise subcategories of resources ranging across financial, technological, human, reputation and organisational areas (Amundson, 1998). This theory is often used to justify SCM with the basic argument that organisations create the greatest long-term value by focussing on their core competencies and relying on using the superior core competencies of other organisations for all other activities. It is argued that the real sources of competitive advantage are to be found in management's ability to consolidate corporate-wide technologies and production skills into competencies that empower individual businesses to adapt rapidly to changing business opportunities. Prahalad and Hamel (1990) directly challenge TCE theory by arguing a purely economic analysis may lead a firm to outsource its core competency and thereby lose its long-term competitive advantage.

Porter's value chain analysis, with its emphasis on market and industry structure as the source of competitive advantage, has dominated strategy. Such industrial economic-based frameworks have been criticised on the grounds that firms in the same industries with the same attractiveness perform differently and even if they have different levels of attractiveness, they often perform the same. The lack of explanatory power of the dominant market attractiveness approach to strategy has led researchers to explore the view that firm-specific factors are more important than environmental or industry structure in explaining superior performance. Several empirical studies in a range of industries have given support to the RBV view. Research conducted by the Michigan State University Global Logistics Research Team in 1995 has provided some support for this premise being supported in logistics. However, much of the development of strategic aspects of logistics theory has been constrained for the past 15 years by Porter's work that held that RBT has not been prominent in logistics literature (Olavarrieta & Ellinger, 1997).

### **Organisational learning (OL)**

OL is a relatively new theoretical perspective compared to TCE and RBV, and tends to have emerged at the same time as SCM (Amundson, 1998). Leveraging superior learning as a source of competitive advantage is well established (Baker & Sinkula, 1999; DeGeus, 1997). Concurrent with the notion of leveraging learning is the emergence of the learning organisation concept, which was popularised by Senge (1990) and, in particular, the "Beer Game" he made famous. The game is educational and simulates the bullwhip effect and systems thinking. A minor but increasing amount of SCM literature has

focussed on OL and SCM (Bessant, Kaplinsky, & Lamming, 2003; Kid, Richter, & Li, 2003; Sorenson & Sorenson, 2001). OL argues that the share price of firms high in knowledge and low in physical resources, such as Microsoft, SAP and various consulting firms, demonstrate how the market values such intangible assets which spring from learning over “bricks and mortar” firms (Sveiby, 1997). However, considerable ambiguity continues to surround the exact nature of the term “learning organisation” that has been described in a raft of synonyms such as the knowledge-creating company, the learning laboratory, the learning company and, therefore, not surprisingly, the learning supply chain.

Conversely, not being able to learn is believed to disadvantage firms. Paradoxically not being able to learn is seen to be linked to having initially achieved a lot of success through innovation and then finding it difficult to continue creating new ways. Ansoff (1994, p. 329) notes that “(s)uccess breeds failure...the historical success model becomes the major obstacle to the firm’s adaptation to the new reality”. This statement is consistent with other research on the link between having initial success in innovation inhibiting the ability of individuals and firms to learn new ways of coping in a changing environment (Tellis & Golden, 2001).

OL assumes a dynamic perspective where organisations are continuously changing. OL is a broad branch of studies explored by researchers studying organisational behaviour, organisational development, organisational management and knowledge management that has been influenced, be it rather vaguely, by the interactionist and constructivist paradigms in social sciences (Magala, 2000). Such a dynamic perspective provides an important contrast with traditional static structure perspectives exemplified by certain economic approaches, including Porter-based models. It also challenges the mechanised theory of organisations that logisticians with an engineering bent have favoured. There are numerous variations which have had significant sway under OL, such as Argyris and Schon’s (1978) double loop learning and deutero learning or learning to learn, Kolb’s (1984) experiential learning, and Stacey’s (1996) linking of the concept to chaos theory. Most variations which fit under OL are concerned with linking learning to intellectual capital and knowledge management which are seen as antecedents to innovation (Drejer, 2002). Most theories go beyond simple “single loop” learning and of these theories many are concerned with the role of the social network in learning. Such theories tend to reject the closed systems thinking which has dominated positivist approaches to logistics research in favour of an open systems approach. Chaos theory

challenges the fundamental assumptions of operation management modelling such as linearity (Brodbeck, 2002; Stacey, 2000). Much of the OL literature embraces an open systems framework as it is assumed to be superior in dealing with social systems which are based on multirealities existing in fragmented cultural contexts (O'Donnell, Regan & Coates, 2000). While not instantly apparent, it needs to be noted that much of the OL literature has in fact emerged from logistics literature albeit in a form which is reacting against its perceived limitations. Senge's (1990) work on learning organisations is a prime example of the evolution of logistics to OL. Senge's doctoral advisor at MIT for his work on systems theory was none other than Jay Forrester (Jackson, 2001).

Much of the OL literature has been criticised as being far too abstract to provide a framework for action (Garvin, 1993). Several writers (Burgoyne, 1993; Jacobs, 1995, Ulrich, Jick, & Glinow, 1993) have found the concept of OL to be ambiguous and confusing. Instead of going into endless explorations of OL, for general purposes it is better thought of as a rich metaphor rather than a precise definition that embraces learning, knowledge management, and the social processes which lead to innovation (Amundson, 1998).

Some aspects of knowledge management have already been explored under workplace design. Knowledge management has emerged as a distinct body of theory under OL which seeks to overcome the criticisms of OL by being far more precise in its concepts and measures. Knowledge has numerous definitions (Tsoukas & Vladimirou, 2001) but Sveiby's (2001) definition of "the ability to act" will suffice for this purpose. It is, therefore, more than information. Sveiby (2001) has extended this area to a knowledge-based theory of the firm. Numerous writers argue that in a postindustrial society, knowledge has replaced traditional resources of production (land, labour and capital) as the main source of maintaining and sustaining competitive advantage (Drucker, 1993; Kogut & Zander, 1992; Nonaka & Takeuchi, 1995; Quinn, 1992; Solow, 1997; Sveiby, 1997). OL provides a framework to examine the creation and dissemination of new knowledge throughout and across organisations which, in turn, is critical to generating innovations (Darroch & McNaughton, 2002; Sveiby & Simon, 2002). Managing knowledge has been a source of intense research interest. The distinction is made between tacit and explicit knowledge which require different management processes (Nonaka & Takeuchi, 1995), different transfer processes (Connell, Klien, & Powell, 2003) and different creation processes (Stein, 1995). Others argue that the widely

accepted dichotomous tacit-explicit knowledge as a category perspective is incorrect and suggest a continuum as a better representation (Blacker, 1995; Spender, 1996).

Knowledge in general, and tacit knowledge in particular, has contradictory features in that it tends to be both “sticky” and “leaky”. It is sticky in that it tends to get stuck in organisational structures but does not necessarily move across cultures or organisational structures. It is leaky in that knowledge flows easily across a community of practices. Brown and Duguid (2000) use Xerox’s famous case study of how the scientists at Palo Alto developed the “graphical user interface” (GUI) yet the development engineers at Dallas knew nothing of it due to hostile communication patterns which had developed between these two groups. Xerox managers invited Steve Jobs of Apple who was perceived to be in their community of practice. Apple then licensed the innovation. The knowledge “stuck” within a part of Xerox yet “leaked” through the front door to Apple. Brown and Duguid (2000) argued that explanations such as lack of “absorptive capacity” in Xerox were misleading. There were bright people throughout other parts of Xerox as well as at Apple.

Brown and Duguid (2002) advocate for a practice-based view of organisations – where information flows within communities of practice rather than organisational structures – challenges the process-based, cross-functional view which has dominated lean manufacturing (including TQM) and logistics (Biazzio, 2002; Mammer, 1996; Rummler & Brache, 1995; Stewart, 1997; Zairi, 1997). Knowledge comes far more from, and is transferred by, fellow practitioners rather than from cross-functional connections so dominant in a process view. Orr (1996) provides evidence that communities of practice find ways to get around the process model imposed by the firm. Such communities meet in their own time on a regular basis and transfer knowledge through collaboration, narration and improvisation, despite working for process-driven organisations which view time spent together as nonvalue adding. Tacit knowledge is contained within social systems and, given its importance to the emerging knowledge economy, provides an argument for why the social system becomes important in generating innovations in supply chains. However, knowledge is also connected to power and social systems within organisations are frequently having to serve the needs of those with organisational power ahead of both the needs of their customers and self (Tsoukas & Vladimirou, 2001).

Despite the lack of clear boundaries, OL appears to open up both a new theoretical and epistemological territory for SCM researchers. Complexity theory for example has been used to explain a continuous shift in organisation forms (Brown & Eisenhardt,



1997). The complexity theory of learning, argues for multidisciplinary approaches and contends that breaking away from a Cartesian epistemology is itself an innovation which in turn generates new innovations. Browaey and Baets (2003, p. 332) qualify the break as “being the real innovation of contemporary science”. To date, SCM appears to have paid little attention to OL (Amundson, 1998). A minority of SCM researchers are exploring the role of OL in supply chains for both goods and services (Bessant et al., 2003; Gupta & Govindarajan, 2000).

Smith, Vasudevan and Tanninu (1996) have argued that RBT and OL could be integrated into one model. Both seek sustainable competitive advantage. RBT initially defined competitive advantage in terms of economic rents derived from strategic resources. Such resources were defined in hard terms with characteristics such as “rare” or “inimitable”. Such characteristics apply to soft resources such as the tacit knowledge needed to manage such assets. Defining resources to include both tangible and intangible assets is seen as a way to avoid looking at resources in isolation. This approach opens the way to a more synergistic management of resources in the pursuit of competitive advantage. Incorporating the dynamic elements of OL, such as learning capability and reconfiguration of resource bundles, enhances innovative capability. Extending the definition of resources beyond those under the direct control of the firm to one that includes what the firm needs to deploy, provides the logical link to use the combined RBT-OL approach in SCM.

### **Marketing Theories**

Literature in marketing theory has explored channel management for over half a century (Bowersox & Cooper, 1992). On initial glance it is difficult to determine the differences between SCM and channel management. Porter’s (1985) value chain theory has had a profound impact on logistics and SCM theory (Amundson, 1998). Svensson (2002) conducted extensive research on the theoretical foundation of SCM and concluded “there is an evident resemblance of the generic theoretical foundations and theoretical boundaries between SCM and Alderson’s functionalist theory of marketing” (p. 749). Shaw (1912) is considered the founder of functional marketing theory. Alderson (1965, p. 43) appears to have struggled with the potential of SCM with his concept of an “organized behaviour system”. Alderson clearly pondered this topic when he stated “a question arises as to whether marketing channels composed of firms, or perhaps firms and households can be regarded as (an) organized behaviour system” (p. 44). He has

concluded that it is not possible, as the parties do not have the commitment over the longer term needed to assume the costs and risks associated with each other's survival and at best all that exists is a "pseudo-system".

### **Network Theories (NT)**

As already shown under the review of information and OL, the concept of network is a recurring theme in SCM and innovation. At its most basic, NT refers simply to the technology. However, such a network does not lead to innovation, which requires the involvement of people (Davies & Harvey, 1994). Therefore, the term NT shall be broadened to include communication technology and communities within social networks which either do, or have the potential to, interact in ways which can have an effect on innovation activities. Such a definition expands the boundaries of the firm to encompass two central themes of Castells' (1996) work: communities of place – the geographical location and reach of the company, and communities of interest – which draws people of diverse backgrounds, interests, attitudes and experience together. Communities of interest are located in organisational learning networks and are supported by both electronic infrastructure and physical locations. Such networks are seen to be a powerful antecedent to generating the learning needed for innovation. Dyer and Nobeoka (2000) have suggested such networks have the potential to create a new form of organisation, arguing that:

... if the network can create a strong identity and effective coordination rules, then it may be superior to a firm as an organisational form at creating and recommending knowledge owing to the greater diversity of knowledge that resides within a network. (p. 346)

### **Range of Network Theories**

There are numerous mid-range theories which fit under NT. All stress the importance of social variables such as trust, commitment, cooperation, collaboration and open sharing of information in creating an intangible asset commonly referred to as "social capital" (Bourdieu, 1986; Coleman, 1990; Putnam, 2000; Robinson & Hanson, 1995; Wall, Ferrazzi, & Schryer, 1998; Wood, 1997; Woolcock & Narayan, 2000). While no clear taxonomy apparently exists to systematically sort out where to locate NT, the term "social capital" will be used as the generic heading. Within sociology, social capital is generally defined as being composed of social networks that are useful for enhancing

features such as learning, social mobility, economic growth, political prominence or community vitality (Wall, Ferrazzi, & Schryer, 1998).

Critical to the concept of social capital is the existence of networks of relationships of varying density between individuals and groups. Social capital cannot be generated by individuals acting in isolation but, rather, depends on sociability and capability to form networks and associations (Knack & Keefer, 1997; Portes, 1998). Many claim there is a clear link between networks high in social capital, learning and innovation (Biemens, 1992; Hurley & Hult, 1998; Szeto, 2000; Yu, Yan, & Cheng, 2001) and the rate of innovation diffusion (Sheth, 1971; Shaw-Ching Liu, Madhavan, & Sudharshan, 2005; Williams, 1994). Erridge and Greer (2002) explored the role of social capital in supply relationships in the UK. Bensaou and Venkatraman's (1995) comparative study of interorganisational relationships in the Japanese and US auto industry found there were many ways to develop productive interfirm relationships. Other studies suggest contingency variables such as the duration of the buyer-supplier relationship, importance of the relationship to a supplier, size of a buying firm and prior experience of an individual buyer can have a high impact on shaping the nature and type of relationship which emerges (Claycomb & Franwick, 2004). They concluded that creating long-term relationships built on mutual trust and reciprocity provided an informal control through the social network, which helped reduce costs. They also cautioned that such relations could block out new entrants to the market. Landry, (1998) explored how social capital determined innovation using a five-form structure of social capital. Strambach (1997) explored similar themes using a different model. Both lots of research provided support for the view that participation in networks involving reciprocal relationships generated innovations.

It is not possible to do a comprehensive review of the mid range theories which sit under NT, therefore a brief analysis of those appearing in the SCM literature are discussed, starting with relationship marketing (RM). RM came into prominence in the 1980s (Berry, 1983) and has increasingly challenged much of the transactional based marketing literature, claiming much of the success of entrepreneurs comes from networks of contacts (Carson, Gilmore, O'Donnell, & Grant, 1998). Gummerson's (1998) research on the topic has suggested there has been considerable variety in how authors use the term RM. Developing closer relationships with customers and making them loyal are recurring themes in this literature, as is the concern with networks. Under this model the network extends the reach and capability of the firm. This theory has tended to see that

the critical variables in supply chains as made up of relationships with variables such as bonding, empathy, reciprocity and trust being prominent. Such variables are often bundled under the broader term of communication. There is mounting evidence in service industries that communication leads to innovation success (Lievens, Monart, & S'Jegers, 1999), and in the SCM literature that it helps improve and sustain performance (Prahinski & Benton, 2004).

Other theories include Socio-technical Systems (STS) theory (Trist, 1983, 1991), Actor Network Theory (ANT) (Latour, 1999), Interorganisational Network (ION) theory (Das & Teng, 1997), Soft Systems Methodology (SSM) (Checkland, 1999; Checkland & Howland, 1998; Checkland & Scholes, 1999) and combinations such as STS-SSM (Attefalk & Langervik, 2001) and STS-ANT (Kaghan & Bowker, 2001). While having very distinct differences, they are united in claiming the social system has a major role to play in innovation. All reject the strict technological determinist argument. Process management methodologies such as the socio-technical design school and workplace redesign reject technological determinism on the grounds that the social system can generate innovation without technology and that if technology is involved, it will require social support to be implemented (Ettlie, 2000). ANT rejects it on the basis that it overly simplifies what happens when an innovation is adopted by ignoring the messy, negotiated nature of innovation and creating an artificial human and nonhuman, or social and technical binary (Bromley, 1997). ION theory which argues network structure around issues of centrality is a strong determinant of innovation uptake across supply chains (Ibarra, 1993)

### **Network structure around issues of centrality**

Social variables such as trust, commitment, collaboration and open communication are given high prominence in the SCM, social network and innovation literature (Skjoett-Larsen, Therno, & Anderson, 2003). Such factors are generally portrayed as an antecedent to creating and transferring knowledge as well as developing intellectual capital and learning capability, which in turn, feed innovation (Assink, 2006; Stewart, 1997). Other views as to why such variables are important are to be found in interorganisational exchange theory which suggests that successful relationships rely on social exchange behaviour such as trust and relationship commitment (Blau, 1964; Van de Ven, 1993). Risk management and an informal governance mechanism are also offered, as “issues of trust and risk can be significantly more important in supply chain

relationships because supply chain relationships often involve a higher degree of interdependency between companies” (La Londe, 2002, p. 10).

Collaboration is used in a variety of ways and contexts such as hard and soft systems, informal and formal networks, supply chains and alliances. It ranges from activities such as sharing information through to complex contractual joint ventures. Collaboration enhances agility through both human and technical interactions between and within organisations (Collins, 1990; Crocitto & Youssef, 2003). Most of the literature suggests attaining good working relationships between organisations involves an evolutionary process and that maintaining these relationships are critical to SCM (Barringer & Harrison, 2000; Sahay, 2003b). Husted (1994) has developed an interorganisational cooperation model which defines three types of cooperation. Opportunistic cooperation is distinguished by very limited or nonexistent commitments, with an expectation that the other party will act in bad faith, with heavy emphasis on extracontractual remedies. Next is low trust cooperation which involves short-term or limited specific commitments, an assumption that others will act in good faith and, if things go wrong, it is due to negligence which will be remedied through contractual penalties. Finally, high trust cooperation is characterised by long-term, indefinite and diffuse commitments, where good faith is assumed as a normal part of business dealings and there is no recourse to contractual penalties. Spekman, Kamauff and Myhr (1998) suggested relationships moved through four stages commencing with open market negotiation characterised by adversarial, transaction based, win-lose exchanges. Next is cooperation, involving fewer suppliers and long-term contracts, then comes coordination involving information linkages, usually of computer systems. Akkermans, Meijboom, and Voordijk (2003) claim improved coordination delivers demonstrable efficiency benefits in reduced cycle time. Collaboration is the final phase and is characterised by supply chain integration, joint planning and technology sharing. The literature is silent on timeframes needed to create such outcomes beyond frequent references to the need for long-term commitment. There is little consistency as to what is meant by such terms, or how they interact or evolve. Such variables are frequently used without definitions, or they are defined as being interchangeable, or the terms are bundled under some cluster heading. The confusion around this term may help explain why a 2004 survey conducted by the Supply Chain Management Review and Computer Science corporation observed that collaboration is cited as the single most pressing issue, but how we achieve it is not well understood. Sabath and Fontanella’s (2002, p. 24) blunt assessment is that

“Collaboration arguably has the most disappointing track record of the various supply chain management strategies”.

A recurring core concept mentioned with terms such as cooperation and collaboration is trust. Morgan and Hunt (1994) claimed trust and commitment were required concurrently to make SCM work. Much of the SCM literature stresses the need for transparency and trust in order to be effective in collaborative supply chain planning work (Akkermans, Bogerd, & van Doremalen, 2004); obtaining cooperative behaviour (Johnston, McCutcheon, Stuart, & Kerwood, 2004); alliance management (Gulati, 1995); being able to manage periods of discontinuity (Coughlan, Coughlan, Lombard, Brennan, McNichols, & Nolan, 2003) and supply chain performance (Kwon & Suh, 2004). Much of the literature tends to define trust in terms of what outcomes it produces rather than trust itself. Such purposes include gaining and sustaining competitive advantage (Barney & Hansen, 1994), making it safe to share information (Bowersox, Closs, & Stank, 2000); assisting in risk mitigation (So & Sculli, 2002); enhancing knowledge management (Kirkman & Shapiro, 1997); growing intellectual capital, expanding organisational learning (Edmondson, 1999); improving branding (Gillen, Durkin, & McGowan, 2000); enabling team performance (Costa, 2003); improving virtual team capability (Jarvenpaa, Knoll, & Leicher, 1998; Jones & George, 1998); and reducing barriers to the uptake of e-commerce (So & Sculli, 2002).

There has been burgeoning interest in the construction of trust, resulting in a diverse and rapidly expanding body of literature drawn from a wide range of social science disciplines such as anthropology, economics, sociology, organisational behaviour, and psychology (Sheppard & Sherman, 1998; Tyler & Kramer, 1996; Wicks, Breman, & Jones, 1999). Consequently the literature on trust incorporates many theoretical perspectives and research interests (Bigley & Pearce, 1998; Clark & Payne, 1997; Hosmer, 1995; Lewicki & Bunker, 1996; Lewicki, McAllister, & Bies, 1998; Sheppard & Sherman, 1998). Research on trust in organisational life is “rich and still emerging” (Tyler & Kramer, 1996, p. 12) and there are many models of trust providing inadequate or incomplete foundations for an organisational theory.

As a result of such diversity, there is no consistent definition and this appears to be inhibiting research across disciplines (Hosmer, 1995; Lewicki & Bunker, 1996). There are also different views on trust and distrust (Bigley & Pearce, 1998) with some suggesting a polarity between trust and distrust, while others regard them as two distinct constructs (Lewicki et al., 1998). However, Bigley and Pearce have suggested this

situation has benefits as it shifts the focus from “what is trust?” to “which trust and when?” Sheppard and Sherman (1998) have supported this view claiming it is critical to understand that different authors from different disciplines and even within disciplines focus on completely different elements of trust in their research. SCM literature seems to parallel this situation with the term being used in a variety of ways depending on different contexts.

While there is widespread agreement on the importance of trust in human conduct, there is equally little agreement on a suitable definition of the concept (Hosmer, 1995). Definitions of trust differ with disciplines. Economics has conceptualised trust as either calculative or institutional; psychology, in terms of attributes and internal cognitions; and sociology, in terms of socially embedded properties of relationships (Rousseau, Sitkin, Burt, & Camerer, 1990).

Within agency theory, both the principal and the agent structure the relationship to minimise risks through contracts. The principal contracts the agent to complete a task that involves delegating responsibility in exchange for compensation (Eisenhardt, 1989). From this perspective trust is associated with monitoring and control (Whitner, Brodt, Korsgaard, & Werner, 1998).

Social exchange theory involves a cost-reward ratio where the parties work to maximise the rewards and minimise the costs. Rather than being a purely economic exchange, this perspective recognises a social element in the exchange between the two parties (Vaughan & Hogg, 1995). Support and friendship are included in the calculation and, by providing a benefit, either party can invoke an obligation to reciprocate (Whitner et al., 1998).

There is a notable lack of attention to the larger social framework in which social interaction and, therefore, trust occurs. (Lewicki et al., 1998; Tyler & Kramer, 1996). Most exchanges between people occur within a social relationship operating within a stable group. Granovetter (1985; 1992) has discussed the social embeddedness of trust. Trustworthy behaviour occurs within a social structure. He has proposed three reasons for trustworthy behaviour. Firstly, it is in the individual’s social and economic interest to behave so. Secondly, it is morally right to do so. Thirdly, it is part of the “regularised expectations” – that is, parties expect that mutual trust will exist because through interacting with each other over a period of time, they have come to know each other. Contrary to a rational cost-benefit trust analysis, a social conception of trust argues that people will trust those to whom they attribute a positive intent (Tyler & Degoey, 1996).

Yet others propose that trust should be considered more as a shared sense of community with a common fate, rather than as a rational self-interest.

The diversity of constructs makes a single conceptualisation of trust difficult, if not impossible. However, there is a common underlying theme of actor vulnerability (Bigley & Pearce, 1998). Trust is not an issue in the absence of vulnerability (Mishra, 1996). Barney and Hanson (1994) defined trust as “the mutual confidence that no party to an exchange will exploit another’s vulnerabilities” (p. 176). Hosmer’s (1995) definition that “trust is the expectation by one of ethically justifiable behaviour – that is, morally correct decisions and actions based upon ethical principles – on the part of the other in a joint endeavour or economic exchange” (p.399) has been widely used in the trust literature. An analysis of the cross-disciplinary literature by Rousseau et al. (1990) suggested trust is not a behaviour but, rather, a psychological condition. They proposed the following definition; “Trust is a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behaviour of another” (p. 395).

These authors also found cross-discipline agreement that risk and interdependence are two conditions necessary for trust to arise. Variations in either condition over the course of the relationship could alter both the level and form that trust takes. Rousseau et al. (1990) defined risk as “the perceived probability of loss, as interpreted by the decision maker” (p. 395) and interdependence as “where the interests of one party cannot be achieved without reliance upon another” (p. 395). “Deterrence-based trust” (Creed & Miles, 1996) is common in interorganisational relationships where the sanctions for betrayal of trust outweigh any potential benefits from opportunistic behaviour. Some authors claim this to be a form of cooperative behaviour rather than a form of trust (Lewicki et al., 1998). Adding to definitional difficulty is that trust is a dynamic phenomenon having at least three phases, namely, – building, stability and dissolution – which can be characterised by the “ebb and flow” of relationships (Rousseau et al., 1990). SCM’s inability to reach consensus on what it means by trust is, therefore, reflective of a wider issue associated with a concept which is struggling to be understood at the level of the firm, let alone between organisations.

Concepts such as NT and trust are so broad that they can be claimed by a raft of OL theories. SCM, like many theories and methodologies, sees such social variables as critical success factors.



## **Governance**

Corporate governance has come to the forefront of academic, regulatory and investor debate, due in large part to financial distress caused by a recent worldwide trend of corporate scandals (Parker, Peters, & Turetsky, 2002). Enron and WorldCom in the United States and HIH and OneTel in Australia are examples of such scandals which have resulted in sweeping reforms to legal aspects of governance. There has been a heightened interest in the governance of intergovernmental organisations (IGOs) in the corporate and governmental sectors (Campbell & Hushagen, 2002). Apart from some rare exceptions (Campbell, & Hushagen, 2002; Whipple, Frankel, & Anselmi 1999) the literature generally appears silent on SCM and governance. The risk management principles which guide a corporation are embedded in corporate governance structures and would ideally determine just how far a firm is willing to go with SCM (Vidaver-Cohen, 1999).

“Governance has several distinct meanings” (Rhodes, 1997, p. 46) due to the term being applied to a variety of contexts. Examples of the terms include new forms of government by policy networks, “good governance”, new public management, corporate governance and governance of industry sectors. Despite such a range of terms, Cutting and Kouzmin (2000) claimed the generic notions included:

Applicability at each of the three levels of firstly the individual, secondly the group, organization or company and finally the nation.

The rule, management, regulation, direction, control or leadership of the affairs or participants of such units.

A system, pattern or structure of participants in such a way that they are a distinctive unit with some notion of a shared purpose.

An acknowledgement of the autonomy and roles played by the individual participants or elements. (pp. 526-527)

Much of the SCM literature on governance has tended to focus on ethics (Blowfield, 2002) around worker and human rights amongst suppliers; power asymmetry (Cox, 1999) and risk management (CLM, 2002) around major disasters with critical suppliers, various forms of contract hedging (Wang, 2002) and how to measure ethical purchasing practices (Carter, 2000). A far smaller body of SCM literature has focussed on how best to meld the requirements of governance and SCM in order to generate innovation. Cassivi (2006) suggests that relational innovation can provide for governing

buyer-seller interactions that are required in a supply chain for the development of new or improved methods that deliver ongoing benefits. Cassivi claims that aspects such as trust, loyalty, and market segmentation determine the existence of relational innovations in a supply chain. This view is supported by previous studies that have identified trust and commitment as critical elements in buyer-supplier relationships and in alliances. (Ring & Van de Ven, 1994; Da Villa & Panizzola, 1996; Gulati, 1995; Handy, 1995; Tait, 1998; Zaheer et al., 1998;). Claro, Hagelaar, and Omta's (2003) research in German and Dutch supply chains have demonstrated a relationship between relational governance and performance, and found trust to be a key determinant of effective relational governance. The focus on social aspects suggests that the corporate governance required for supply chains "is not an objective representation of a fixed reality, such as an objective representation of a fixed, external reality, such as an efficient and optimal form/mechanism or organisation or some universal principles" (Letza & Sun, 2002, p. 57) but rather needs to be embedded in the social world of our minds. In other words, the governance required is predominately a social construct which represents or reflects the periodic patterns of continuously shifting ideas. SCM represents such a shift and will possibly require a reshaping in the mindset of managers and others who are used to working in an enduring and unitarist governance model (Letza & Sun, 2002).

Despite recognition in both the SCM and wider governance literature of the requirement for new forms of governance, Fligstein and Freeland (1995) claim that while the rhetoric has changed, there is little evidence that relations between firms are converging toward networks or strategic alliances as the dominant form of governance. Barringer and Harrison (2000) have demonstrated that at least six forms of organisational arrangements such as joint ventures, while not necessarily new, are nonetheless becoming far more common. Researchers are exploring potential governance structures for supplier networks (Verwaal & Hesselmanns (2004); enhanced relationships (Watline & Heide, 2004); regional development (Zeitlin, 2004); electronic value chains (Rasheed & Geiger, 2001); "agro-food vertical chains (Raynaud, Sauvee, & Egizio, 2005); globalisation (Keohane & Nye, 2000); global value chains (Gereffi, Humphrey, & Sturgeon, 2005); projects (Pryke, 2005) and global supply chains (Griffith & Myers, 2005). Most of this research is still being carried out in a manner which does not challenge the fundamental corporate centric philosophy of governance. It is therefore unclear at this stage if the continued endurance of existing governance arrangements is because they are adequate or

if the emerging models have not yet reached a critical mass to be considered as a viable alternative.

Two broad theories inform governance at the level of the firm – shareholder and stakeholder theories. The shareholder theory of corporate governance is directly descended from agency theory (Eisenhardt, 1989). The shareholders appoint the board of directors who then jointly and severally act as their agents. The purpose of the company, and the obligation of the board, is to maximise profits and enhance value for its shareholders (Koutsoyiannis, 1980). Company assets are seen as the property of shareholders and any interference and consideration of interests other than those of stakeholders is inconsistent with the concept of property rights. So the Board and management should focus exclusively on the financial needs of shareholders, leaving other issues to social institutions (Miller, 1998). The Board is an agent of the shareholders and no other obligation is owed to other stakeholders. The rights of creditors (including suppliers), employees and others are strictly limited to statutory, contractual and common law rights.

Stakeholder theory of corporate governance rejects the philosophy of focusing solely on the benefits of a single stakeholder, the shareholders (Wijnberg, 2000). This theory argues a company should operate in the interests of all groups with the strategic aim of creating value for all stakeholders (Miller, 1998). Stakeholder theory proponents argue that a company should be viewed as a joint venture in which suppliers of inputs (including equity, loans, labour, management expertise and goods and services) participate to achieve economic success. All stakeholders are seen as mutually dependent so the purpose of the company is to serve the interests of all parties (De Witt & Meyer, 1998).

Donaldson and Preston (1995) argued that a key characteristic of this theory was that the corporation was viewed as a constellation of cooperative and competitive interests, each possessing intrinsic value. Opinions vary on just how to limit stakeholders to the narrow view of stakeholders whose relationship is primarily economic (Shankman, 1999) and the wide view which involves an ethical dimension (Clarkson, 1995) and includes owners, suppliers, customers, employees, local communities, trade associations and government. This theory places high store on intangible assets such as corporate reputation and therefore also considers the needs and reaction of “secondary stakeholders”, such as the media and special interest groups who, while not having a

direct relationship with the firm, nonetheless can influence public opinion (Ogden & Watson, 1999).

Yet others see the key issue of corporate governance as being related to political power (Cutting & Kouzmin, 2000; Handy, 1978; Mintzberg, Jorgensen, Dougherty, & Westley, 1996). Power is defined as the ability of one party to get others to do or cease doing actions they would not otherwise freely choose to do. Political power extends this concept to incorporate individuals and groups driven by personal interests. Corporate governance is most concerned with the manifestation of power through management dominance as articulated by captive board theory which results in overpaid managers and self-interest rather than shareholder-interested decision-making (Eisenhardt, 1989). Postmodernists argue that knowledge is not independent of power (Alvesson, 2002a; 2001). Significant innovation which jeopardises existing political power arrangements would therefore generally struggle, since those with the power would define what are good ideas.

The overlap between political power and innovation creates as yet unanswered questions, such as DeGeus's (1997, p. 231) "where should the power be seated in the knowledge creating company of tomorrow and to whom should it be distributed?". Cutting and Kouzmin (2000) have argued that present governance principles should be changed to address "the need for an effective executive decision-making process that allows for a more effective distribution of power and also calls for, and provides, an ongoing learning experience for executive decision makers" (p. 479). OL literature makes it clear that a "learning experience" which leads to innovation involves taking risks and making mistakes. Governance is about reducing risks and avoiding mistakes. The literature on the tension between innovation and governance does not yet appear close to resolution.

SCM literature suggests new organisational forms are known under various names such the extended enterprise (Boardman & Clegg, 2001), the horizontal organisation (Ostroff & Smith, 1992), the network and the virtual organisation (Nikolenko & Kleiner, 1996) that are emerging and will be radically different from what has gone before. It would appear logical that corporate governance structures may also have to drastically change to accommodate such organisational forms. Failure to do so may inhibit the ability of firms to harvest the innovations offered by such new organisational arrangements. Stakeholder theory would appear better aligned with such new organisational forms, yet the governance structures which are emerging are overwhelmingly taking a shareholder

perspective. A recurring criticism of SCM is that large firms in the chain improve their performance by extracting wealth from weaker members in the supply chain (Cox, 1999). The present evolutionary path of governance structures does little to encourage firms to work for the best interests of the entire supply chain.

Despite present governance arrangements, SCM suggests that corporations are also extending outside their legal boundaries as a normal way of organising and forming competitive networks of companies. Thus, companies need to develop strategically aligned capabilities not only within the company itself, but also among the organisations that are part of its value-adding networks. There are already some examples where collaboration between legal entities is routine to the point where advanced process practices that allow transfer of responsibility without legal ownership are in place (Lochamy & McCormack, 2004a). Technology advancement is yet another force which, it is claimed, is changing the market place and organisational structures. In parallel with these developments “the role of logistics has expanded over the decades to encompass other stakeholders.... Logisticians within its expanded role must now operate within organizational structures that allow them easily to interact between multiple stakeholders” (Williams, Esper, & Ozment, 2002, p. 708). Designing governance structures to meet these emerging organisational forms will be difficult as governance has both formal and informal processes as well as institutions that guide and restrain the collective activities of groups. Formal aspects of governance such as policies and rules are complex enough, while the effects of policy constraints are often intangible and difficult for management to identify. Developing and changing such formal policies is difficult enough but changing the informal aspects such as collective mindsets of employees who work in such chains will be far more challenging (Williams et al., 2002).

### **State of SCM theory**

To qualify as a theory, it is widely accepted that four elements with the following abilities should be displayed: define its concepts; explain the relationship between those concepts; state the domain of application and, finally, be able to predict in a manner which will inform practice (Singh, 2001). On this basis, SCM cannot yet lay claim to a distinct body of theory. If anything, it appears to be a practitioner-led movement (Voss, Tsiriktsis, & Frohlich, 2002). Currently, SCM seems to be more at the phase of developing knowledge about the concepts within itself than the extent of the relationship of such concepts to each other. SCM embraces and adapts a broad range of concepts. The

depth of understanding of such concepts as suggested by the literature, let alone the interaction of such concepts, appears poorly researched.

SCM's ideology appears to be capitalist, centred around the process of consumption and anchored in the classical economics view of the firm seeking to maximise shareholder wealth (New, 1997). The examples given in most popular texts are descriptive case studies overwhelmingly drawn from retail and consumer sectors as well as the auto industry (Burgess, 2003).

SCM has been linked to several theories from numerous disciplines. Many such theories overlap; however, the two which are most polarised are the technological determinist and NTs. This polarisation is profound as they not only make very distinct claims as to the causal factors involved in SCM, but also as to what are valid methods by which to investigate such variables.

### **2.3 SUMMARY**

As shown by this literature review, SCM is a very broad multidisciplinary and emerging body of knowledge which is informed by the theories developed from of a vast array of disciplines. Many of these disciplines have differences in the ontological and epistemological assumptions that inform the research traditions that are used to develop their respective theories. As this thesis aspires to add to this relatively young body of knowledge of SCM which is informed by disciplines with different research traditions it is very important to examine the implications of such differences. Failure to do so would run the risk of continuing with a static approach based on unquestioned assumptions that could potentially be theoretically and logically flawed. While Chapter 2 has revealed the key issues in the body of knowledge, Chapter 3 explores an equally important issue around the strengths and limitations employed to generate such knowledge. As will be shown, a small but increasing body of literature is suggesting that SCM has been biased in the research methods employed and this in turn is potentially inhibiting the development of SCM (Burgess et al., 2006). Discussion around the implications of such bias is considered particularly relevant as this thesis is exploring social dimensions of supply chains. Chapter 3 will demonstrate that unlike the natural sciences, social sciences have many choices as to what research approach to employ. As each approach will potentially arrive at very different conclusions is it vital that the both the assumptions and rationale for making such a selection be evident prior to the commencement of the research. Having clarified the implications of research approaches used in SCM, Chapter

3 then lays the foundation for the justification of the research approach discussed in Chapter 4.

# CHAPTER 3

## 3 PHILOSOPHICAL RESEARCH FRAMEWORK

### 3.1 OVERVIEW

This chapter will identify why there is a case to widen the SCM research agenda in order to enhance theory development. Section 3.2 will develop the case which demonstrates the systematic biases in the SCM literature and how this set of biases has highlighted the need to generate research outside of what Burrell and Morgan (1994) would define as a “functionalist” framework in order to advance the SCM body of knowledge. As will be shown in Section 3.3, there is considerable ontological and epistemological diversity around SCM which has a strong potential to generate confusion. This confusion reflects aspects of a debate that has occupied some of the greatest philosophical minds of the past two centuries. This debate centres on the fundamental differences between the ontological and epistemological assumptions found in the natural sciences compared with those of the social sciences. As confusion of this type inhibits theory development, Section 3.3 seeks to reduce the confusion by exploring the range of options open to SCM research.

This exploration is deemed necessary on several grounds. The first is that no literature was found to suggest that the current research agenda is the result of a well thought-out and deliberately chosen path. The second is that the systematic literature review in Section 3.2 strongly suggests that studies addressing social issues are small in proportional terms and tend to use positivist methods. Thirdly, while the metatheoretical framework for quantitative studies tends to be empiricism, the metatheoretical framework for qualitative studies varies considerably. This last point is extremely important because whenever social science steps outside a positivist research tradition, it loses the luxury of having a single methodology. Section 3.3, therefore, seeks to identify the main options available for researching social factors before presenting a justification for choosing the specific research paradigm of critical realism for this study, discussed in Section 3.4. This identification of options is also intended to overcome an important criticism of the present SCM research agenda – that is, there is no examination of taken-for-granted assumptions. Section 3.4 describes what constitutes critical realism. Section 3.5 describes the distinctive features that critical realism can bring to multidisciplinary research. Section



3.6 discusses the critical realist research methodology that is employed in this study and a justification of how the selection of a predominantly qualitative case study research approach provides the most viable research approach for the overarching question, “What is the role of social factors in generating innovation within supply chains?”

## **3.2 RESEARCH METHODS IN SCM**

### **3.2.1 Background on SCM Research**

If it is accepted that operations management and logistics have been the major force behind the development of SCM knowledge, then the bulk of such knowledge has been informed from a positivist tradition (Forza, 2002; Franks, 2000). “Logistics research in general, and perhaps US logistics research in particular, can be characterized as significantly influenced by a positivist paradigm” (Nasland, 2002, p. 322). Operations research, which has dominated logistics, has remained consistent with the logical empiricist paradigm stressing rationality, objectivity and measurement. As a result, the bulk of research still favours examining “hard” content such as movement of goods, money and information.

Over the past decade there has been a rapidly growing body of research exploring the soft aspects of SCM. These include human resources (Gowen & Tallon, 2003), learning (Hult, Ketchen, & Nichols, 2002), intellectual capital (Das, Sen & Sengupta, 2003); and knowledge (Rodan, 2002). This trend should be seen within the overall movement in SCM of borrowing from other disciplines such as marketing, human resources, and IT. Irrespective of the content, such research is generally conducted within a positivist framework. Also, with SCM appearing to support the use of a multidisciplinary perspective, the bulk of research in this area is conducted from a single disciplinary perspective (Burgess et al., 2006; Nasland, 2002).

Most of the operations management research also shows a strong positivist bias, with an overwhelming emphasis on rationalist research methods – primarily statistical survey analysis and mathematical modelling (Jackson, 2003). While several nonpositivist traditions such as interpretivism, critical theory, feminism, pragmatism and postmodernism have been accepted as legitimate frameworks for enquiry within the social sciences, this has not been the case within logistics. The quantum of research conducted outside the positivist tradition remains very low (Burgess et al., 2006).

Given that many commentators purport that SCM has strong links to information systems, developments in this field may be informative to SCM. Goles and Hirschheim’s

(2000) research demonstrated that while there were some optimistic signs of the acceptance of alternative research perspectives, “the indisputable consensus is that positivism dominates information systems research” (p. 254). A literature review of ERP implementation also concluded that this body of research was heavily positivist and did not take into account the social system of the end user (Hobson, Kerr, Burgess, & Houghton, 2005). Authors such as Mingers (2001) who have investigated both operations research (OR) and ICT have concluded that these two disciplines are heavily biased to positivism and that this bias is inhibiting their theory development.

A key reason given for such a positivist bias in IS research is that the ICT developed from the computer science and engineering fields, which were grounded in hard disciplines. The gravitation of information systems researchers to business schools did little to abate this trend. The positivist tendencies in business schools anchored such research in what Burrell and Morgan (1994) refer to as a functionalist paradigm – basically positivist methods applied to suit economic ends. Researchers who fail to comply with such a paradigm risk exclusion from publication and career opportunities (Burgess, 2003).

### Historical Research Roots of SCM

Reasons for a positivist bias in SCM appear to emanate from its historical roots. It is also widely accepted that operations management, logistics and SCM are based on systems theory (Biazzo, 2002). Systems theory is a very wide body of research in its own right. However, Jackson’s (2003) model shown in Figure 3.1 provides a useful way of conceptualising some of the key issues associated with systems theory and the ontological assumptions that have informed SCM and have led, possibly, to its research bias.

# A Systems Theory Typology

## Participants

		Unitary	Pluralist	Coercive
Systems	Simple	<b>Simple-Unitary</b> <b>Hard Systems Thinkers</b> e.g. Operations Research – inventory, queuing, scheduling, routing, etc Focus to optimise the system in pursuit of the <b>known goal</b> . Hyper rational, mathematical •Capacity Constraints •Lean/TQM. IT (e.g. ERP)	<b>Simple-Pluralist</b> <b>Soft Systems Approaches</b> Stress the importance of values, beliefs and philosophies – assumes widely different viewpoints can be negotiated. • Soft Systems Methodology (SSM) - Checkland	<b>Simple-Coercive</b> <b>Emancipatory Systems Thinking</b> – consensus is probably not possible Mainly found in wider society analysis e.g. lack of voice and recognition for class, sex, race, sexual orientation, disability. <i>Move to organisational systems</i>
	Complex	<b>Complex-Unitary</b> <b>Systems Dynamics, Organisational Dynamics, Complexity Theory</b> •Viable Systems Model (VSM) •Learning Organisation (Senge)	<b>Complex-Pluralist</b> <b>Soft Systems Approaches</b> As above but more intricate •Interactive planning – Ackoff •Critical Systems Heuristics - Ulrich	<b>Complex-Coercive</b> <b>Post-Modern Systems Thinking</b> Anti-systemic in that systems have to be challenged and broken down – “dominating discourse”. Bring emotion to the fore – does the proposed action “feel” right

Figure 3.1. A Systems Theory Typology

Adapted from “Systems Thinking: Creative Holism for Managers”, by M. C. Jackson, 2003, Chichester: John Wiley & Sons Ltd

The vertical axis in Figure 3.1 represents a continuum of systems from the relatively simple to the extremely complex. Simple systems are characterised as having few subsystems; having few, but highly structured, interactions; having low rates of change over time; and being relatively unaffected by independent environmental influences. Complex systems, on the other hand, demonstrate almost the opposite in characteristics, and their outcomes are not predetermined. The horizontal axis classifies the relationships that can exist between participants in the systems into three types - unitary, pluralist and coercive. Participants in unitary relationships have similar values, beliefs and interests, and common purpose around agreed objectives. Pluralist relationships differ in that while the interests of the participants are compatible, they do not share the same values and beliefs and so space needs to be made for debate and conflict resolution so that compromises can be made in order to generate productive relationships. Participants in coercive relationships share few, if any, interests. If they were free to express them, they would hold conflicting values and beliefs. Compromise is not possible in coercive relationships and so agreed objectives are needed to direct

actions. Decision-making is through power and coercion to ensure adherence to commands.

The two axes in Figure 3.1 essentially represent the hard and soft, or technical and social, aspects of systems. Combining the two dimensions produces six ideal types of system, each of which, as the figure illustrates, is occupied by distinct and separate traditions and theories. All six are considered open systems as they have to interact with a wider environment. However, on a continuum, a simple-unitary system is the nearest to a closed system while a complex-coercive system could, given the right circumstances, be the most open.

These six ideal systems theory typologies suggest differences in ontology and epistemology, the implications of which will be revealed in more depth in Section 3.3. What is important at this point is to establish whether SCM fits within any specific typology. According to Jackson (2003), the term OR was invented in 1937 by UK scientists and was then supported by the systems engineering movement of the 1930s and 1940s. Professional OR societies started to be formed and flourish in the 1950s. The “underlying assumptions of classical OR are simple-unitary” (Jackson, 2003, p. 20). OR is, therefore, a hard systems view in which it is assumed that people share values and beliefs, and that systems are simple enough to be modelled mathematically. Hard systems have served OR well in tackling a whole range of operational issues such as queuing, inventory, allocation, replacement, coordination, routing, competition and search. However, the assumptions embedded in hard system approaches create limitations around being able to extend such approaches. Criticisms of hard systems include their inability to handle significant complexity; cope with a plurality of different beliefs and values; and deal with issues of politics and power. From a research perspective, “[m]uch of the philosophy and theory underpinning hard systems thinking is taken for granted and not declared openly. This is not surprising as so much of it is borrowed directly from the natural sciences” (Jackson, 2003, p. 49). Reductionism is often a major method used by natural science and it has been widely criticised by systems theorists on the grounds that whole systems often take forms that are not recognisable from their individual parts.

The major research implication suggested by systems theory is that, prior to selecting a research paradigm, it is important to understand what type of system typology is assumed. Since the 1970s, the limitations of hard systems thinking have been acknowledged and, to their credit, hard system approaches have tried to reach out to deal with the more complex types of systems. However, one of the reasons they have been

unsuccessful in this endeavour is because of the taken-for-granted use of positivism which has embedded within it assumptions about the nature of systems. As will be discussed in Section 3.4, the philosophical assumptions of positivism are not necessarily well equipped with complex social systems.

What now follows is a systematic review of the SCM literature which will demonstrate that a similarly positivist bias exists, and appears to have been taken for granted, by the bulk of this literature. Such a review is considered necessary on three grounds. Firstly as shown in the thematic literature SCM is so broad as to require systematic analysis to make more sense of the literature. Secondly as Suzuki (2006) warns the information age means it is easy to get article and evidence to support whatever viewpoint a person wishes to support. The diversity of sources and vastness of articles on SCM suggests this field is no exception to this rule. Thirdly as shown in Chapter 2 under learning initial success often blinds people to being able to learn other ways of engaging with a changing world (Ansoff, 1984; Tellis and Golden 2001). Understanding how SCM literature learns about its subject matter is therefore just as important as understanding what it is learning about.

### **3.2.2 Systematic Literature Review**

#### Making Sense of SCM Literature

Much of the knowledge about SCM continues to reside in narrow functional silos such as purchasing, logistics, IT and marketing. There appears to be little consensus on the ontological and epistemological bases of the concepts associated with it from an integrated enterprise perspective. Yet understanding such bases is important in order to develop a coherent and justifiable research methodology. Therefore, to develop a better understanding of the ontological and epistemological issues, it was deemed necessary to conduct a systematic review of the SCM literature in addition to the thematic literature review. A systematic process was used to classify the literature along salient ontological and epistemological dimensions (Burgess & Singh, 2004). The results from this review were then used to generate a meta-analysis of the philosophy of knowledge that could be used to guide future SCM research.

#### Selection of Articles

Journal articles were sourced from the ABI/Inform Global Proquest academic database. The aim of the review was to capture a snapshot of the diversity of research

being conducted in the SCM field. Accordingly, all of ABI/Inform Global Proquest's journals were included in the search. An initial keyword search for articles containing any of the terms of the phrase "supply chain management" (limited to citations and abstracts of periodicals) revealed that there were more than 10,000 articles present in the database. The key word search was subsequently limited to the exact phrase, "supply chain management". This search revealed 3,511 articles (as of July 2003). Control over quality was achieved by limiting the search to peer-reviewed publications only. With this additional restriction, the number was reduced to 882. Prefaces, editorial notes, book reviews and interviews, in addition to any articles from magazines or industry publications, were excluded from this set, leaving 614 usable articles. A comprehensive approach would require that all 614 articles be reviewed. This was deemed inefficient. Instead, statistical methods were used to generate a representative random sample. To be 90% confident of being correct to within  $\pm 0.1$  of the true proportion of all articles, a minimum sample size of 61 articles was needed (Berenson & Levine, 1989). This sample was increased to 100 to reduce the probability of Type II errors. Full bibliographic details of the 100 articles selected for analysis are shown in Appendix A.

#### Classification Framework

Eleven key dimensions relating to ontology and epistemology were defined, and all the articles were then classified within these dimensions. The 11 dimensions along which the articles were analysed were integrated into a framework which broke into four distinct, yet logically ordered, groupings commencing with the least complex concepts and progressively working through to more philosophically-advanced research issues. Table 3.1 summarises the framework.

**Table 3.1** *Literature review classification framework*

Grouping	Content covered	Rationale
1. Descriptive features of SCM literature	<ul style="list-style-type: none"> <li>• Time distribution of publications</li> <li>• Journal names</li> <li>• Industry sectors</li> </ul>	Describe characteristics of sample of articles.
2. Definitional issues	<ul style="list-style-type: none"> <li>• Approaches to definitions</li> <li>• Conceptual representations of SCM</li> <li>• Constructs of SCM</li> <li>• Discipline bases</li> </ul>	Explore consistency or variation in SCM definitions by researchers on a range of dimensions. Define the territory that researchers claim falls within SCM.
3. Theoretical concerns	<ul style="list-style-type: none"> <li>• Theoretical perspective</li> <li>• Purpose of theory</li> </ul>	Determine the range of theories that are used to inform SCM and ends to which they are applied.
4. Research approaches	<ul style="list-style-type: none"> <li>• Paradigmatic stance</li> <li>• Research methods</li> </ul>	Determine the methodological assumptions being made and the types of research methods that are used to explore SCM.

As Table 3.1 shows, the classification framework is structured to enable a holistic ontological and epistemological analysis of the field. Specifically, Grouping 1 provides an analysis of the sample of articles used and examines trends in the literature. Grouping 2 classifies the territory covered by SCM from a range of perspectives using either purpose-built or existing classification schemes. Grouping 3 also classifies the literature, but deals with issues around theoretical bases. Finally, Grouping 4 examines issues associated with research methods. While any classification system can be challenged for levels of comprehensiveness, it was felt that the breadth of perspectives covered by the 11 dimensions was adequate to develop a sound understanding of SCM. Also, the classification categories for some of the 11 dimensions were a potential source of contention. To overcome this, where possible, existing conceptual and taxonomical frameworks that have been extensively used in similar research was used. For dimensions where no existing framework was available, new ones were developed.

The 11 elements of the framework were designed to assist in establishing a clear “line of sight” from information sources to definitional matters, and then through to theoretical concerns and research approaches used. Together, these covered ontological and epistemological concerns. The framework, therefore, provides a method to check for logical links and connections to verify consistency (or the lack thereof) amongst the

various research activities within SCM. The data generated from examination of the relationships between the framework's 11 elements then inform a meta-analysis on the philosophy of knowledge in the SCM area.

The sample of references (100) used are listed in Appendix A. A number of key findings on SCM emerged, namely: the field is a relatively “new” one; several disciplines claim ownership of the field; consensus is lacking on the definition of the term; contextual focus is mostly on the manufacturing industry and consumer goods industries; predominantly “process” conceptualisation prevails; research methods employed are mostly analytical conceptual, empirical surveys or case studies; the positivist research paradigmatic stance is very popular; and theories related to transaction cost economics and competitive advantage dominate.

This review enabled a succinct description of SCM, suggested how it should be conceptualised from a philosophy of knowledge perspective, and charted an agenda for this research. Dominant characteristics that were found included the presence of mostly descriptive-type theories; strong positivist paradigmatic stances in the research methods employed; the utilisation of analytical conceptual, as well as empirical statistical sampling and case study methods; and a paucity of research on the social factors involved in SCM. These dominant characteristics appear to have prevented plurality of ideas in terms of how the area has been conceptualised, theoretically described and researched, making the development of the field a narrowly concentrated one. This, in turn, has prevented wider dissemination and greater acceptance of ideas, outside the functional areas with which SCM has traditionally been associated. As a consequence, the soundness and robustness of the ideas underpinning SCM have not been fully tested. If this pattern continues, then there is a risk that SCM will get confined to a narrow intellectual base. This could lead to SCM being considered unworthy of serious scholarship by the broader academic community.

### Summary of Implications

As a “young” field, SCM appears to be “struggling” to develop a coherent body of knowledge. The thematic review and, to a far greater extent, the structured review have suggested that SCM is deeply entrenched in a narrowly defined operations management approach in terms of research methods used and subsequent theory development. This seems both illogical and wasteful of scarce resources. If SCM is to be more than a management fad and wishes to speed up its rate of knowledge development, it needs to



rapidly expand its methods of inquiry. SCM's research framework needs to embrace rapidly emerging issues such as those found in the social system of supply chains. It also needs to take a multidisciplinary research approach in order to, firstly, deal with the complexity inherent in a supply chain and, secondly, be able to inform practitioners who must manage such complexity to make SCM work. It also needs to expand the type of industry research to include mature industries such as those found in industrial markets.

Moving outside the traditional research methodologies used in SCM has ontological and epistemological implications. These implications are explored in Sections 3.4 and 3.5. This philosophical examination is considered necessary on two grounds. Firstly, it needs to be demonstrated that a break from traditional positivist research paradigms has substance in its own right and is more than an ill-conceived reaction against dominant approaches. Secondly, such an analysis is needed to justify the research methodology (case work) adopted in Chapter 4. The content area, specifically an industrial market consisting of mature industries, chosen in Chapter 4 is also justified by the findings in this literature review.

### **3.3 POSSIBLE PHILOSOPHICAL STANCES IN RESEARCH**

The basic position argued in this section is that, broadly speaking, an individual researcher's choice of a particular research design is necessarily framed by the researcher's own ontological assumptions about the nature of reality, and epistemological assumptions about how one can come to comprehend it. Ideally, therefore, researchers should be able to answer questions about what research assumptions they are using and why, before proceeding with the research. Such an approach, then, provides better information about the strengths and limitations of the findings generated.

Being able to answer questions about research assumptions requires an assessment of the relevance and value of different research methods. Kuhn's (1970a) groundbreaking work on paradigms created a serious challenge for research. Despite such confusion due to multiple uses of the term "paradigm" by Kuhn (Masterman, 1970), he uses the term most often to refer to a set of beliefs, values, assumptions, and techniques, centred around successive exemplars of successful practical application. According to Kuhn (1970a), a regulative framework of "metaphysical assumptions [is] shared by members of a given community" (p. 175). For Kuhn, research is constrained by the boundaries of the paradigm and observations, and their meanings are determined by the paradigm deployed by the social scientist. Mingers (2003) claims Kuhn's notion of "paradigm is thus a

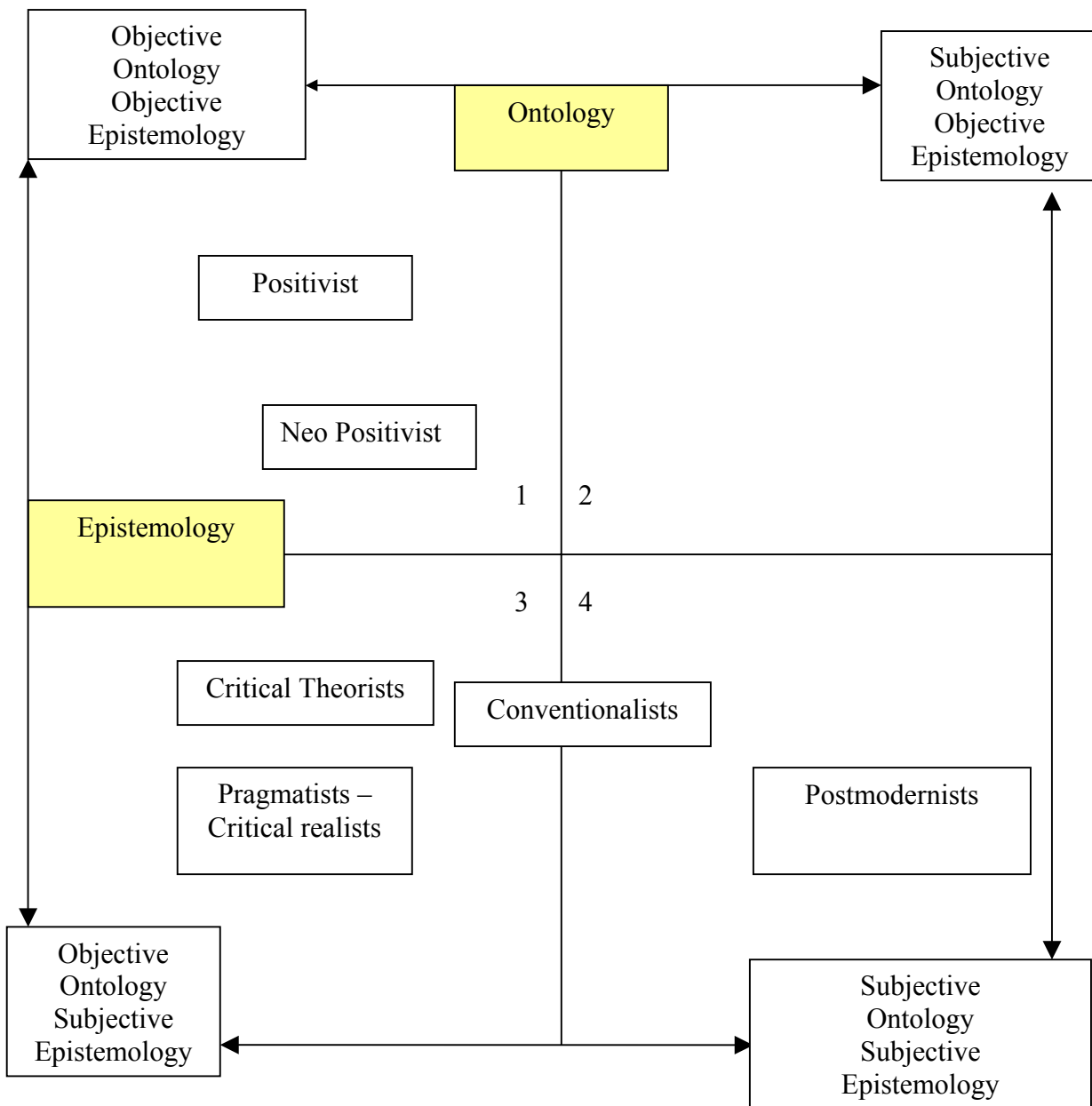
construct that specifies a general set of philosophical assumptions covering for example, ontology (what is assumed to exist), epistemology (the nature of valid knowledge), ethics or axiology (what is valued or considered right) and methodology” (p. 599). While there are numerous variations on this definition (e.g., Lincoln & Guba, 1985; Mink, 1992; Bowersox & Daugherty, 1995; Morden, 1997), Mingers’ (2003) definition appears sufficiently broad to capture the breadth of dimensions implied by others.

Kuhn demonstrated that there is no paradigm-free, neutral position from which to work, as there is no “objective” ground for choosing a paradigm. It is therefore important for the researcher to declare both the ontological and epistemological stance used in research, as the paradigmatic stance will define a position from which to interpret the meaning of the results. Given that the overarching research question in this thesis examines the supply chain primarily from the social system, the following argument is confined largely to exploring epistemological issues within the boundaries of what is termed social sciences. While ontological issues will also be examined, this will largely be limited to instances where there is a requirement to gain greater insight into the epistemological issues which are central to research. Mathews, White and Long (1999), for example, claim the ontological position defines the conceptualisation of social reality, which in turn identifies subjects of inquiry, issues worthy of attention and methods of demonstration. However, it is even more critical to understand the role epistemology plays in scientific theorising and, in particular, the implications of that role to this research.

“Science wars” have been generated between the natural and social sciences in which both sides have sought to claim their own paradigm as incontestable by denigrating the other’s (Flyvbjerg, 2001). Rather than seek to provide an incontestable schema, this section has set a far more modest aim of exploring the key range of epistemological theoretical issues associated with a variety of different research approaches and associated ontological issues. It then seeks to demonstrate the effort that has gone into creating consistency with the epistemological assumptions deployed, their origins and ramifications in respect to this thesis.

A brief overview of the different research approaches follows to highlight more clearly the implications of the research stance taken. While there are numerous taxonomies on research approaches (Perry, Riege, & Brown, 1999), the framework used by Johnson and Duberley (2000) will be used to explore key issues associated with major research approaches.

Figure 3.2 outlines the ontological and epistemological assumptions of each research paradigm as shown in the quadrants. Quadrant 1 covers an objective ontology and epistemology as described by positivists and postpositivists. Quadrant 2 is blank as no-one defends an objective epistemology with a subjective ontology. Quadrant 3 represents an objective ontology with a subjective epistemology as exemplified by critical theorists and critical realists. Quadrant 4 has both a subjective ontology and epistemology, as best captured by postmodernists. While occupants of the first three quadrants fear the implications of relativism which contends that notions of truth are socially and historically constructed postmodernists celebrate relativism. Conventionalists span across both quadrants 3 and 4 and are represented by theorists such as Kuhn. Conventionalists are unwilling to embrace relativism and tend to use metatheories in an attempt to get around such difficulties. As a result, they appear to create epistemological tangles and tend to oscillate inadvertently between subjective and objective ontologies.



**Figure 3.2. Research Paradigms.**

From “*Understanding Management Research – An introduction to epistemology*” by P. Johnson and J. Duberley, 2000, p. 180.

An objectivist view of epistemology presupposes the possibility of a theory – neutral observational language – in other words, it is possible to access the external world objectively. A subjectivist view of epistemology denies, for various reasons, the possibility of such an epistemological foundation. An objectivist view of ontology

assumes the social and natural reality have an independent existence prior to human cognitive processes. A subjectivist ontology assumes what is taken to be reality is an output of the human mind. Objectivist epistemology is necessarily dependent upon an objectivist ontology, as it would be incoherent to claim an independence of realities which do not exist independently of the act of cognition. However, a subjectivist epistemology can be considered with either an objectivist or subjectivist ontology. Differences at the subjectivist and objectivist level separate the main approaches to research into distinct forms. Figure 3.2 highlights that there is considerable and apparently irresolvable disagreement over epistemology and the standards used to discern knowledge (Johnson & Duberley, 2000).

Section 3.2 demonstrated that the research paradigm used in SCM is overwhelmingly positivist, and the content explored is sparse on social issues. This study seeks to address some of these biases by choosing to take the more difficult path of stepping outside of positivism, which is defined as the belief in the basis for absolute knowledge (Nielson, 1990). First, this is more difficult because positivism's dominance in both the natural and social sciences and its status as the taken-for-granted "one true way" means the limitations of its epistemology do not need to be explored in anywhere near the depth required when using other approaches. However, it is precisely because the tacit legitimacy given to positivism's apparent common sense way of doing research may in fact be inhibiting SCM research. Therefore, a different approach is required to better understand if such limitations exist. Second, the considerable debate around positivism's limitation with respect to social sciences research suggests alternative research methods may be required to generate fresh insights (Chalmers, 1979; Denzin, 1989). Even the most eminent positivist, Popper (1962), conceded that the subject matter of social sciences is different from that of the natural sciences in the matter of causality, with the former being contingent and the latter invariable. Despite such differences, Popper advocated a single research method (Lawson, 2002). Kuhn (1970b) tended to distinguish between natural and social science, arguing the latter was preparadigmatic. Kuhn's work also demonstrated that positivism is but one of many paradigms. It therefore seems timely, appropriate and logical to use non-positivist research methods to explore social variables in the relatively young and emerging field of SCM.

The challenge becomes which alternative research approach to use. Under Kuhn's argument there is no framework of paradigm-independent epistemological criteria by which to decide between competing knowledge claims of different paradigms. Lakatos

(1970; 1999) is critical of such an approach, claiming it means that there is no way of judging a theory, save by assessing the number, faith and vocal energy of its supporters. Kuhn's approach opens the door to a relativistic approach due to there being no neutral standpoint, as epistemic standards are encoded in paradigms which themselves are culturally specific. Feyerabend (1978, p. 76) claims this leads to an epistemological anarchy in which "anything goes". Kuhn (1970b) is eager to avoid such anarchy and, while claiming paradigms are incommensurable, is ambivalent about the relativist stance which logically follows and opens the way for subjectivist ontology. Kuhn (1977) specifically claims not to embrace a relativist position and has made implicit appeals to ontological realism elsewhere in his work.

A conventionalist approach which, according to Johnson and Duberley (2000), includes both Kuhn, and Burrell and Morgan (1994), is also rejected. Kuhn contends social science is not science but "proto-sciences" (1970b, p. 245) or prescience. Kuhn uses these terms to describe a multiplicity of "pre-paradigmatic" (1970a, p. 160) schools of thought. As shown in Chapter 2, this does appear to be the case, as many disciplines with distinct lines of thought are claiming SCM. Skjoett-Larsen (1999) appears to have reached similar conclusions arguing that logistics research needs to go beyond both a Popperian and Kuhnian approach. Burrell and Morgan's (1994) four paradigm model would seem better equipped to deal with many disciplines. However, all conventionalist approaches are rejected for this research because while conventionalism has cast doubts on the strength of positivism, it nonetheless has been criticised as being incapable of defending itself given its relativist position (Siegel, 1987). Kuhn, and Burrell and Morgan "oscillate inadvertently between subjectivist and objectivist ontologies and thereby vary in their orientations toward subjectivism" (Johnson & Duberley, 2000, p. 86). Such an approach therefore tends to increase epistemological tangles rather than resolve the criticisms laid at conventionalism.

Kuhn's incommensurability of paradigms opens the door to an issue which has been, and remains, a source of considerable controversy – relativism, which is the opposite of conventionalism. While many struggle with relativism, the postmodernists seem to thrive on this argument. Postmodernism is notoriously difficult to define. Reasons include the complex (and possibly impenetrable) language used; the disparate range of writers such as Foucault, and Lyotard and Baudrillard who are categorised under this banner (Alvesson, 2000b); and the use of a methodology that encourages "a multiplicity of perspectives which emphasize ambivalence and indeterminacy" (Johnson

& Duberley, 2000, p. 91). As a result, many “associate postmodernism with a lack of interest in, or even direct scepticism of, the very idea of social research as conventionally understood” (Alvesson, 2000a, p. 1). Simply defined, postmodernists are the exact opposite of positivists as they claim that both ontology and epistemology are subjective (Appignanesi & Garrat (1995). This position is criticised by Johnson and Duberley (2000) as relegating science to a self-referential exercise with no common ground for judgement between theories. Relativism is caught in a paradox as it contends that notions of truth are constructed through sociohistorical processes and, therefore, it follows the doctrine itself cannot be valid since it is also created by the same forces. Such a research paradigm also appears to contradict the very basis of SCM that presupposes an objective reality, which enables firms to create contracts and exchange goods, services and finance. In terms of management and organisational studies, postmodernism would reject any claims to a grand narrative, as empirical findings are seen to “reflect pre-existing categories” (Hassard, 1993, p. 12). While such an approach would doubtless provide some insights into the limitations of conventional research, it is rejected on the grounds of being too disconnected from the assumptions of SCM – built upon the positivist underpinnings of operations management, logistics, and the exchange of goods and services for money – to allow much reflection on, or advancement of, existing research.

This leaves the critical approach to research. Common to both the critical theorists and the critical realists is a realist ontology and a subjectivist epistemology. Critical theorists draw on the concepts of the three leading thinkers of the Frankfurt school – Max Horkheimer, Theodore Adorno and Herbert Marcuse. Initially they commenced within a Marxist framework and whilst second generation thinkers in this body of theory, such as Habermas, were to abandon the strict Marxist position, the focus on domination and repression in the modern world remains a unifying theme. The fundamental assumptions of critical theory include an emphasis on the social construction of reality; focus on power relationships and the role of ideology in preventing people from living fulfilling lives; a systems approach and the need to understand the multiple connections within holistic historical contexts and the importance of praxis which involves the research being actively engaged in social struggle (Prasad & Caproni, 1997). This last point is a recurring theme in critical theory and without a commitment to praxis, research is seen as “becoming a self indulgent academic effort and thus risks losing its emancipatory potential” (Prasad & Caproni, p. 3).

This school rejected Cartesian-based epistemologies, arguing that it is not possible to separate knowledge from the interests of the knower; therefore, positivism's claim to theory-neutral language is not only wrong but, in fact, conceals the values of the knower and, often, the domination associated with their interests. Critical theory is often credited with having been the logical step which opened the door to postmodernism. While there are many areas of overlap between the two, the key difference is found in the critical theorists' rejection of relativism and a distinct ethical position and goal around emancipation.

Critical theory has not been widely used in management studies. Some suggest this is due to the fundamental contradiction within this theory which views management philosophies as masquerading as neutral while in reality they are structuring relationships around oppression and exploitation (Grice & Humphries, 1997). Critical theory, however, is not exclusively antimanagement (Deetz & Kersten, 1983; Grice & Humphries, 1997), rather it seeks to move outside institutionalised managerial values. However, critical theory often appears to treat managers as a homogeneous group whose sole purpose is to act as agents of capitalism by oppressing workers while generating returns for shareholders (Clegg, Hardy, & Nord, 1996). Some critical theorists, however, claim managers are oppressed or conflicted by the same system (Alvesson & Wilmott, 1992; Forrester, 1992; Horkheimer, 1989). Still others claim critical theory has a research bias which favours the abstract and esoteric above empirical research, thereby failing to provide a clear exposition of the impact of their approach upon research methods, and creating a considerable theory and research practice gap.

Other criticisms of critical theory centre on whether researchers using this approach can step outside hegemonic power relationships to assess reality. Worse still, if all knowledge is interest based then how can they be sure they are not setting up new sources of domination? Postmodernists would argue the metanarratives of the critical theorists "assume the truth of their own claims" (Rosenau, 1992, p. xii). Any such claim to truth represents an arbitrary privilege which is at odds with the emancipatory aims of critical theory (Grice & Humphries, 1997).

Critical theory is rejected in this case study research on a number of grounds. Firstly, its preoccupation with oppression has within it too many assumptions about the nature of truth. This is not to say that critical theory does not have a role to play in SCM. An obvious role exists by virtue of the exploitative aspects of supply chains which result in the proliferation in third world countries of child labour, lower safety standards and



environmental degradation (Blowfield, 2000; Klein, 1999). Concerns with the social construction of reality and the role of wider systems are also important to the research questions. However, this case study is based in Australia and while that does not exclude the possibility of exploitation, it is assumed that existing labour laws provide adequate protection compared to those which exist in poorer countries. Also, the research questions do not directly seek to explore issues around oppression.

Secondly, the proposed research is examining interactions across the supply chain. The research, therefore, has to work at higher organisational levels – that is, predominately at that of key decision-makers rather than incorporate all the workers in a particular function within a supply chain. This means the majority of subjects will, in fact, be managers or supervisors. Given that critical theory has far less to say about relationships that are assumed to be roughly equal, such a methodology is not ideally suited to this research design.

Finally, while both the postmodernists and critical theorists are correct to focus on the need to examine power (as in Chapter 2 it has been shown as a key dimension in SCM), it is a construction which can be examined by other methods. In addition, such approaches tend to *a priori* ascribe greater causality to this factor than to other variables. As the proposed study is exploratory, it is considered prudent to initially treat all factors as having equal causal capability.

### **3.4. CRITICAL REALISM**

A pragmatic, critical framework which combines the two streams of critical realism and pragmatism has been chosen for the conduct of this research. While Bhaskar (1989b) is considered the founding father of the critical realist movement, there is a wide array of views on what the realism means and what Bhaskar is advocating. Beck (1996) argues realism and social constructivism have to be mutually exclusive. Hammersley (1992) states “that there is a reality independent of the researcher whose nature can be known and that the aim of the research is to produce accounts which correspond to that reality” (p. 43). Still others seem to conflate an objectivist epistemology with a realist ontology in a manner which ignores the possibility of combining alternative epistemologies with a realist ontology.

Critical realists reject the “epistemic fallacy” that lets the question “what can we know?” determine our notion of what exists. While supporting Kuhn’s attack on what is seen as positivist’s naïvely objectivist epistemology, critical realists then distance

themselves from Kuhn's boundary riding with relativism. Bhaskar specifically repudiates the idea "that we create and change the world, along with our theories" (1986, p. 2). Therefore, unlike the relativists, critical realism eschews any attempt at collapsing ontology and epistemology into one another. Many see critical realism as an attempt to overcome the challenge of postmodernism, as critical realism's imperative is that truth must be more than a language game yet it cannot be absolute. Critical realists are not alone, as Alvesson and Deetz (1996) and Kilduff and Mehra (1997) have sought in various ways to divert postmodernism from its relativistic trajectory by tacitly attempting to combine its social constructivism with a largely unrecognised realism. Parker (1993) captures the general mood of this movement of distancing from postmodernism when he states:

... unlike postmodernists I believe that there are limits to human action ... I do not believe the world is infinitely pliable and would want to assert that physical, biological and social constraints exist in a real sense ... Language may be the medium for all forms of inquiry ... but it does not follow from that premise that language is all there is. (pp. 207-8)

The ontological basis for this research is provided by transcendental realism (Bhaskar, 1978) which is consistent with the open systems worldview. This latter point is important, as most positivist research assumes a closed system view. Transcendental realism is the term for Bhaskar's general philosophy of science, while his focus on the social sciences (as opposed to the natural sciences) was named critical naturalism. In time, "critical realism" came to be an inclusive referent (Bhaskar, 1989b), and will be used hereafter in this document.

Bhaskar (1978) presents an objectivist ontology that is stratified into three domains: the real, where interacting causal or generative mechanisms reside, independently of our knowledge of them; the actual, where events occur; and the empirical, where events are measured or experienced. Reed (1997) argues that such stratification also avoids the conflation of structure and agency that occurs in ethnomethodology, ANT, and poststructuralism, and which he claims reduces the explanatory power of organisational analysis. Reed reports ethnographic researchers as claiming that structures have no ontological status, a position with which Bhaskar (1986) disagrees. In his view, agency draws on structure for action, and actions create structure, thus structure and agency cannot be reduced one to the other as postmodernists believe

they can (Johnson & Duberley, 2000). While Reed identifies circular causality between structure and agency, he fails to make a connection to the nonlinear dynamics that such a process produces.

It is contended that a stratified ontology is consistent with the complex, dynamic, multidisciplinary nature of supply chains – for example, where technological assets such as IT exist in the real domain, and come into play at the actual level of social interaction in ways which may or may not be observed in the empirical domain. In accepting a relativist epistemology that knowledge (not reality) is socially constructed, the means for judging theory comes from an appeal to the causal mechanisms located in external reality, and the efficacy of human actions in achieving outcomes (Johnson & Duberley, 2000). Fortunately, while supply chain research literature may lack consensus on the exact nature of the outcomes, there is sufficient consensus around issues such as improved efficiency and customer service to suggest that the methodology is well suited to SCM research.

While others, such as Maturana (1988), Harre (1986), and Shotter (1993) criticise elements of critical realism, it is gaining recognition as an appropriate paradigm and a guide to methodology within complex phenomena including nonlinear research (Manicas, 1987; Tsoukas 1989). Rather than establishing law-like correlations associated with constant conjunctions of events, critical realism describes the operation of causal tendencies or powers, and examines their effects using empirical evidence. Critical realists use case studies in ways which are “epistemologically valid because they are concerned with the clarification of structures and their associated generative mechanisms, which have been contingently capable of producing the observed phenomena” (Tsoukas, 1989, p. 556).

Like any research paradigm, critical realism has its limitations. It is, therefore, not offered as a panacea to overcome the limitations of other research approaches such as positivism or social constructivism. However, its stratified ontology is seen as capable of embracing the findings generated by other research approaches. The empirical domain is completely able to use positivist research approaches and can, therefore, build upon the findings coming from the dominant theories such as operations research and logistics, which have historically played a large role in informing SCM. Critical realists agree with positivists that there is a world of social events out there that is observable and independent of human consciousness (Danermark, 2001). However, they also have links to “weak” as opposed to “strong” constructivist approaches (Lupton, 1998). The latter

approaches claim that reality cannot have an “independent” existence because it is experienced, interpreted and understood through the human mind. Nonetheless, the weak approaches, while accepting there is no neutral access to the world and that knowledge is by and large linguistic and social, claim there exists external to us an independent reality – an intransitive dimension (Bhaskar, 1978). The real distinction is that, under critical realism, positivist findings – such as those involving statistical analysis – are seen more as descriptions than explanations of causal relations in highly complex situations and as such, are a starting point for looking at such relationships rather than the final phase of the research (Danermark, 2001).

The application of critical realism to research is not common (Archer, 1995; Johnson & Duberley, 2000), and there are no widely agreed upon methodological prescriptions, consistent with a relativist epistemology. The reasons are unclear, as a critical realist framework allows both theory and theory development. However, Miles and Hubermann’s (1994) research method and qualitative data analysis has been widely used in a variety of settings over several decades. The authors of this credible research methodology specifically align themselves with Bhaskar’s (1978; 1989a) theory when they state that “(w)e see ourselves in the lineage of ‘transcendental realism’” (Miles & Hubermann, 1994, p. 4). Other researchers also align with Bhaskar’s approach (Harre & Secord, 1973; Manicas & Rosenberg, 1982). The research paradigm and research methods and tools have alignment. The exact details of how this method is used for exploratory rather than confirmatory research are discussed in Chapter 4.

### **3.4 CRITICAL REALISM AND MULTIDISCIPLINARY RESEARCH**

As shown in Chapter 2, SCM is multidisciplinary by its nature. Ideally, the research paradigm used for SCM should therefore presuppose that different areas of knowledge are involved and the research methodology can deal with those differences. As already shown in the previous section and illustrated in Figure 3.3, this is no simple matter because different disciplines divide on the basis of what combination of research methods to apply in order to advance their respective bodies of knowledge. The differences in research paradigms have profound implications both on what is found and how it can be interpreted and analysed. The major point of difference is that science seeks to deal with facts. The problem is that social facts are different from physical facts; with the latter, assertions are treated as factual statements which can be empirically tested as to truth or falsehood while the former deals with formal statements which can be conceptually

tested. For example, some social facts are regarded as such because we agree upon their meaning and give them meaning, but they are not universal in the way that physical facts are. Some social facts are negotiated, or constructed if you like, while other social facts exist independently of the opinion others or we may hold (Johannessen, Olaisen, & Olsen, 2002).

## Differences in Natural and Social Sciences

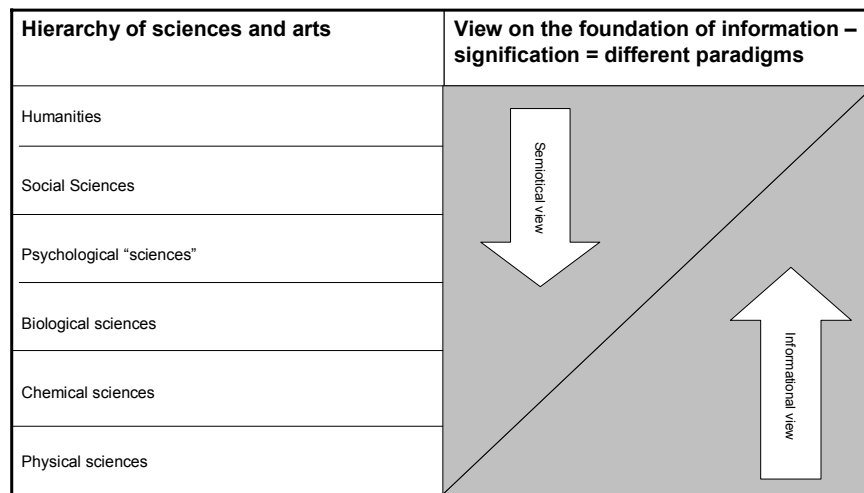


Figure 3.3 Differences in Natural and Social Sciences

Adapted from “The necessity of trans-scientific frameworks for doing interdisciplinary research” by S. Brier , 2006, *Kynerbetes*, 35(3/4), p. 405.

An immediate implication of the use of different research paradigms is found when investigating SCM which fits within open systems theory. Senge (1990) stresses the need for systems thinking in investigation systems. Systemic thinking argues that in order to understand objective social facts, the subjective aspects must be studied. In systemic thinking there are both objective and subjective social facts, but they are often more difficult to grasp than facts in nature, because social facts are often distorted and influenced by expectations, emotions, prejudices and ideology in addition to economic and social interests. It is, therefore, difficult to separate objective social facts from subjective social facts. But even if objective social facts are embedded in subjective entities, they will still have a real existence for systemic thinking. (Johannessen & Olaisen, 2005).

Jackson (2003) stresses the need embrace the “transdisciplinary” of systems thinking which involves drawing ideas and concepts from a variety of different disciplines. Some literature distinguishes between multidisciplinary and interdisciplinary research on the grounds that the former places emphasis on integration in terms of theories, concepts and methods whereas the latter chooses to analyse a problem at different levels with different methods. Critical realism claims that the act of unifying, as sought by multidisciplinary research, is not possible and is, therefore, best described as using interdisciplinary research (Danermark, 2001). Henceforth, if either term is used it is to be taken as defined within a critical realist approach.

Critical realism’s alignment with interdisciplinary inquiry brings the following distinct perspectives to any research:

1. The stratified ontology – the distinction between the three ontological domains (the empirical where we observe events, the actual where events and nonevents are generated and the real which underpins the structure of society) means that the research is seen to examine all three including “the deep structure” of reality (Bunge, 1979). The three levels are assumed to be hierarchically ordered in a way that the lower level creates the condition for, but does not determine, the higher level. Each level has its own generative mechanisms and it is the existence of such specific mechanisms that constitute a level. The research results are produced by these mechanisms working at different strata. The key concept here is “emergence” whereby something qualitatively new emerges at one level that cannot be explained at another and so what happens at one level cannot be reduced to another level. However, this does not exclude the research determining if an event is produced by mechanisms or if it is determined by systems at other levels. To understand what is happening at one level requires insight on how mechanisms happening at other levels might influence outcomes at the actual level. For example, a person with a physical handicap can have that explained at the empirical level in medical terms but the stigma experienced as a result of the handicap is produced by social mechanisms which could vary with cultures. The clear advantage to SCM of a stratified ontology is that the same phenomenon can be studied at different levels.
2. The transitive and intransitive dimensions of reality – independent reality (intransitive dimension) exists which consists of the natural world and the human-constructed world about which we have fallible knowledge (the transitive dimension). This view

is well suited to research exploring social factors in SCM and, again, is best served by interdisciplinary research.

3. Causation in terms of generative mechanisms – mechanisms exist ranging from the macro through to the micro which have powers we cannot observe but which we can experience indirectly by their ability to make things happen. The powers of such mechanisms produce events and in the social level these are given their own ontological status (Archer, Bhaskar, Collier, Lawson, & Norrie, 1998). Such ontological status guides the explanatory theories about the status.
4. The importance of contextualisation – all events are produced in a highly complex context with the exception of extreme cases where it is possible to isolate all other mechanisms other than those being studied. Such isolation can only happen in closed systems. In closed systems it is possible to use experimental design and in semiclosed systems, quasi-experimental studies. While these methods can be used with the lower level stratum, critical realism argues there are too many mechanisms involved in social science research to effectively use both of these methods and too many contextual variables are missed by such approaches. The outcome of a mechanism is, therefore, always dependent on the context in which it is active and, as processes are always contextually determined, history is also important. Social phenomena are often determined by factors of culture, class and gender. Context determines how the mechanism is empirically manifested (fully, partially or not at all).
5. An open systems approach – SCM and logistics is based on systems theory (Rigby, Day, Forrester, & Burnett, 2000; Sterman, 2000). However, this tradition has largely dealt with the movement of freight, and even passenger studies tend to view people as “self loading cargo.” As a rule, it is not possible to conduct closed systems research in the social sciences – hence the need for an open systems approach. Nor is it possible to do such in most biological science (Suzuki, 2006). Therefore, the mechanisms which are assumed to constitute reality cannot be studied in terms of regularities but tendencies. This has implications for how research is conducted as quantitative research practices, such as testing the null hypothesis, are not adequate for unmasking possible causal explanations. This view aligns well with the possibilities raised by Jackson’s (2003) ideal system typology which suggested that a reductionist hypo-deductivist approach was not well suited to exploring anything but relatively simple hard systems. The other implication is that the methodological approach has to be designed in accordance with the context in which the phenomena are situated.

The five ontological assumptions combined with interdisciplinary research open up wider research possibilities including, if required, metatheoretical perspectives, and the use of different research methods at different levels.

Critical realism also pays considerable attention to the various cognitive processes used to infer knowledge. This is considered important since reality does not speak for itself. Understanding the limitations of our reasoning – including our ability to analyse, abstract, relate interpret and draw conclusions – is a fundamental precondition to knowledge development. Critical realism contends that there are four modes of inference and these have different possibilities and limitations in terms of knowledge discovery. These modes are deduction, induction, abduction and retroduction. Appendix B provides a comparative summary of the possibilities and limitations of each.

Deduction is generally taken to be the opposite of induction in that it takes its starting point from the conclusion of induction, namely a universal/general law. Deduction can thus be used to deduce a particular from a universal law. The key point to make is that while deduction and induction are very effective at investigating the empirical level of reality, critical realism is also concerned with understanding the generative powers and mechanisms which cannot be directly observed at the domain of the empirical (Bunge, 1993). A decisive difference between deduction and abduction is that deduction proves something must be in a certain way, while abduction shows how something might be (Habermas, 1972). Critical realism criticises empiricism for its reduction of reality to the observable because it claims there is a distinction between a real world and a conceptual one, between our description and the factual reality. Comprehending deeper structures and generative mechanisms requires the use of abductive and retroductive inference. It is for this reason that the study described in this thesis cannot be conceptualised as a strictly inductive study. Critical realism would argue that induction “gives no guidance as to how, from something observable, we can reach knowledge of underlying structures and mechanisms; it is limited to conclusions of empirical generalizations and regularities” (Danermark, Ekström, Jakobsen, & Karlsson, 2002, p. 87). Critical realism’s notion is that the objects of science are not primarily empirical regularities, but structures and mechanisms.

The American philosopher Charles S. Peirce (1931), a pioneer in semiotics and the American pragmatics philosophical movement (which shares much with critical realism) developed the term abduction. Peirce used the term to embrace both abduction and retroduction. Social scientists generally see this distinction as important (Danermark,



2001). Abductive research has entered numerous streams of research in disciplines such as learning, logic, neural networks and artificial intelligence. More recently there have been pleas for it to be used in SCM in order to break out of the positivist bias which has resulted in “a paucity of discussing different research approaches in logistics journals” (Kovács & Spens, 2005, p.132).

The abductive approach stems from the insight that most great advances in science follow the pattern of neither pure deduction nor pure induction. Creativity in research is necessary to break out of the limitations of deduction and induction, as advances in sciences often come from intuitive leaps that emerge as a whole and are commonly called abductive reasoning (Kovács & Spens, 2005; Danermark et al., 2002; Taylor, Fisher, & Dufresne, 2002). The introduction of intuition, creativity and imagination into research is what differentiates abduction from the dominant research methods. Abduction involves the ability to see something in a different context, to “see something as something else”, so to speak. It involves not only description but redescription. Redescription is not seen as necessarily providing a better description of the object of study; rather, in abductive reasoning, the case presents a plausible but not logically necessary conclusion. Therefore, abductive conclusions in social science are seldom capable of deciding if something is ultimately true or false (Danermark et al., 2002).

The severe limitations of abduction raise the question about why it should be used in SCM research. The first point is that abduction seeks to generate new insights by examining matters from fresh perspectives and, similarly, SCM is a multidisciplinary field, drawing on many perspectives. Secondly, SCM involves investigating social issues. Social scientists are not in the business of discovering new events previously unknown to anyone; rather, what they discover is connections and relationships that are not directly observable. The modes of inference available through abduction will assist social research. Finally, abduction is very useful in developing theory in emerging fields such as SCM and can lay a platform for subsequent inductive and deductive research (Kovács & Spens, 2005).

Retroduction differs from deduction, induction and abduction in that it is not a formalised mode of inference. What it does have in common with these other modes of inference is thought operation, whereby it is possible to move one thing to knowledge of something else. The core of retroduction is transcendental argumentation. This argumentation seeks to clarify the basic prerequisites or conditions for social

relationships, people's actions, reasoning and knowledge. In this context, conditions mean the circumstances without which something cannot exist. As intentionality is taken as a universal condition for all human activity, retroduction encourages investigators to ask questions as to what would happen to social structures if intentionality changed. An obvious example in SCM would be what would happen if intentionality around the often cited constructs of trust and collaboration were removed. This approach has been severely criticised for being outside what we spontaneously experience or observe. Critical realism repudiates such a view on the grounds it reduces knowledge to that which is directly given or observable. Retroduction has been widely used in social science by researchers who side with and against critical realism, such as Habermas, Bauman and Collins (Danermark et al., 2002). Since it has been established that we are dealing with research into open systems, and the more open the system the more the complexity around the mechanisms which are cooperating to maintain that system, retroduction is well suited to assisting the exploration and possible detection of tendencies which maintain the system within a specific context.

### **3.5 CRITICAL REALIST RESEARCH METHODOLOGY**

Bhaskar (1989b) and Archer et al., (1998) argue that the ontological perspective determines the research methodologies. In this instance, a single case study approach consistent with Miles and Huberman's (1994) research methodology was used for the following reasons. Firstly, Miles and Huberman define their approach as critical realist. Secondly, this approach allows deeper exploration of issues because context is given such high importance. It can capture "thick description" (Geertz, 1973, p. 2). Thirdly, as case study research has a long history in operations research, especially in Europe; it is well suited to dealing with the physical elements of organisations (Drejer, Blackmon & Voss, 1998); it has been particularly effective in the generation of new theory (Voss et al., 2002); and it is well suited for field studies and exploratory research (Lewis, 1998; Wacker, 1998). Fourthly, while case study research is good at examining "what" type questions, it has also been recognised as being helpful in sorting through "how" and "why" questions (Yin, 1994). The ability to explore such a wide range of questions through a single method is therefore well matched to the aims of this exploratory research.

### **3.6 CONCLUSION**

This chapter has demonstrated that there exists an enduring and largely taken for granted positivist bias in the SCM literature. It has revealed that positivism is limited in its ability to investigate complex systems and social phenomena, and that an argument has been proposed by some of the literature to use research methods which sit outside positivism in order to progress SCM theory development. It has examined the range of nonpositivist approaches and explained which of these alternatives has the best fit with the overall aims of the research. As there is no absolute standard by which to justify the supremacy of one research paradigm over another, it could be argued that any choice comes to a leap of faith. However, the reasoning behind such faith leaps was developed to demonstrate why critical realism was seen as an appropriate framework to explore the relatively new and extremely complex topic of SCM. Finally, the alignment between a critical realist research framework and the application of a case work study approach using Miles and Hubermann's (1994) research methods was also demonstrated. Chapter 4 now provides the details on the case study itself and how the critical realist research methodology was applied.

# CHAPTER 4

## 4 RESEARCH DESIGN

### 4.1 OVERVIEW

The purposes of this chapter are to describe in detail the application of the research methodology developed in line with the research paradigm identified in Chapter 3; to explain how the research was conducted and finally to show how the data were treated and analysed in order to generate the findings described in Chapter 5.

Section 4.2 describes the pertinent organisational characteristics of the firms involved in the supply chain. Section 4.3 discusses some limitations of the study which were not initially contemplated. It then goes on to explain how the research approach was modified to accommodate unanticipated constraints. Section 4.4 discusses the interdisciplinary team composition and multimethodology approach used. Section 4.5 details how the questionnaire was designed and demonstrates how the questions linked back to the research streams which in turn were directly aligned with the three propositions outlined in Chapter 1. Section 4.6 provides details of the key characteristics of the population and how and when the research was conducted. Section 4.7 discusses how ethical concerns were addressed. Section 4.8 reveals the processes used to handle the raw data and transform them into findings. Finally, Section 4.8 outlines how the overall case methodology employed led to the detailed production of the findings given in Chapter 5.

### 4.2 AREA OF RESEARCH - SUPPLY CHAIN

#### 4.2.1 Overcoming prior limitations in SCM research

The structured literature review in Chapter 3 identified two limitations to date in SCM research. Firstly, supply chains located in industrial markets and involving mature industries had not been extensively explored. Secondly, there was a strong tendency to conduct research almost exclusively within a positivist framework. This research has sought to overcome both limitations through the use of a single-case study of a steel rail supply chain based in Australia and within a critical realist research paradigm.

The first limitation has been addressed by the selection of a supply chain that has been in existence, fundamentally in its present state since 1983 and involves three

corporations (exact details follow in section 4.2.2). The three organisations are located in two mature industries (rail and steel). The first limitation is therefore addressed. The second limitation of using a nontraditional research approach is addressed by the application of a critical realist research orientation. Just what such an approach entails is explained throughout the rest of this chapter.

#### **4.2.2 Details of the Organisations in the Supply Chain**

The three corporations are, the manufacturer of the steel rail (Firm A), the transport provider (Firm B, also referred to as Firm B Pty. Ltd. in Figure 4.1) which transports lengths of steel rail on rail wagons across three states until it finally arrives at the GOC (Firm C), which uses the steel product for construction and maintenance purposes in its own rail network. Both Firm A and B have only existed in their present corporate entities for 4 years. Despite changes in ownership structures, the technical roles (production and transportation) of both Firms A and B in this chain have not significantly altered since the creation of the chain in 1983. Firm C has existed in its present form for 140 years. As Firm C was at the end of the chain the research has used this as the focal firm from which to understand the chain.

Firm A (the manufacturer) is a publicly listed company that was divested from its parent company (Big Oz) in 1997, but maintained its contractual transport long-term arrangements set up by the parent with the interstate rail transport provider while it was government owned and subsequently when it became a privately owned firm. Firm A's previous corporate parent, Big Oz, had been a highly successful multibusiness corporation for most of the last century, with national and international interests in mining (minerals, coal and iron ore), petroleum and gas, steel manufacturing and bulk freight transportation. Big Oz's transportation arm set up the long-term contracts between Firm A and Firm B. A series of poor financial outcomes by Big Oz resulted in the appointment of a new management team which was followed by a decision to break up and sell off parts of the company. Firm A was relatively small compared to the parent and was the first business to be sold off. Firm A started its life with heavy debt levels but traded its way out and down to more tolerable levels within 3 years. Share prices have generally experienced steady growth over that period.

Firm A had been run as eight historically distinct – yet related – businesses under the corporate parent. When Firm A was divested, it set about “vertically integrating” (according to its own official documents) eight business units spread across mining, steel

manufacturing, and steel and metal distribution in order to operate as a single company. With annual revenue of AU\$3 billion, it has 200 operational sites across Australasia, and 30,000 commercial customers, Firm A employs 6,900 staff and specialises in the production of long steel products, the bulk of which are used in construction, manufacturing, housing, mining and agricultural products.

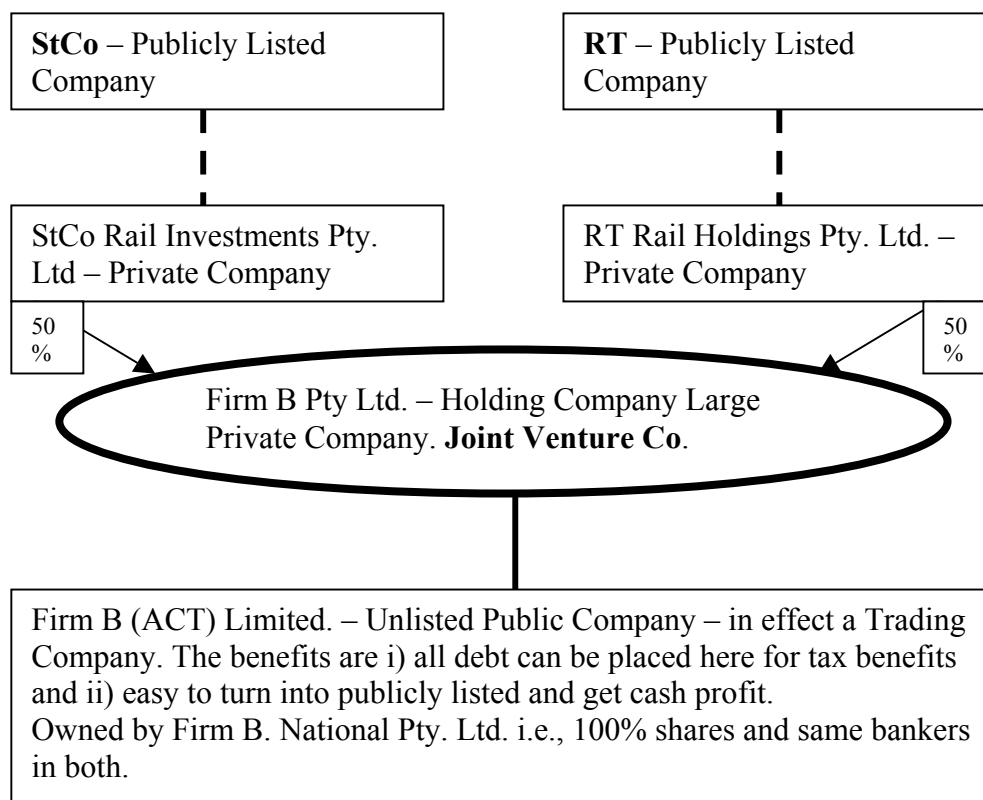
Firm A's main manufacturing plant, which smelts and rolls steel, is located in rural Australia. The advantage of this location is that it is near large iron ore deposits in which it has direct interests. This plant produces just over one million tonnes of steel per annum which are then rolled into a variety of long steel products used in a range of industries. Approximately 5% of its annual production is rolled as steel rail. It is the only producer of rail in Australia and has tended to enjoy monopoly status as overseas competitors are disadvantaged, firstly by Australasia having a unique rail specification on footing and profile, thereby increasing the set up costs for competitors and, secondly, by the bulk nature of the commodity which increases transport and handling costs over distance. For the period 1990 to 2000 half of this rail was produced for Firm C. This supply chain commenced in 1983 when the equipment for producing the present 27.5 metre lengths of rail was set up at Firm A's manufacturing plant. Rail comes in several types, such as 50 and 60 kg (weight per metre), and plain and head hardened. In this supply chain, over 95% is plain steel rail.

As both firms B and C are in the rail industry a brief description of the two models in this industry is required. A "vertically integrated" railway is a single entity which owns and controls both "above rail" operational assets such as locomotives and wagons and the "below rail" assets (track, signalling equipment and stations) along with the right to sell access to the track. This model is dominant in North America. A "vertically separated" railway, on the other hand, is where the operators and track owners are in different companies and work with each other through contracts. This model applies in the UK and most of Australia. While all Australian state governments had owned vertically integrated railways up until the 1990s, Firm C is the only government owned vertically integrated railway left in Australia. Firm B is very different from Firm C as in its present form it fits under a vertically separated railway model. It is predominately a rail operator and buys track access from a track provider – Oztrack. Oztrack controls the track crossing three states which is used to transport the rail to the fourth state where the track is both owned and controlled by Firm C. Oztrack was not included in this study. It deals with several hundred trains moving across its network each week. The single train movement per week

associated with this supply chain was, therefore, not particularly significant to their operations.

Firm B became a national force in 2002 when it acquired the rail freight businesses of the Federal and State governments. Both governments had sold their freight businesses in response to a series of microeconomic reforms, most notably the National Competition reforms commenced by the then Federal Labor Government in the 1980s. The joint venture that formed Firm B was part of a clearly articulated strategy by the two owners to control most of the critical factors of production in transport supply chains by controlling all modes of transport, ports and terminals. The privatisation and selling off of most state rail systems and the entire federal system, made possible the implementation of such a strategy within a very short time. The ownership structure of Firm B as shown in Figure 4.1 helps demonstrate how its organisational structure aligns with the supply chain strategy by controlling all factors of production in the transport chain.

Firm B is a private joint venture company equally owned by two publicly listed companies – a stevedoring company (StCo) and a road transport (RT) company. The ownership structure is shown in Figure 4.1.



**Figure 4.1. Ownership Structure of Firm B.**

The joint venture between the two partners who own Firm B has effectively locked in most modes of production (wharfs, road and rail transport, airlines, and warehouses) in the transport chain value stream under their control. Both StCo and RT have enjoyed spectacular growth in the past 10 years. Road transport in Australia has been steadily growing for the past decade. RT's annual reports reveal that its revenue growth for the same period went from AU\$150 million to AU\$2.5 billion. Much of this growth is attributable to takeovers and buy-outs rather than growth of the total freight market. RT's growth through concentration has coincided with a trend which saw a reduction in the number of transport providers across the nation. Its acquisition strategy accelerated this trend. Firm B now employs 3,700 staff across Australasia, has 1,000 locomotives and 10,299 wagons located in over 100 sites, and is investing AU\$300 million in terminals and new rollingstock (mainly wagons).

While rail operation has changed from government to private ownership (Firm B), the actual mode of transport and the rail corridor has not significantly altered since Firm A set up its plant in 1983. Firm B owns wagons designed and dedicated to transporting steel rail. These are referred to as "sets" or "pairs" because the rail lengths are placed across two wagons.

Firm C is a public utility that has been in existence for 140 years. It was transformed from a government department with the protection of the Crown (Australian Federal and State governments had tended to exempt themselves from much of their own legislation) to a fully commercially accountable entity when it was corporatised in 1995 under the GOC Act (1994). With the exception of Firm C, all other state owned railways have privatised their freight operations. Firm C is a multibusiness corporation, with four distinct businesses which all trade under the one corporate entity they serve. These markets are freight (bulk, general and small), passengers (long distance and commuter, along with tourism activities), track access (providing slots for operators) and consulting (selling intellectual services on rail engineering and operations). Annual revenue is in excess of AU\$2 billion per annum with an asset base valued at AU\$8 billion. On average, Firm C invests in excess of AU\$500 million per annum in capital works. At the time of the study it had approximately 13,500 employees.

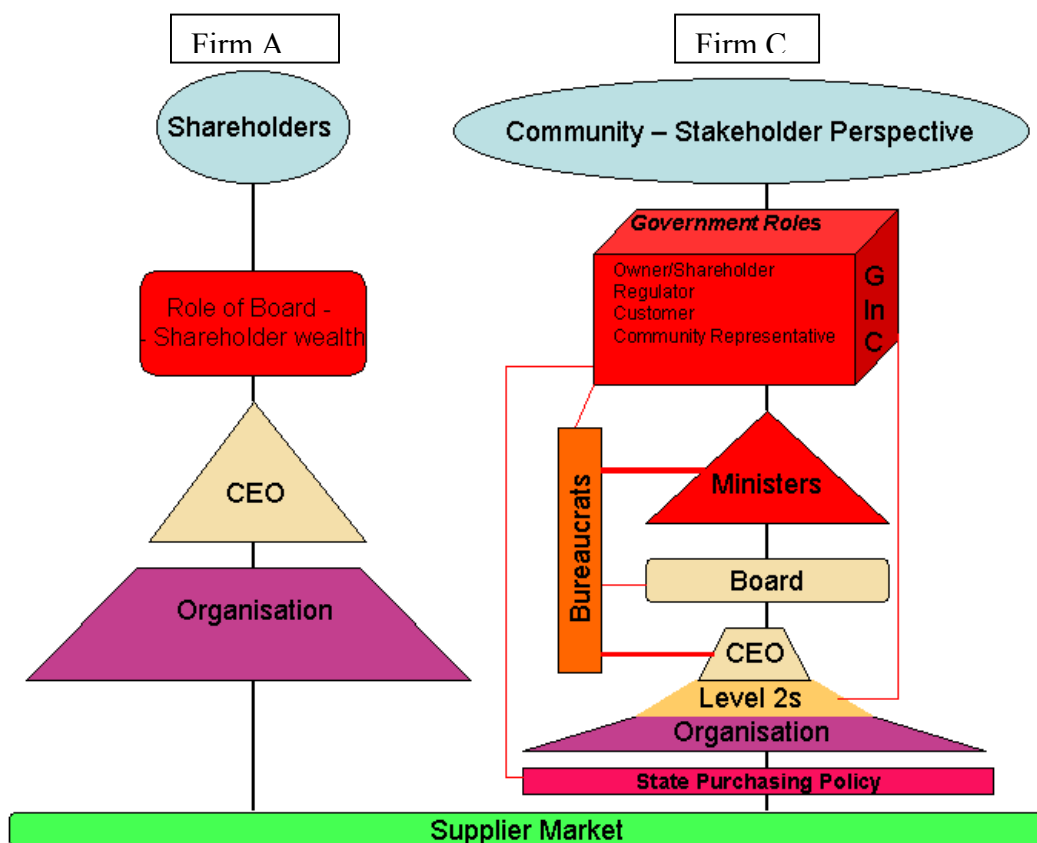
For the purposes of this study, the focus is on the track access business (TAB). Firm C is the owner of almost 9,500 km of track and associated assets such as bridges, tunnels, signalling systems and electrical overhead which provide traction power. The TAB generates AU\$600 million in annual revenue by selling train paths for specific time



periods (slots) to all rail operators including the freight and passenger businesses in its own corporation. Its asset base is in excess of AU\$5 billion.

Firm C faces unique difficulties as a vertically integrated railway which exists in a country with a national and state rail regulatory framework designed for vertical separation. Such a framework was seen as necessary to meet the requirements of the NCP as expressed in the legislative requirements of “competitive neutrality”. Specifically, a vertically integrated railway is seen to have an advantage over any operator who would want to use its track. In such a case, the vertically integrated railway could not only gain information on its competitors’ operations but could also use that information to frustrate the competitor by, for example, selling track access to its own rail component when that access was required by the competitor. TAB has to not only provide access to all operators but be seen to do it in a fair and impartial manner. This is achieved by a complex administrative arrangement known as “ring fencing”. This means that while information can go into the TAB from all operators for planning access slots – and possible extensions to the network – such information cannot be shared with the other arms of the corporation as this would give an unfair advantage to Firm C’s operating arm which presently dominates the operations. Meeting ring fencing requirements involves complex and expensive administrative arrangements for Firm C. Others avoid the need for ring fencing by making the track owner a separate legal entity with no overlapping interests to rail operators beyond providing track access on a commercial basis.

A comparison of the governance structures of Firm A and Firm C is shown graphically in Figure 4.2. The purpose of the comparison is to illustrate how two organisations which are, in theory, both set up to serve commercial objectives can experience major operational differences because of their governance regimes.



**Figure 4.2. Comparison of Firm A and Firm C's Governance Structures.**

Firm A (left) is a public company listed with the Australian Stock Exchange (ASX). This firm has a simple shareholder decision-making framework. Firm C, on the right, has a far more complex governance structure with a stakeholder focus that creates conflicting roles in relation to decision-making. As shown in the diagram, there are at least four roles that the State Government plays with Firm C. These are owner (shareholder), regulator (Department of Transport), customer (the government funds Firm C to provide freight and passenger services for “socially good” reasons in markets which are not economically viable), and community representative (being government owned means customers and a range of lobby groups try to direct Firm C by political processes). As an owner, the government can exert enormous control over the organisation. The Chief Executive Officer (CEO) can suggest senior management appointments (those who report directly to the CEO) to the Board. The Board can in turn recommend such appointments, but only the Governor in Council (GiC) can approve the appointments. The two shareholding Ministers (Treasury and Transport) can direct Firm C to carry out activities which are at odds with its commercial charter provided the Ministers do so

jointly as specified in Part 3, clause 84 of the GOC Act (1994). The GOC Act specifically states that the Ministers are not directors. The Act also makes it very clear that all power to make significant decisions clearly lies with the Ministers. However, the two shareholding Ministers are reliant on their advisors (defined as bureaucrats in Figure 4.2) as they do not have the time to work through the volume and complexity of issues they regularly face.

Reference is made to the State Purchasing Policy (2000) in Figure 4.2. to show how the controls placed on Firm C by its owners impose restrictions on the type of supplier relationships that Firm C can enter into, thereby affecting supply chain agreements. The GOC legislation allows the Minister to direct the GOC to meet government requirements even if these directions work against the economic interests of Firm C which, under the same legislation, has a commercial charter. Other state government legislation appears to contradict the intent and execution of GOC legislation. For example, the state consumer protection legislation is administered by the State Competition Authority (SCA). In the absence of a competitive market the State Government has entrusted the SCA to set the track access charge rate for Firm C's TAB (which is essentially a monopoly). These rates are based on the SCA's assessment of best practice and competitive prices. Yet at the same time through instruments such as the State Purchasing Policy, the State Government requires Firm C to buy inputs at noncompetitive rates to meet other apparently conflicting government objectives.

The State Government had, under the NCP, agreed to give up its monopoly rents on utilities in return for massive funding from the Federal Government. Such funds were conditional on states opening up their utilities to full competition deregulation combined with corporatisation or privatisation. The State Government had little or no experience in running GOCs in the late 1980s and early 1990s. It also had little or no choice but to engage with the massive changes needed in order to implement such reforms. Signing up to such undertakings with the Federal Government meant that failure to reform would result in dire economic and legal consequences. However, while such reforms reduced economic risk in the eyes of government, they increased political risks. Subsequent evidence of this concern was demonstrated with the formation of the "One Nation" political party which, within a couple of years from its inception, had converted public anger against NCP into 11 seats in an 89 seat state parliament (in Firm C's home state) and had gained seats in most parliaments across Australia. The creation of the GOC Act (1994) and the subsequent application of this legislation need to be viewed in the context

of a government with valid concerns around voter backlash to economic reforms, and ideological divides within its own party about which ownership models were best suited for delivering services provided by utilities. The net result is that Government entered the world of GOCs trying to satisfy numerous stakeholders with conflicting needs. The consequence for the TAB is that it has to manage within this complex, and somewhat confused, regulatory framework.

The basic management task of the TAB is planning for the maintenance, upgrading and extension of the rail network. This planning triggers the demand for rail by Firm C. Once the rail arrives at Firm C it undergoes several steps before it reaches its final destination and fulfils its purpose – that is, being in the track and fit for usage by operators. The first step involves transshipping rail from a standard gauge used by Firm B to a narrow gauge used by Firm C. It is then transshipped approximately 2,000 km to a welding plant where three 27.5 metre lengths are welded together into 110 metre lengths. Long lengths are seen to add value by reducing installation time on site. The greater the length, the more efficient the track-laying machine (TLM) can be. These long length rails are then dispatched by train to their final destination where they are installed into the rail network of Firm C.

#### **4.3 LIMITATIONS OF STUDY**

A severe limitation in this study is that no subjects from Firm B were interviewed despite the key role it plays in this chain. The reason was that the focal organisation (Firm C) was seen to be the instigator of the research. Firms B and C were in legal dispute over possession of a freight terminal because while Firm C owned the terminal, Firm B was claiming it had an exclusive lease. This terminal included the transshipment area for the steel rail. Both firms had the same basic competencies and had begun competing in each other's markets. The view was taken that in the unlikely event that subjects from Firm B would agree to participate within such a difficult and strained context, the risk remained that the responses generated would be very guarded and, therefore, of limited use. However, as will be discussed, this situation in itself helped raise some interesting findings about the environments in which supply chains have to work, and just how far collaboration and trust can be taken. Fortunately, from a research perspective, Firm C's direct relationship in this chain was with Firm A. Firm B had contracted directly with Firm A and had, accordingly, no direct contractual obligations with Firm C with respect to this commodity. Despite these limitations, all the transport performance information

was available to Firm A and staff were able to discuss their dealings with Firm B's staff. Secondary sources of information such as annual reports and legal documents were also examined in depth to gain a fuller appreciation of Firm B. Firm C also had a great deal of competitive information on Firm B, but very little understanding of how Firm B's social dynamics affected the supply chain.

#### **4.4 INTERDISCIPLINARY TEAM AND MULTIMETHOD RESEARCH**

##### **4.4.1 Interdisciplinary Team**

A team consisting of three academics and four practitioners (including the author) was brought together to assist in the research process shortly after a research methodology was chosen. Two team members were female. The academics had expertise in organisational sociology, human resources (HR) and workplace design while the practitioners had knowledge of the focal firm and the supply chain, as well as having expertise in logistics, operations research, information management (including records management) and HR. Such a team was deemed necessary to ensure effectiveness of the research for the several reasons. Firstly, for reasons explained in Chapter 3, a stratified ontology argues that the disciplines and methodologies needed in order to achieve understanding can vary across strata (empirical, actual and real). An interdisciplinary team provides the diversity of knowledge and approaches to better understand each stratum. Secondly, critical theory posits that the social factors being researched are internally related. This interrelatedness is unlikely to be easily understood when atomistic approaches to research are taken. The use of an interdisciplinary team can help ameliorate this difficulty in understanding the interrelatedness of social factors by facilitating the sharing of various insights offered by each discipline. Thirdly, as also discussed under systemic thinking in Chapter 3, social facts are complex to examine because unlike natural facts which involve a single hermeneutic, social facts involve a double hermeneutic. Fourthly, a quality assurance (QA) process is required to ensure validity and reliability. The "soft" social constructivist approach ideally requires some way of surfacing and challenging the assumptions of the researcher to ensure greater integrity of the research methodology at all stages of the process. The diversity of disciplines involved in SCM also warranted some form of checking to avoid biasing either the questionnaire design or the data analysis toward a single discipline. The team was, therefore, able to provide a form of QA at critical stages of the research processes. The team also collectively reflected upon its own processes and kept a diary of those

reflections in order to assess if its own processes might be unwittingly adding bias to the research process. Finally, an interdisciplinary approach was entirely consistent with the multidisciplinary nature of SCM. It should be stressed that despite the aforementioned roles carried out by this team, members were neither actively involved in conducting the research nor doing the bulk of the subsequent analysis. Their involvement was limited to those activities which were needed to support the overall critical research approach adopted. The activities did include assisting, on rare occasions, in conducting the interviews in order to give the team members a richer appreciation of the contextual factors in which subjects operated. However, their role was predominately limited to reflection at critical points of data analysis.

#### **4.4.2 Multimethod Approach**

As shown in Chapter 3, a stratified ontology implies that interdisciplinary research is best complemented by the use of multimethod research. Definitions of such a research approach range from involving all team member answering the same questions within the research methodologies prescribed by their respective disciplines through to a loose group of different disciplines coming together to explore data in an *ad hoc* fashion (Mingers & Gill, 1997). The research approach taken was closer to the latter definition as the intent was to use the team as a resource for the researcher rather than as researchers themselves. As will be discussed, it is more accurately described as a multidisciplinary approach as the different research methods favoured by each discipline were not rigorously applied at different strata. However, a combination of data collection methods was employed in an attempt to increase the validity and reliability of the information collected and collated throughout this study. This method also assisted in creating space for “voices” which represented different disciplines working at different strata to be integrated into the overall findings. The early involvement of the team was therefore in line with critical realist aspirations of providing maximum opportunity for interaction among disciplines to work on the integration of complex phenomena. Therefore, the research requirements of a critical realist approach were met.

### **4.5 QUESTIONNAIRE DESIGN**

#### **4.5.1 Topic Selected for Research**

The SCM literature in Chapter 2 strongly suggested that themes around IT and the role of social factors involved in IONs were strongly implicated in innovation. The social

network literature also highlighted the importance of the latter. It was also demonstrated that social networks and the relationships in them were affected by the physical layout and workspace design. While governance was not identified as a strong theme in the SCM literature, it seemed counter-intuitive to exclude it because, for the reasons shown, governance has been a rapidly growing body of literature in its own right. The research was conducted at a time of massive reforms in corporate law which could potentially impact on which SCM practices were permissible. Having determined three broad areas which had possible relationships with innovation in SCM, it was necessary to work out a methodology to define the parameters of the supply chain for research purposes. The Supply Chain Council's Supply Chain Operations Research (SCOR) Model (2002) was chosen to define the supply chain as it has the status of a *de facto* SCM standard. It needs to be stressed that the SCOR was not itself a topic of research interest. Rather, it was seen as a useful tool to conceptualise, define and communicate with others the boundaries of the supply chain being investigated.

The benefits of using the SCOR model were as follows. Firstly, it was developed by a combination of practitioners in the Supply Chain Council (SCC) to assist firms in increasing the effectiveness of their supply chains, and to provide a process-based approach (Lochamy & McCormack, 2004b; Stewart, 1997). It was therefore seen to have reasonable credibility. Secondly, it was "the first cross industry framework for integrated supply-chain management" (Simatupang & Ramaswami, 2004, p. 12.). Thirdly, it built upon earlier attempts by researchers such as Pittigilo, Rabin, Todd and McGrath (known as the PRTM concept) to generate a comprehensive set of fact-based performance measures, which, if applied to the activities of planning, sourcing, making and delivering, could develop a world class supply chain (Lochamy & McCormack, 2004b). The PTRM concept of supply chain benchmarking was extended by SCOR. Little attention has been paid to tailoring a benchmarking scheme to supply chain collaboration at the intercompany level (Simatupang & Ramaswami, 2004). Fourthly, SCOR provided standard process definitions, terminology, and metrics (Lochamy & McCormack, 2004b) and this was seen as a very useful way of generating common language for research purposes across three organisations. Fifthly, SCOR was promoted as adding benefits such as providing better understandings associated with the complexities of implementing inter- and intraorganisational change (Power, 2005). Finally, at the time of the research under discussion there was an absence of an official standard on supply chains and a paucity of widely accepted modelling tools for supply chains. During this period, SCOR

was widely promoted by many consultants as a *de facto* standard and this view was not challenged.

Figure 4.3 illustrates the relationship between SCOR and the three major research streams in this case study. SCOR, shown at the left of the figure, was simply used as a means of defining the supply chain under investigation in order to place a boundary around the research. SCOR was a tool to scope the research and was not part of the research. The first three bubbles in the centre of Figure 4.3 (Governance, Information and IONs) were assumed to have a causal relationship with the fourth bubble, on the right – innovation. Each of these three bubbles directly relates to the three subordinate research questions. Question 1: How well suited are present corporate governance structures of individual organisations to supporting the generation of innovations within supply chains? Question 2: What has been the impact of the widespread adoption of IT in generating innovation in supply chains? Question 3: What is the role played by interorganisational social networks in generating and embedding innovations within supply chains?

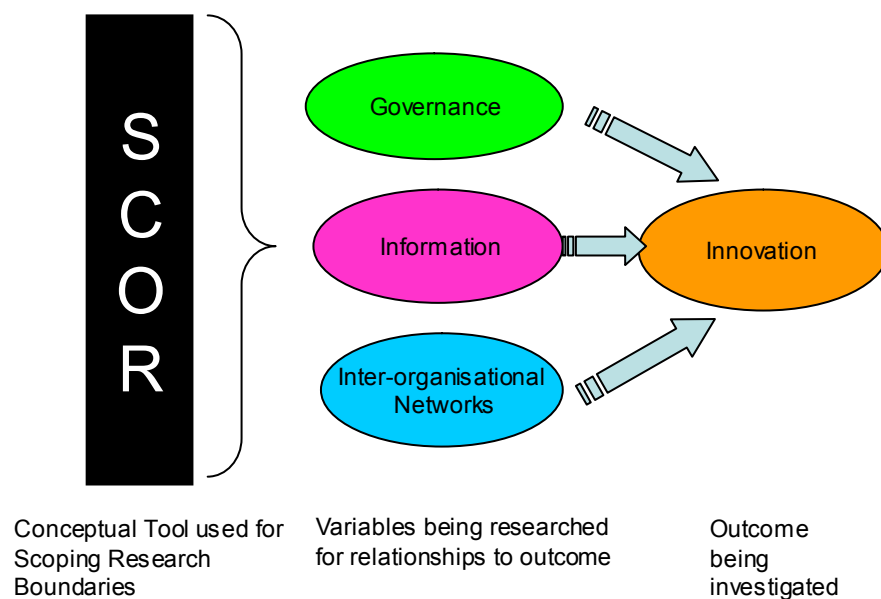


Figure 4.3. Relationship between SCOR and the research streams.

#### 4.5.2 Questionnaire Development

Following the literature review, the author developed a questionnaire which was then checked with a multidisciplinary team. This broad range of expertise was consulted



to verify that the questions were relevant to the topic areas chosen. The active involvement of discipline experts at key points in the process helped to ensure the questions probed the wide variety of perspectives implied by the literature review.

Consistent with exploratory research, a semistructured interview format was developed to allow space for a wide range of issues to emerge. Appendix C details the questions given to the subjects as shown in the two left hand columns. The two right hand columns detail prompt questions which the interviewers had at their disposal. The prompt questions were developed in consultation with the interdisciplinary team and a pilot study with proxies of the target research group.

Table 4.1. shows the intent of the various questions in terms of probing the specific research streams (bubbles) shown in Figure 4.3. as well as giving an overall feel as to the questions and their respective intents from a research perspective. It will be noted that many questions explore more than one stream so tight taxonomies are not so neat as to create mutually exclusive categories. This was a deliberate design feature as the intent was to use as few questions as possible to address the inquiry needs of several disciplines while taking the least time. An additional advantage was that clustering the research requirements under fewer questions enhanced the research design through semistructured interviews which encouraged free flowing responses thereby avoiding the questioner placing too much structure on the responses. It was also found to cover off some questions prior to them being asked. If the answer was not forthcoming, the interviewer could then prompt using the listed secondary questions (see Appendix C). The multidisciplinary team provided considerable assistance in distilling these questions into a common set which could meet the purposes of several disciplines.

**Table 4.1. Questionnaire Summary**

<b>Question Number</b>	<b>Focus of Enquiry</b>	<b>Links to Research</b>
1.	<b>Overall orientation in Supply Chain</b> <ul style="list-style-type: none"> <li>• Role in the chain</li> <li>• Interplay with other people</li> <li>• Location in social and technical network</li> </ul>	<b>Research Bubbles</b> <ul style="list-style-type: none"> <li>• Governance – authorities and delegations.</li> <li>• IONs</li> </ul> <b>Critical Realism</b> <ul style="list-style-type: none"> <li>• Richer Context</li> <li>• Open systems – probing for both formal and informal structures</li> </ul> <b>Research Technique</b> Such questions are used to build rapport with subjects prior to deeper questioning
2.	<b>Interaction In Supply Chain</b> <ul style="list-style-type: none"> <li>• Purpose</li> <li>• Strength</li> <li>• Type</li> <li>• Frequency</li> <li>• Alternatives</li> </ul>	<b>Research Bubbles</b> <ul style="list-style-type: none"> <li>• Information</li> <li>• IONs</li> </ul> <b>Critical Realism</b> <ul style="list-style-type: none"> <li>• Richer Context</li> <li>• Systems dynamics between actors</li> </ul>
3.	<b>Desired Improvements</b> <ul style="list-style-type: none"> <li>• Type</li> <li>• Obstacles to Innovation</li> <li>• Management Systems</li> </ul>	<b>Research Bubbles</b> <ul style="list-style-type: none"> <li>• Governance</li> <li>• Information</li> <li>• ION's</li> <li>• Innovation</li> </ul> <b>Critical Realism</b> <ul style="list-style-type: none"> <li>• Exploring Deeper Structure</li> </ul>
4.	<b>Proven Improvements</b> <ul style="list-style-type: none"> <li>• Establishing what improvement have happened as seen by subjects</li> <li>• Historical Patterns</li> </ul>	<b>Research Bubbles</b> <ul style="list-style-type: none"> <li>• Governance</li> <li>• Information</li> <li>• IONs</li> <li>• Innovation</li> </ul> <b>Critical Realism</b> <ul style="list-style-type: none"> <li>• Historical Context</li> <li>• Exploring Deeper Structure</li> </ul>
5.	<b>Relationships</b> <ul style="list-style-type: none"> <li>• Role in Problem Solving</li> <li>• Power</li> <li>• Importance in getting work done</li> </ul>	<b>Research Bubble</b> <ul style="list-style-type: none"> <li>• Governance</li> <li>• Information</li> <li>• IONs – greatest emphasis</li> <li>• Innovation</li> </ul> <b>Critical Realism</b> <ul style="list-style-type: none"> <li>• Exploring Deeper Structure</li> </ul>
6.	<b>Relationships continued</b> <ul style="list-style-type: none"> <li>• Non economic benefits</li> <li>• Trust</li> <li>• Commitment</li> </ul>	<b>Research Bubbles</b> <ul style="list-style-type: none"> <li>• Information</li> <li>• IONs</li> </ul> <b>Critical Realism</b> <ul style="list-style-type: none"> <li>• Exploring Deeper Structure</li> <li>• Richer Context</li> </ul>

<b>Question Number</b>	<b>Focus of Enquiry</b>	<b>Links to Research</b>
7.	<b>Decision Making</b> <ul style="list-style-type: none"> <li>• Planning Models</li> <li>• Planning Styles</li> <li>• Use of Power to influence or force decision</li> </ul>	<b>Research Bubbles</b> <ul style="list-style-type: none"> <li>• Governance</li> <li>• Information</li> <li>• IONs – greatest emphasis</li> <li>• Innovation</li> </ul> <b>Critical Realism</b> <ul style="list-style-type: none"> <li>• Exploring Deeper Structure</li> <li>• Historical Factors</li> </ul>
8.	<b>Relationships in more depth</b> <ul style="list-style-type: none"> <li>• Overall pattern used in Supply Chain</li> <li>• Reliability</li> <li>• Protecting self interest</li> </ul>	<b>Research Bubble</b> <ul style="list-style-type: none"> <li>• Governance</li> <li>• Information</li> <li>• IONs – greatest emphasis</li> </ul> <b>Critical Realism</b> <ul style="list-style-type: none"> <li>• Exploring Deeper Structure</li> <li>• Richer Context</li> <li>• Openness of System</li> </ul>
9.	<b>Improvement Strategies</b> <ul style="list-style-type: none"> <li>• Links to Corporate Strategy</li> <li>• Strategic Planning</li> </ul>	<b>Research Bubble</b> <ul style="list-style-type: none"> <li>• Governance</li> <li>• Information</li> <li>• IONs – greatest emphasis</li> <li>• Innovation</li> </ul> <b>Critical Realism</b> <ul style="list-style-type: none"> <li>• Exploring Deeper Structure</li> </ul>
10.	<b>Work Place Design</b> Use of Space Use of Place Interaction Participation	<b>Research Bubble</b> <ul style="list-style-type: none"> <li>• IONs – greatest emphasis</li> <li>• Innovation</li> </ul> <b>Critical Realism</b> <ul style="list-style-type: none"> <li>• Exploring Deeper Structure</li> </ul>

It needs to be noted that as the research is exploratory, the questions are semistructured and broad, rather than narrowly-focussed and linked to a tightly defined, unidimensional aspect of the literature.

## **4.6 RESEARCH POPULATION AND QUESTIONNAIRE ADMINISTRATION**

### **4.6.1 Identification of Population**

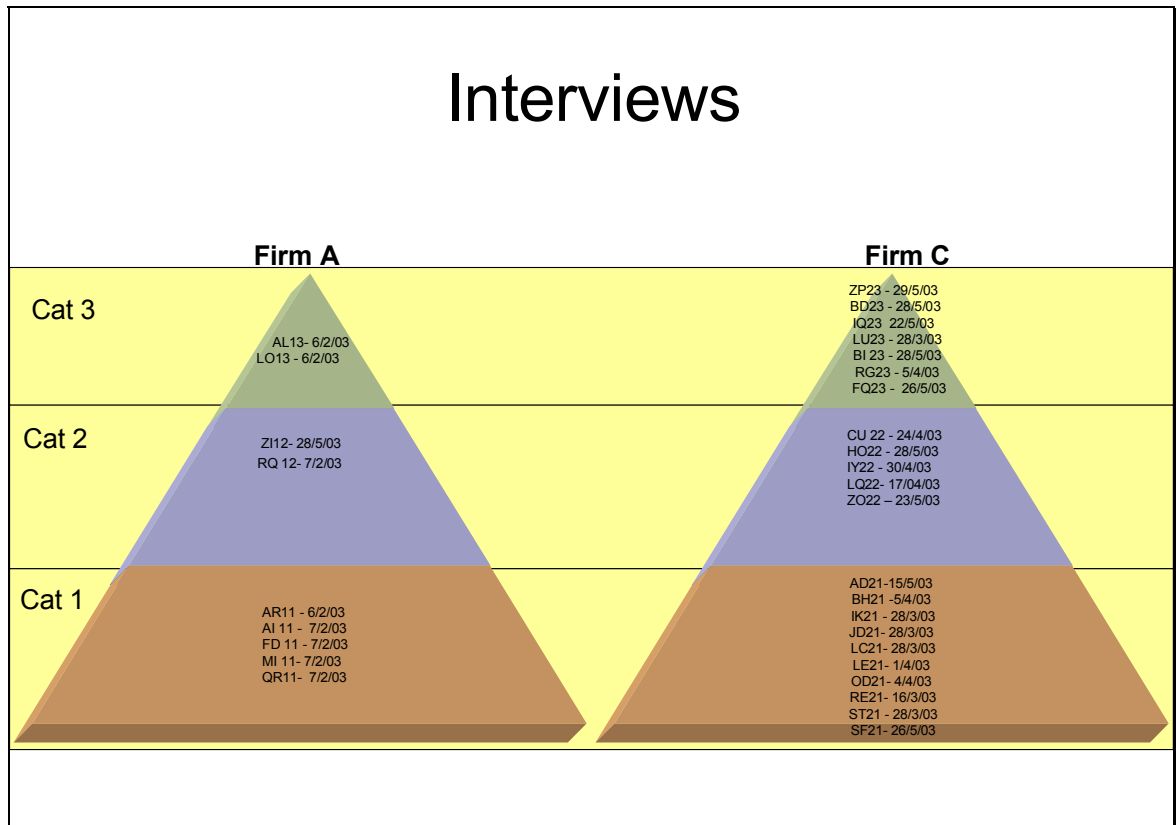
A total of 31 interviews were conducted. The data for the study were gathered in three distinct forms; operations analysis (SCOR model output), interviews, and a review of documents from the organisations involved. SCOR was used to “define” all the elements of the supply chain. The use of SCOR also enabled the identification of the key personnel to be interviewed as it helped locate subjects who played key roles in the steel supply chain. Again, it needs to be stressed that SCOR was not the focus of the research; rather, it was used as a scoping tool to assist in defining the boundaries of the research. Therefore, issues associated with SCOR were not part of the questionnaire. The topics that were deemed relevant to the key variables discussed in Chapter 2 were integrated into

the semistructured interviews. The interviewees belonged to three distinct categories. Table 4.2 describes the characteristics of each category as well as the coding used to identify subjects as belonging to a particular category.

**Table 4.2. Subject Categories based on Role relative to the Supply Chain**

Category	Characteristics	Coding in transcript
3	Those managers and supervisors directly involved in a value-adding or some transformational step in the actual supply chain where the rail physically passes through.	Firm A – Fake Initials followed by 1 for Firm A or 2 for Firm C followed 3 to denote this category, e.g., LU23 = subject LU who is Firm C, and category 3.
2	Those functional and technical specialists who while not having any direct line control in regard to the supply chain, nonetheless implemented policies and procedures as well as setting standards through corporate governance structures which had impact upon supply chain operations. For example, defining what the technical specification of the rail should be in metallurgic characteristics and tolerance measures at different points of transformation along the chain.	As above except finishing in with 2 (second in this string) to denote this category, e.g. ZO22 denotes a staff member from Firm C (represented by the first 2 in this string) and Category 2 (the second 2 in this string).
1	Those senior managers who were either responsible for the managers in Category 1 or had to make strategic decisions which would impact upon the supply chain. Such decisions included the allocation of resources, and large capital investment decisions.	As above except 1 now denotes that this category consists of senior managers e.g. RE21 denotes a staff member from Firm C who is also a senior manager

Details of the number of staff who were interviewed, and when, are shown in Figure 4.4.



**Figure 4.4. Schedule of Interviews.**

The questionnaire was piloted on subjects from Categories 2 and 3 prior to use. It was found that subjects from these categories struggled when prompted on more strategic questions so interviewers did not pursue such issues in as much depth as they did with Category 1 subjects.

Table 4.3 provides summary demographic data on the subjects. There were no female subjects in this population.

**Table 4.3. Simple Demographics of Subject Population**

<b>Firm</b>	<b>Category</b>	<b>Education level</b>	<b>Average Length of Service</b>	<b>Average Age</b>
A	1	All had tertiary qualifications – none had qualifications in logistics, one (QR11) in operations management	Over 20 years in the firm Big Oz	46
C	1.	All had tertiary qualifications. One subject had two degrees in logistics (RE21)	Over 20 years in Firm C	44
A	2.	Tertiary Qualifications – not related to SCM	Over 20 years with Firm A	43
C	2	All had tertiary qualifications but had done extensive work in logistics	Over 20 years in Firm C	45
A	3	Secondary qualifications and some with trade qualifications.	Over 20 years with Firm A	48
C	3	Secondary qualifications and some with trade qualifications	Over 20 years in Firm C	41

Table 4.4 provides a wider summary of the demographic data on the total workforce of Firm C. This information was selected to permit a rough estimation of how representative the sample population is of the total population. A less detailed analysis of Firm A suggested similar characteristics.

**Table 4.4. Demographics of Firm C's Workforce 2003**

<b>Characteristic</b>	<b>Data</b>
Union Membership	Majority of workforce – approximately 85%
Gender Balance	91% male (11,905 staff) 9% female (1,177)
Age Profile	87% in excess of 42 years olds 90% of males are over 42
Average Tenure	Male – 27.5. years, Females – 2.5 years
Turnover Rates	Under 25 years is 20% compared to 4% in the 45-55 age group
Geographic Location	50% outside the capital city dispersed in regional centres across the state
Occupational Types	70 % employed in trades and base clerical positions
Full Time /Part Time	94% are full time; 2% are part time; 1% are contract (senior managers) and 3% are other (e.g., contractors)
Managers/Supervisors	3% Managers; 6 % Supervisors
Recruitment Practices	Majority (over 90%) of positions are filled by internal applicants

The Australian Bureau of Statistics (2003) reports that the Australian population is comprised of 49.98% males and 50.02% females

**Table 4.5. Age Distribution of Firm C's Workforce**

<b>Age Range</b>	<b>Percentage</b>
<30 years	15
31 – 40 years	23
41 -50 years	34
51 – 65 years	28

Source: Firm C's payroll – June 2003

The workforce average age profile for Firm C is older than the average of the Australian workforce. The main source of difference is in the under 30 years category where Firm C is running at about half the Australian average. However, this pattern is not vastly different to national rail industry trends.

Firm C does not reflect the Australian community in work population, gender balance or mean age distribution; however, neither do many of its competitors – such as Firm B – nor its suppliers – such as Firm A. In addition, 71% of Firm C's workforce is in operational-type roles, which are typically male-dominated occupations. The sample population was, therefore, drawn mainly from the 9% represented by managers and supervisors (Table 4.4). Within this population, the age and gender mix, while not subject to strict statistical sampling, looked fairly representative.

#### **4.6.2 Questionnaire Administration**

Individual interviews constituted the principal source of data collection and, although undertaken within a structured format for consistency across the range of participants, the semistructured, open-ended questions provided space for a wide diversity of responses. All interviewees received a copy of the questionnaire with a covering note explaining that the broad purpose of the research was to know more about supply chains, with the long-term aim being to develop an enhanced SCM methodology (refer Appendix D). The letter also explained that the interview was entirely voluntary and that subjects' written consent would be sought before commencing the interviews. Two people attended each interview, with one of those attending all interviews to ensure consistency in the process and to reduce variability of interviewer bias. Consistent with the critical realist attention to the importance of context (Chapter 3), interviews were conducted in the subjects' everyday workplace and immediately after they signed the consent form (Appendix E).

## **4.7 ETHICAL ISSUES**

After the subjects signed the consent forms, all interviews were tape recorded and transcribed. The two interviewers then checked each transcript to confirm its accuracy prior to making it an official research record. The ethical framework and standard research protocols as outlined in the National Health and Medical Research Council (NHMRC) (1999) were employed in this study. This framework has been approved by other universities (such as Griffith University), in past work they have conducted with Firm C. Firm C's own R & D Committee, which approved this research, made its approval conditional upon compliance with such ethical considerations. Firm C's R & D GMF requires that any research involving humans or animals demonstrates how the ethical requirements will be met prior to approval being given to proceed. This framework is consistent with the Australian Standard AS 4752 (2004) on market and social research which was subsequently adopted by Firm C during the course of the research. While the research was nearing completion, when this standard was adopted by Firm C, it was evaluated against AS 4752 and found to comply. All members of the multidisciplinary team were also required to sign a legal agreement stating they would not breach confidentiality with the data. All questionnaire responses are held by RMIT.

Professor Kosmas Smyrnios, Director of Research, School of Marketing, Faculty of Business at RMIT is in receipt of the following documents associated with the research:

- Transcripts of Interviews;
- Signed Consent Forms for all Interviewees;
- Signed letter of approval from Firm C to proceed with research - subject to meeting all ethical requirements; and
- Signed Agreement by all members of the multidisciplinary team to abide by confidentiality.

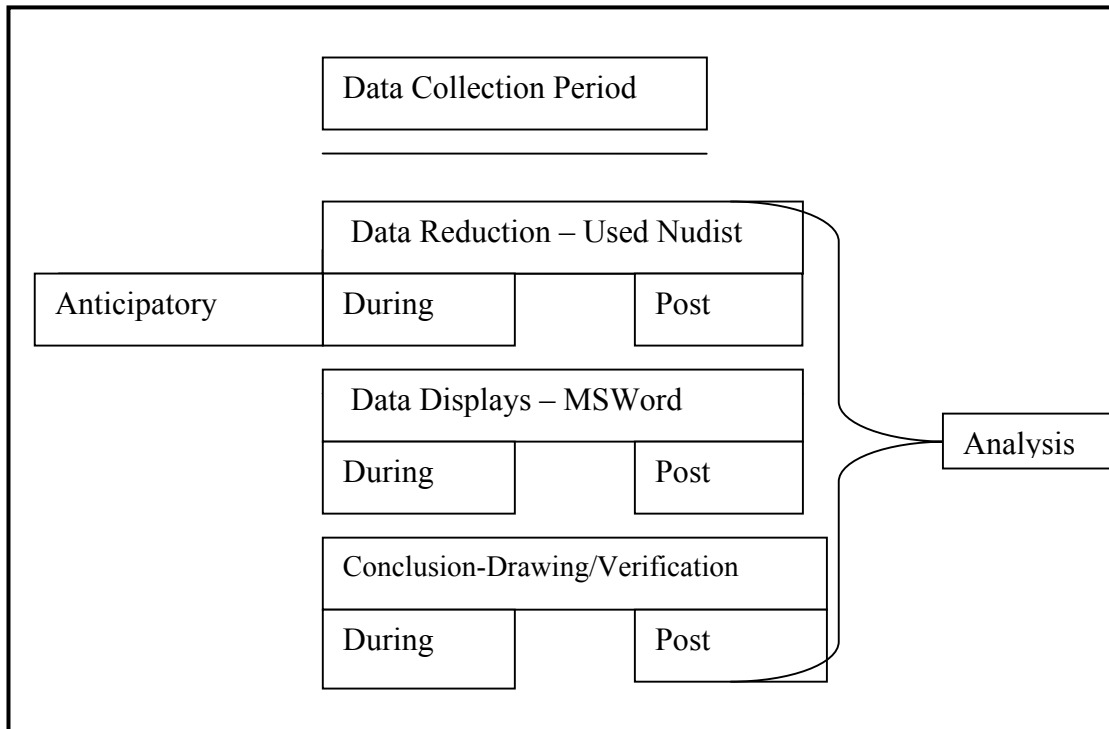
## **4.8 DATA HANDLING AND INVESTIGATION**

### **4.8.1 Analysis**

All interviews were transcribed into a total 800 pages of text. The interviews and transcriptions were completed during 2003. The transcriptions were checked and verified by the interviewers as accurate prior to being analysed using the qualitative analysis software package called NUD\*IST (QRS International, 2004). The basic process of



progressive refinement of data was in line with Miles and Huberman's (1994) methodology as shown in Figure 4.5 which follows.



**Figure 4.5. Components of Data Analysis Flow Model.**

Figure 4.5 is Miles and Huberman's (1994) modified grounded theory technique designed to suit a critical realist approach. As suggested by the diagram, many steps are involved in the various components of data analysis prior to drawing conclusions. There were several iterations in each step and the entire process of analysis took over 14 months and was completed in 2004. The first step involved initially coding raw data against the broad categories outlined in Figure 4.3. The second step involved considerable analysis and discussion with the interdisciplinary team to determine if the preliminary coding made sense to all members. The third step involved developing partially ordered displays which sought to list those areas which the coding suggested had strong overlaps. The fourth step involved analysing partially ordered displays in considerable depth and then converting them into constructs after extensively exploring a wide range of possibilities. The final step involved looking at the key relationships between constructs and ordering them into a framework (detailed in Chapter 5) which illustrated these relationships. It should be stressed that within critical realism the frequency of an event is not seen as proof of underlying structures. It is enough that it has happened once to suggest possible tendencies. The analysis which was used to generate the framework was, therefore, more

focussed on the strength of relationships than on their frequency, but if both existed then all the better.

Appendix F provides more detail on the successive steps of ongoing refinement which allowed movement away from descriptive displays to conceptually ordered displays of the data. Such displays were then used to refine the analysis further to examine what variables might be at play – such as a subject's position in the organisation, and his educational levels. The more concentrated data meant that they could now be displayed in Microsoft Word. Use of this program enabled easier distribution of data to team members in a more timely manner as not all had access to NUD\*IST. This change allowed team members greater time to consider the data in more depth before offering comments. More deeply considered comments enriched subsequent team discussions which aided the critical realist aim of understanding deeper structures. The change in software therefore helped to enhance the research methodology as defined by Miles and Huberman (1994).

Distributing refined data in Microsoft Word resulted in a cycle of ever-increasing refinement which shifted the data from descriptive to conceptually ordered displays. Several hundred hours of work was spent further distilling the data so as to not only define the constructs but also identify the relationship between them. Appendix G is an example of one such distillation. Conceptually ordered displays enhanced awareness of the centrality of key themes and allowed greater explanation of possible causal relationships. No one criterion was used to judge such relationships but there was a bias to place emphasis on personal meaning, public actions and those elements which could be independently verified. After considerable work at this level designed to notice and identify themes and patterns, plausible explanations were then developed, explored and refined. From this process it was possible to note relationships and to eliminate rival explanations and spurious relationships by using techniques such as weighing the evidence and triangulation.

#### **4.8.2 Multidisciplinary Approach**

As mentioned in Section 4.4.2, it was not possible to apply a full scale multimethod research approach, so a modified version was applied. This is best described as a multidisciplinary approach because while it used different research techniques such as interviews, SCOR and secondary data sources, these techniques fitted into a case study research methodology. This may initially appear to weaken the research rigour as the use

of a subjective epistemology makes it important to continually examine the underlying methodological assumptions. However, throughout each of the critical steps outlined in Section 4.8.1, the team found it essential to discuss the texts and to access specialist knowledge in order to gain a deeper understanding of the main relationships. When team members were asked to expand upon what might sit behind a specific piece of data, they often chose to investigate matters within their own preferred methodologies prior to bringing their findings back to the wider team. Discussions often moved, therefore, from research content to epistemological considerations. The epistemological debates proved very useful in surfacing the methodological assumptions that resulted in differences on how to interpret the same data. Some research team members with a strong preference for one or other of the methods initially struggled with this approach. However, when it was established how these methods would complement each other, and that the overall purpose was to generate a more integrated understanding, the tensions associated with epistemological preferences diminished. Therefore, while pluralist research methods were not applied there was still so much discussion around this topic of research approaches that the requirements from a critical realist perspective were met.

The requirements of an objective ontology were more easily met by the use of a multidisciplinary approach where all team members had the opportunity to express their views on what they believed was discovered. While the multidisciplinary approach taken acknowledges differences in perspectives and methodologies, the primary aim was to integrate findings into a coherent whole. Since critical realism argues that it is better to achieve such integration in an ongoing and iterative fashion, regular meetings were scheduled to ensure ongoing dialogue. Using the diversity of views in the team to probe and better understand contextual factors such as historical influences was highly consistent with critical realism which argues that the social world turns on human practice. However, human practice happens in the social realm, which is also “structured”. The social realm includes underlying structures and customs such as social positions that are internally related – for example, customer and supplier. Researching the social realm in order to understand such structures requires the use of pluralist research. The interdisciplinary team were able to provide those perspectives through their discussions by being able to more fully explore the “values” and “meanings” which shape and direct human practice. The use of rich dialogue by a multidisciplinary team was, therefore, a deliberate attempt to draw insights into better understanding the potential underlying structures of the social realm.

### 4.8.3 Validity and Reliability

The assumption of a subjective epistemology means the reliability and validity of the research methods can and should be challenged. While never claiming to offer the certainty claimed by positivism, a range of basic procedures as suggested by Miles and Huberman (1994) were followed to add greater rigour. The use of an interdisciplinary team who applied a modified version of pluralist research was designed to expose potential weaknesses in research approaches. The triangulated approach to data collection was adopted to enhance verification and assist all team members in acquiring a richer appreciation of the complexities confronting a manager trying to improve supply chain performance. This kind of heightened understanding was considered necessary to enhance the team members' ability to comment on possible hidden structures. Other data sources, such as official documents, policies, reports and performance analysis measurement, were also used. In addition, where points in transcripts were unclear, the interviewees were contacted to gain a better understanding of what they meant so as to avoid imposing an incorrect interpretation. In some cases experts outside the subject pool were contacted to determine if the view put forward by a subject aligned with the expert's interpretation on topics such as policies. All such steps were taken to enhance the validity and reliability of the data. Each of the data collection methods progressively informed the investigative process and, to a degree, guided the direction of the research.

Additional steps to those above which were taken to reduce personal bias included sharing data coding outcomes with the team; gathering feedback from the team to determine if the nominated critical variables were accepted by the team; undertaking additional exploration of data that overlapped different disciplines; and using a combination of quantitative and qualitative methods in the analysis of this case study.

### 4.8.4 Constructs

With the exception of the constructs used for innovation, all other constructs were developed from the data. It was considered necessary to use constructs developed in the literature for innovation as it would have been extremely difficult to examine the data and identify and establish potential causal relationships without some firm concept of the outcome. The following modified version of the definition by Chapman et al. (2002) was used to classify the innovation outcomes at four levels.

- **Incremental** – restricted to small step improvements around what happens at the work team level – minor increased efficiencies, usually localised to where a work

team is located or in the case of a mobile gang the improvement made to their operations as found in TQM teams, etcetera. Basically, it is an improvement within a single unit in a supply chain as distinct from an improvement across the chain.

- **Architectural** – improvement requiring more than the efforts of a local team and generally involving cooperation of several discrete groups or teams – for example, in a supply chain consisting of several units, units across the chain finding ways to make the entire chain more efficient, rather than just their one area. Also included in this heading was office and space redesign around buildings that located communities of practice in ways which increased their ability to transfer knowledge across and between different disciplines and resulted in improvements across common processes involving several different and distinct work groups.
- **Radical** – involves a large step improvement such as found in business process reengineering. Process redesign with existing resources could be included if it could be demonstrated it led to a massive function improvement. For instance, an output improvement of 50% or more to a supply chain's output. Otherwise such improvements were classified as architectural. The introduction of the technology which resulted in large step improvements or in reengineering an entire process with or across a firm was included. Note that the output of the chain may not necessarily have changed but the way it is delivered has been reengineered in a major way that process efficiencies have been made.
- **Transformational** – refers to an innovation that is so profound it changes the very nature of the chain. This is more commonly used when referring to a technology which produces changes at the societal level – for example, the steam engine and the telegraph. For the purposes of this research, the definition was used to cover instances which resulted in fundamental and sustained structural change to an industry. Such changes can be the result of policy or technological reforms.

The above definitions of innovation were seen to provide sufficient granularity to meaningfully sift and sort the data to determine what types of issues, activities, perceptions and patterns were associated with particular types of innovation outcomes.

#### **4.9 OVERALL OUTCOMES**

This chapter has described how the case work was conducted and the various steps taken to ensure all methodological and ethical research requirements were met. It has explained how the questions in the semistructured interviews were linked back to the

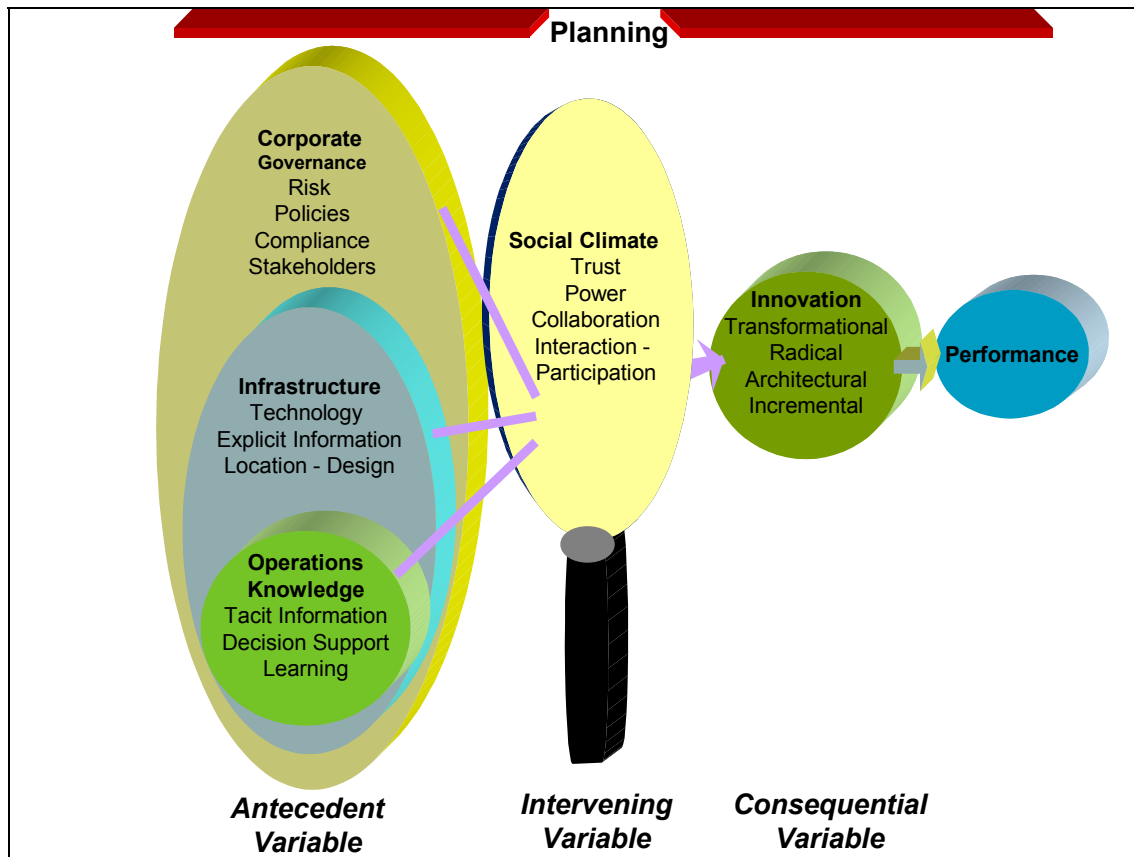
research streams which were, in turn, directly related to the three propositions which formed the basis of the thesis. It then described the processes used to generate findings which are described in more depth in Chapter 5. While it may initially seem odd to combine these findings and analysis in Chapter 5, such an approach is appropriate for the following reasons. Firstly, it is methodologically sound to do so when operating outside of a positivist framework. Secondly, the nature of the qualitative data gathered in the form of text cannot be described independently in some forms of analysis which helps the reader understand the deeper meaning often embedded in the text. Chapter 5 now reveals the findings and analysis.

# CHAPTER 5

## 5 FINDINGS AND ANALYSIS

### 5.1 INTRODUCTION

This chapter deals with the findings and analysis, which resulted from the application of the research methodology discussed in Chapter 4, on an industrial supply chain located in mature industries. Figure 5.1 is a graphic summary of the conceptual framework which was created out of successive refinements of the data gathered primarily from interviews but also supported by other sources such as reports, surveys and discussions over the course of the research.



**Figure 5.1.** Conceptual Framework of Issues Influencing the Ability to Generate Innovation in the case study Supply Chain.

There are two purposes in revealing Figure 5.1. Firstly it represents the distillate of the findings. Secondly, it is to assist the reader in making sense of much of the findings and analysis which follow. This figure presents a conceptual framework of issues

influencing the ability to generate innovation in the supply chain, as seen from the focal firm, Firm C. It identifies the constructs which were found from the data analysis and attempts to demonstrate some of the relationships existing among them. Section 5.2 describes the framework and explains its main concepts. Section 5.3 then exposes the research findings in more depth in order to provide insight into the details, which sat behind and were used to justify, each construct in the framework. The findings used to justify constructs also help to expose the complex relationships among them all. Section 5.4 discusses two other issues, which, while not directly addressed in the framework, nonetheless impact upon the constructs within it. These two issues are the wider national economic and legal landscape and the internal activities of an individual firm. While both issues are considered and discussed in Section 5.3, they are further refined in Section 5.4. This section (5.4.) defines three distinct layers of activities involved in SCM and defines the driver for innovation in each. Drawing out the implications of such layers is consistent with the open systems approach of critical realism which seeks to understand the complex interaction of various systems and the contextual variables in each system. Section 5.5 provides a summary of the major results relative to the research propositions before leading into Chapter 6 where the implications of the research are discussed in more depth.

## **5.2 MAP TO INTERPRET FINDINGS**

Figure 5.1 provides a skeleton on which to hang the fleshed-out findings. The logic of this framework is as follows. At the highest level of abstraction the framework is structured around three broad types of variables – antecedent, intervening and consequential. The antecedent variables are captured under the three “super constructs” of corporate governance, infrastructure, and operations knowledge. Each super construct is defined by the constructs grouped within it.

The three types of variables in the framework would, in positivist terms, equate to independent, mediating and dependent variables. However, while conceptually similar, these headings are not equivalent, based on philosophical and methodological assumptions. Venkatraman (1989) provides a very deep understanding of what is meant by a mediating variable within statistical theory and a positivist framework. While both critical realism and positivism use statistics, the philosophical assumptions which guide interpretation of the outputs from such methodologies are considerably different. The use of positivist terms is therefore avoided here.



The framework positions social climate as a mediating variable (represented as a lens in Figure 5.1). Venkatraman (1989) distinguishes mediating from moderating variables by stating that the former is:

... viewed simply as indirect effects, less precise than the moderation perspective (strength, form and quadratic effects, etc). Moreover, more than two variables can be incorporated within this perspective, thus reducing the level of precision that can be reflected in specifying the form of fit. (p. 429)

Social climate as discussed in this research is clearly better defined as a mediating variable. It is for this reason that the metaphor of a magnifying glass has been used to suggest that the social variables, while not able to stop outright the relationship between the antecedent and consequential variables, can add value by helping to better focus the antecedent variables to deliver desired outcomes. These outcomes are captured under the consequent variables described by the super construct of “innovation”. The meaning ascribed to each innovation construct has already been described in Section 4.5.8 Performance is depicted in this framework in a manner suggesting it to be a super construct. It is better described, however, as an additional feature of innovation rather than as a distinct construct. Its purpose is to provide extra verification that an innovation has led to an improvement, as defined and measured within a corporate reporting framework. The assumption of this research has been that innovation required some demonstration of improved performance. The focal firm, in line with many large corporations, has a deliberate strategy in place to develop a “performance culture” and measures innovation in such outcome terms. The issue of the role of performance measures in driving the supply chain and generating innovation is discussed in detail under the super construct of “operational knowledge”.

Planning could possibly have been considered a super construct but insufficient data were found from the case study to justify developing a range of distinct constructs under this heading. As shown in Figure 5.1, planning is certainly an important and distinct construct in its own right and it spans the entire framework. This breadth means it does not sit neatly under any one of the three variables. It will be shown later in this chapter that while planning informs and seeks to influence all three variables, it does so with the intent of increasing the chance of achieving desired outcomes. It is, therefore, categorised as an antecedent variable as it is generally assumed to precede supply chain activities through premeditated acts such as placing orders and arranging budgets which

in turn, to a very large extent, determine consequential variable outcomes. Planning also seeks to direct the mediating variable of social climate but it far more difficult to define a direct relationship between the two due to the dynamic nature of the social system.

### **5.3 FINDINGS IN DEPTH**

#### **5.3.1 Approach Used**

In this section, reading from left to right in Figure 5.1, the various constructs which sit under a specific super construct will be described. Examples of the sort of data used to develop the constructs, combined with analysis used to interpret the data and generate the constructs will then be given for each construct. As a critical realist approach is being taken here, it should be noted that the emphasis is not simply on justifying constructs with endless supporting data but also examining the relationships among variables. Gaining a better understanding of such relationships is seen as a key to understanding the deeper structures which shape how an open system such as a supply chain operates and innovates.

#### **5.3.2 Corporate Governance**

The findings which follow align with the first subordinate question: How well suited are present corporate governance structures of individual organisations to support the generation of innovations within supply chains? The super construct of governance is defined by the four constructs of risk, policies, compliance and stakeholder perspective. The data showed that corporate governance was the dominant, and possibly the only truly, autonomous variable. The other super construct antecedent variables are shown as fitting within the ring of corporate governance. It was initially assumed all three antecedent variables could be viewed as separate entities, however subsequent analysis revealed they all interacted with each other and that corporate governance tended to have a more powerful relationship over the other two super constructs. The immediate question such an arrangement raises is why not make all antecedent variables sit as constructs under Governance. As will be shown, both infrastructure and operations knowledge are sufficiently different in nature to be considered entities in their own right despite the massive influence corporate governance exerts over them.

Within the super construct of corporate governance, the order in which the first three constructs are listed in the framework is deliberate. Corporations ideally manage risk by developing policies and ensuring that adherence to those policies is monitored by

compliance activities. As will be shown, such a sequential view is moderated by the interactions between and among the three constructs. Stakeholder perspective has a less direct sequential link to the other three constructs – risk, policies and compliance. However, all four constructs have sufficient distinctive characteristics to be clustered under the super construct of corporate governance.

Descriptions and data analysis of the constructs now follow.

### **Risk**

Firm C's definition that "risk equals severity times consequence" is widely accepted and is adopted for the purposes of this study. Chapter 2 (under the heading "Governance") highlighted that governance is about managing risk. As shown in Chapter 4, the legal structures of each firm resulted in significant differences in governance arrangements between companies. Firm A was the least complex, operating as a publicly listed company registered on the stock exchange. All managers highlighted how they enjoyed being free from the control of the corporate parent and how they now felt far more empowered and more in control of their own destinies. Firm B's personnel were not interviewed; however, its governance structure has suggested one way that integrated hybrid firms (Figure 4.1) may develop hybrid structures to meet the challenges of SCM. Firm C's governance structures were the most complex and contained the greatest number of checks and balances.

Three examples from Firm A demonstrate how staff felt that having been released from their previous corporate parent had led to significant improvements.

*I guess it gets back to, sort of, like Firm A's example, is a new company evolved from Big Oz. I think generally everybody is more, feels closer to the company if you like, and more dependent on the company. In other organisations, I think, we haven't got that big brother looking over our shoulder. I think we are a leaner, hungrier, more focussed (I hate that word, but anyway) focussed organisation, in dealing with, or that we're closer to the coalface. Well, certainly from my point of view you feel closer. (MI11, lines 668-673)*

*We have been given charge of our own destiny, basically. Which I think is a wonderful thing for most people to get in their life. Um ... getting out from underneath the patriarchal arm of Big Oz. Cut adrift with a shitload of expense, um survived, I think we are stronger for it too. Much more nimble, much more agile also closer to the boss. One boss to serve and the board, of course. Very*

*close to that gentleman who visits here regularly. And looks you in the eye and says well, are you performing, show me, show me the results, looks you down. Pats you on the back. If not he says how can we help. So, yeah, very close to the action, which is great. (AR11, lines, 21-28)*

*Firm A, unlike Big Oz, runs a not very intrusive head office. There's 13 or 14 in head office. (RQ12, lines 275 – 276)*

These comments demonstrate that change in governance has led to enhanced flexibility and agility as well as greater customer focus – as suggested by terms such as “closer to the coal face” (MI11). Clear lines of accountability with “one boss to serve”, are associated with enhanced agility and flexibility (AR11). RQ12’s comment on the lack of intrusiveness from head office provides a stark contrast to Firm C’s staff perceptions of head office which by comparison, was very intrusive. Much of this intrusion is linked to the conflicting roles generated by the governance structure outlined in Chapter 4, which means staff in Firm C feel they have more than one boss to serve. The quotes which follow illustrate a sentiment which is widespread among Firm C managers.

The first quote demonstrates how multiple, and apparently conflicting, policy directives from government create complexity and confusion for managers.

*The government has placed five criteria for Firm C to do business. When they're making a business decision, they must address those five criteria. One is financial, one of them is the people and community impacts. If you have a commercial business you do not necessarily have that. So we have situations where if it was yours or my business we would do something else but in this environment there is a connection to the political side running the business where you keep it going or do things not quite as commercial to cover those responsibilities on behalf of the government. (LC21, lines 246-254)*

The next quote demonstrates how managers perceive that the arrangements the government have put in place and the selection process used to appoint the Board works against commercial objectives.

*We have a board of political appointees who know nothing about the industry, who aren't allowed to make decisions without an army of bureaucrats, who are even more removed from the industry and driven by political rather than commercial concerns. Firm B by contrast probably have a board with people from*

*the industry who once they see a business case, decide in a day to go or not to go and then implement the decision. (LQ22, lines 291-296)*

Finally, the intrusiveness of government on Firm C is mirrored by a widely held belief that head office possesses asymmetrical power (discussed more under social climate) which means it can impose its requirements in ways that work against Firm C being able to implement good supply chain practices.

*There is probably indirect issues too, that I need to talk about. I have to deal with corporate HR. In their case, as with so many other corporate functions, I don't have any other choice – so they can and do impose their rather narrow functional interests rather than work with me on what is required for supply chain management. The power is so much in their favour they possibly don't feel they need to make adjustments to my requirements. (JD21, lines 78-84)*

Further analysis revealed that most head office functional specialists, such as HR, administer and report on legislation which in turn gives them considerable power over the rest of the business. They assess risks associated with noncompliance with the respective pieces of legislation for which they are responsible. It is very easy for these groups to use Firm C's governance and management framework (GMF) to argue that the corporation is at risk unless it responds to their suggestions. Firm C's Board also pronounced that it would meet all legislative compliance requirements even in circumstances where it would be cheaper to pay a fine. The net result is that head office specialists can and do shape a lot of what happens in the supply chain.

### ***Policies***

Firm C had far more policies than the manufacturer. At the operational level, Firm C staff expressed frustration at the number of policies they had to address. The reason for the lower number of policies in Firm A was not clear but it was inferred that having broken away from the parent they perceived as overbearing, all parties saw the benefit in giving each area the necessary “elbow room” to get things done with as little central interference as possible. RQ12's earlier comments (refer Risk) about a nonintrusive corporate parent with few head office staff provides a contrast with Firm C which has by comparison a massive head office staff. Depending on what definition is used of overhead, the figure varies from 5 to 16% of Firm C's staff who are involved in carrying out activities which service head office functional requirements such as monitoring and reporting policy compliance. The sentiment generally expressed by Firm C staff was that

most policies were developed in isolation from the operational and commercial realities of the business. As suggested by the quote which follows, the approach taken to policy formulation reinforces a bureaucratic management style which progressively moves managers away from being able to exercise judgement to simply administering policies.

*Our culture and our policies work against us. There are a million policies and more coming out every day and each says what you can't do. Take our equity policies; all you have to do is take offence at what I say and then you can report me to HR and I have to defend myself for asking you to do the job you are paid for. These policies take the view that there is no need to even talk to each other in the first instance to check out what was meant and if you take offence then what I said must have been meant to offend you – total madness. We are already a rigid enough culture but if we keep pushing more of these policies which make it even harder to do anything then we are stuffed. (IK21, lines 20-34)*

A subsequent analysis was carried out on the policies generated just by Firm C's head office staff through the vehicle of the GMF. The GMF consists of three main document types. The purpose of each is shown in Table 5.1.

**Table 5.1. Document Types in GMF**

Document Types	Criteria	Documents	Audit/Compliance
Governance (Absolute requirements)	<ul style="list-style-type: none"> <li>• Nonnegotiable requirements (Board/CEO directions, government/shareholder requirements)</li> <li>• High and extreme risk</li> <li>• Legislative requirement</li> </ul>	<ul style="list-style-type: none"> <li>• Standards</li> <li>• Specifications</li> <li>• Forms related to the above</li> </ul>	<ul style="list-style-type: none"> <li>• Audit for compliance</li> <li>• Corporate Compliance process used</li> </ul>
Management (Required for efficient operation)	<ul style="list-style-type: none"> <li>• Low and medium risk</li> <li>• Consistent management and efficient use of resources</li> </ul>	<ul style="list-style-type: none"> <li>• Procedures</li> <li>• Forms related to the above</li> </ul>	<ul style="list-style-type: none"> <li>• Audit where required for process or efficiency outcomes</li> <li>• Corporate Compliance process <u>not</u> used</li> <li>• Managed using accountability and performance management</li> </ul>
Information (Guideline/information)	<ul style="list-style-type: none"> <li>• Guidelines related to a management system</li> <li>• Information related to a management system</li> </ul>	<ul style="list-style-type: none"> <li>• Related documents</li> </ul>	<ul style="list-style-type: none"> <li>• No audit</li> <li>• Corporate compliance process <u>not</u> used</li> </ul>

Source Firm C's guide to the GMF (2003)

Policies are broad strategic directives which are then translated into the three types of documents. Based on the calendar years of 2002 and 2003, an average of 25 policies

per annum were produced. It should be noted that in 2001 this figure was twice that, and the proliferation of these documents was so great that a process was put in place under Firm C's GMF to effectively choke the flow of documents. This was in response to the workload created by each discipline head (e.g. functional specialist such as HR) sending out documents that the business groups considered noncore, time consuming and in conflict with other policies generated by different discipline heads. Each policy could be supported by as many as several hundred pages of standards which must then be implemented by all key parts of the corporation. Once in existence, these policies and directives are subject to ongoing reviews which can result in modification, withdrawal or maintenance. Review activities are resource-intensive on the rest of Firm C which must get involved in the process. Table 5.2 details policy and some directly associated documents generated by the GMF in 2003.

**Table 5.2. GMF Documents**

Policies	7
GMF Documents	1
<b>General Management System</b>	
Board Directives	0
Standards	38
Specifications	12
Procedures	0
<b>Safety &amp; Security Management System</b>	
Board Directives	1
Standards	104
Specifications	55
Procedures	0
<b>Environment Management System</b>	
Board Directives	0
Standards	8
Specifications	3
Procedures	0
<b>Human Resource Management System</b>	
Board Directives	1
Standards	77
Specifications	5
Procedures	0
<b>Finance Management System</b>	
Board Directives	1
Standards	8
Specifications	54
Procedures	0
<b>TOTAL - Board Approved Documents (Policies, Board Directives, GMF Documents)</b>	<b>11</b>
<b>TOTAL - Governance Documents (Standards, Specifications)</b>	<b>364</b>
<b>TOTAL – Management Documents (Procedures)</b>	<b>0</b>

*Note:* Table 5.2 does not include Related Documents or Forms –“Information Documents”.

An overview of the historical context around governance is given to provide a richer appreciation of the comments which follow. In 2003, the total number of documents (364) equated to more than one a day, allowing for a five day week and public holidays. The number of polices has been reduced in the past 5 years from over 500 due to complaints from business groups about the sheer volume of documentation and the effort required to assess the impact of policies on their business areas, report that



information back, and work through amendments. The tacit assumption was that decreasing the number of policies would reduce the workload by forcing single disciplines to reduce both duplication of and contradictions between policies. The workload has, in fact, remained constant as the requirements of policies are now expressed under standards. Some standards can place onerous requirements on a business group in Firm C, in terms of both implementation and administrative costs.

The pattern of head office staff numbers compared to the rest of the workforce illustrates stark oppositional trends. In the past decade Firm C has reduced its workforce by 35%. In the same period, head office staff numbers have doubled and their average pay rate has seen an almost 50% increase. This pay rate compares with an increase of approximately 20% for the remainder of Firm C staff.

The growth in head office staff has occurred within narrow functional specialist areas such as HR, finance, risk management, safety, environment, and legal. Beyond the basic controls already mentioned to slow down the flow of policy documents, no clear evidence was found either through the transcripts or review of secondary source documents to suggest that the policies were integrated prior to being imposed on the rest of the corporation. Such a segmented approach is at odds with SCM and may explain why no conclusive evidence was found of policy makers as a whole either understanding or working together on SCM policy development. The following quote captures how the intrusive role of government, reflected through the activities of head office staff, is so pervasive that it distracts managers from engaging in improvement strategies and sound policy development, a circumstance which is detrimental to SCM.

*I guess we um, have a sense that, um we've been absent as a corporation in providing a suite of policies to assist supply chains It's more a vacuum that I sense that help and guide us in terms of providing the incentive to, to have efficient supply chain systems, and a whole lot of other things. Um, I get a sense that we try, that we um, we make too much emphasis on trying to second guess what political ramifications we should be covering off on, rather than um, than, than pursuing um logical, coherent um, ways of dealing with um logic and coherent systems and processes to underpin our business activities. (RE21, lines 138-146)*

The reference to “second guessing” the “political ramifications” also demonstrated that what is stated in formal documents does not represent the “deep

structure” which determines and drives so much organisational behaviour. As one manager put it: *“There are un-stated macro-measures from our owners which are to avoid negative headlines on the front page of the (local) newspaper”* (LQ22, lines 154-156).

Clear evidence supporting these claims has been found, for example, in overseas travel arrangements. If a staff member wanted to go overseas for work purposes, the following steps had to be carried out. First a detailed rationale and itinerary for the trip must be attached to the formal application. This form then has to be approved by: the person’s divisional manager; the group general manager; the chief executive; the chairman of the board; the Minister; and, finally, the Premier. Every person in the approval chain has a financial delegation ranging from AU\$50,000 to AU\$1 to AU\$2 million in the case of Firm C category 1 staff and through to potentially unlimited amounts in the case of the Premier. Air travel costs are a materially insignificant within such financial delegations. The issue is that a handful of people have been seen to abuse overseas travel in the past which has attracted negative and sensationalist media attention. This policy is therefore designed to manage political, rather than financial, risk. The procedures which sit behind the policy again illustrate the very strong controls which overarch Firm C’s operations. An employee travelling overseas has to produce a diary accounting for every hour and in the case of participation in a conference, must provide formal, signed proof of attendance. The stakeholder perspective of Firm C’s owners is again aimed at managing political rather than commercial risk. Firm C staff have sensed political risk in the form of “un-stated measures” and have tried to manage the uncertainty this creates for them by “second guessing” the needs of their owners.

The head office policy development process with its lack of integration appears to mirror that of legislation development within government. Conflicts in legislation are felt in the organisation at the level responsible for implementing them – at the business group level in the case of Firm C. Several subjects such as LE21 and JD21 referred to conflicts in legislative requirements. The State Purchasing Policy (2000) and the State Competition Authority Act (2000) are prime examples. The former requires Firm C to support local industries, which can often involve paying a premium. The latter is supported by a Commission which, in the absence of a competitive market for access to the rail network, sets the prices Firm C can charge. These prices are based on the Commission’s view of best practice. Rail operators who believe the charges are too high can appeal to the SCA and Firm C then has to reveal all the elements of its cost structure. Having sufficient

transparency in place for the SCA adds to the administrative costs of Firm C which must keep very detailed records, again adding to the sense that nothing too risky should be undertaken for fear of intervention by another arm of government. The combined effect of measures which are not stated but felt, or are stated and conflicting, helps to clarify why Firm C staff feel it is far too difficult to take risks.

As head office staff liaise with various government departments, and because senior managers experience considerable anxiety around anticipating government needs, head office staff have been able to exert considerable power within the organisation through formal and informal structures. Because Firm C does not have activity based costing (ABC) systems, it was not possible to determine the full costs of implementing its policies. It was found that parallel organisational structures were developed in the business groups to meet the reporting and compliance requirements generated by head office policy makers. These positions in the business groups which shadow head office functions have also grown substantially in both the number of staff and pay rates over the past decade.

### ***Compliance***

While both organisations had tight compliance regimes, Firm A's were primarily limited to QA issues around manufacturing requirements. Firm C, by contrast, had tight compliance requirements on virtually every aspect of its operations. Governance requirements appeared to be generating ever-increasing overheads in both organisations in terms of administrative effort and the resources required to maintain it. Both organisations were clearly burdened by the onerous demands of translating legislative requirements into operational realities. Staff of both expressed the view that the reward system seemed to be shifting to compliance and away from innovation. Staff in Firm C were particularly sensitive to the time consumed in trying to get new ideas through the various filters of compliance systems. As the following quote highlights, compliance not only adds costs it also appears to drain creative time from staff wishing to make improvements:

*It's very difficult at the end of the day when you are working a 12 and 14 hours just to make the business stay a business. And the industrial issues, and endless compliance requirements – take them out and I can do better. (LC21, lines 587-589)*

Still others questioned the effectiveness of the intrusiveness of head office staff to add value. The following two points show two variations on a belief commonly held among Firm C staff.

*For instance, we were looking at um ... looking at trying to get a transaction process into the system of Firm C. We ended up at a meeting with 37 people. I asked one question. I said, 'How many people in this room have any experience about transaction processes?' Nobody. Was this a meeting in which to discuss a governance process or implement transaction processes? We've now got 37 people that know nothing about this topic trying to formulate a governance process. (ZO22, lines 30-36)*

*I think there are elements wherever there is corporate governance, always elements that hinder productivity. It may be. I cannot stack over 2.4 metres. We were stacking up to three (metres) in the past without any obvious loss of productivity. (IK21, lines 159-163)*

The first quote highlights that while head office staff may not be seen to add value, they can certainly add cost (as implied by reference to 37 staff). In the case of stacking the rail, the decision was made without consulting those who did the work or going on site to gauge the situation first hand. The staff who did the work could not see the benefits of the restriction in stacking height and in reality it decreased productivity by reducing the storage capacity of the supply chain. Both quotes demonstrate the power head office staff possess in being able to either slow down or stop others from doing things.

Policies appeared to be made largely in isolation from their impact upon other disciplines and areas. The inability or unwillingness of head policy makers to act collectively does not appear to impact on their power, as each seems to have a right of veto. This veto is exercised over the business groups more than over policy makers. Some managers view this power of veto as a major obstacle to innovation:

*Even if we could achieve all of these things, there is still a framework issue which makes improvement hard. Externally, if I have an idea I only need one out of 600 to fund me and I can start doing it. Here you need 600 to approve an idea and only one to say no and kill it. In fairness, our R and D strategy tries to get around this but it seems restricted to technology rather than supply chains per se. (JD21, lines 421-425)*

Some staff have found ways to reduce the burden of compliance. For example:  
*Safety and the maintenance of the crane. I have to be honest, and say that beyond what I needed to do the work, I would ignore most of the information which keeps coming – especially from head office. I am not much of a reader to start with so I give it the flick.* (BI23, lines 433-436)

While the above approach could be described as minimalist, the next example is more about building a shadow system to get around the existing governance systems.

*There are a few grass stocks around ah ... for example we have got one down there where they have told us to skip two kilometres because they wanted more time to make a decision in terms of what to do in terms of our project ... there's two kilometres down there that is always in the back of our head ... if there's a derailment we will go pick that up so it doesn't affect our program out here, sort of thing, so while it's not strictly grass stocks, that's a terrible term, but grass stocks and ... grass stocks that are hidden forever until emergencies.* (ZP23, lines 911-918)

Grass stocks refer to those stocks which physically exist yet are hidden from corporate information systems. Such practices have existed for a long time and, indeed, the corporation has made numerous attempts to rectify this situation. There is an apparent lack of alignment between the audit requirements set out in the corporate governance system and the operational realities driving this supply chain. Firm C is also audited by external auditors (State Audit Office). While both internal and external auditors have been critical of inventory management practices they agree that the policies stated in the governance system are correct and appropriate, and they see the cultural practices as the problem.

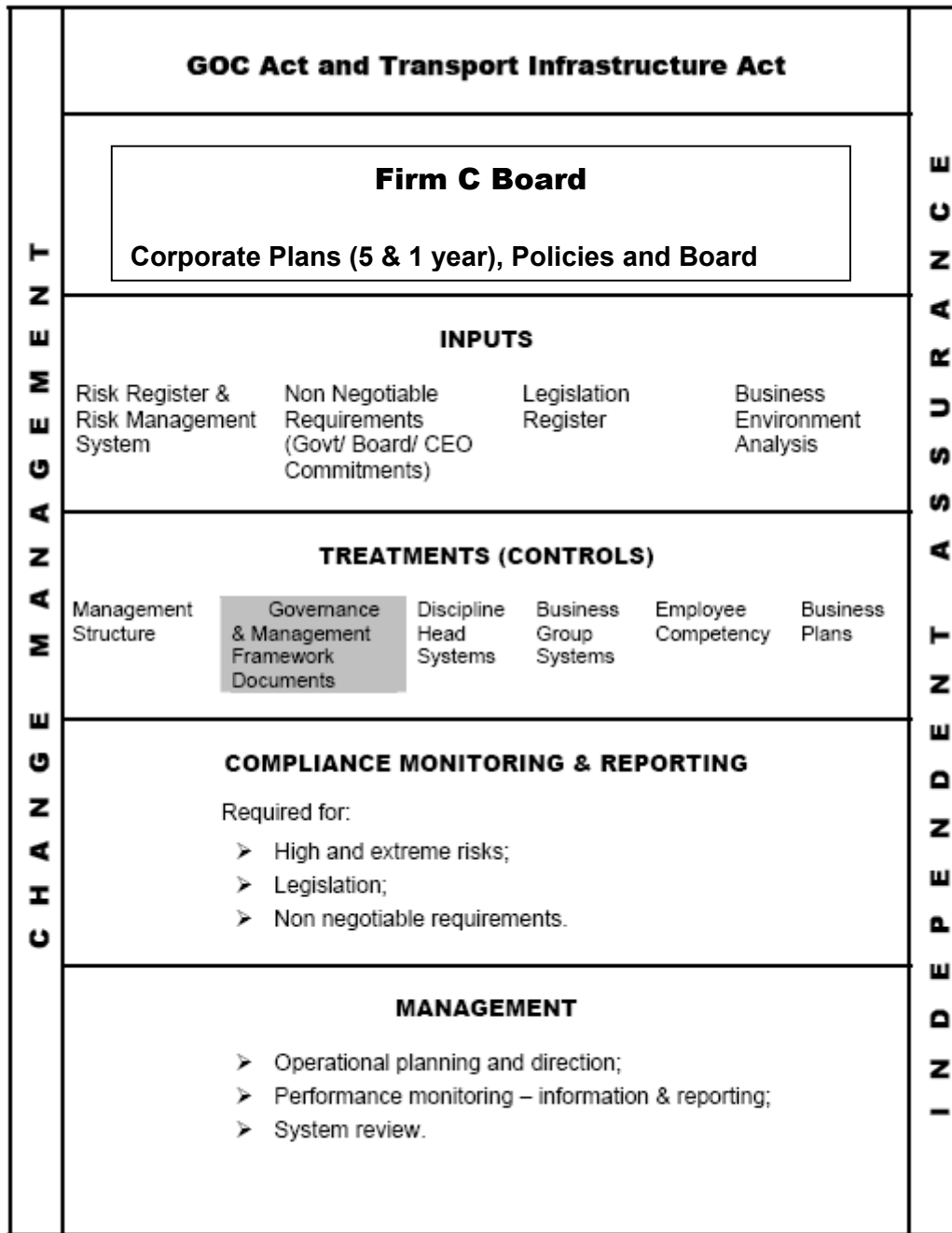
While ZP23 may be able to circumvent policy and compliance requirements once goods are in the organisation, he must comply with strict purchasing requirements. As he states:

*You need approval first of all from Investment Committee, you need approval for Project element numbers, you need approval for EA which is Expenditure Authorisations from a number of senior executive people then like the rail through the SAP system it doesn't take very long to go out of people's delegations whereas you probably don't need that level of delegation because of common sense is going to question that much ... it's not sort of like ya going out and buying*

*\$50,000 worth of consumables which are attractive to everyday people out there so you're not going to rot the system by buying \$500,000 worth of rail. (ZP 23, lines 250-258)*

This long process is clearly frustrating to ZP23 and in his mind it is not effective for managing financial risk. Firm C is managing expenditure risk yet, as he points out, he could “rot” more money using his \$50,000 expenditure authorisation to buy portable and attractive items which he could easily on-sell. He needs to do his work and infers that the controls in place are excessive for the level of risk, and that such compliance may in fact be creating commercial risks by increasing associated administrative costs.

Firm C was sufficiently concerned about the tension created between compliance requirements and performance that it commissioned a report into GMF in 2004. Figure 5.2 provides a summary of the overall system.



**Figure 5.2. Firm C’s Governance Management Framework (GMF).**

The highlighted area in Figure 5.2 was found to be the prime weakness because while the system had listed six types of treatments (controls) which could be applied to manage risks, only one – the production of documents – was being used. This was also all that was being audited. The net result was that it placed enormous emphasis on creating and distributing massive volumes of documents to satisfy this particular treatment. Despite this report, Firm C was struggling to find ways of using the other five forms of treatment.

IK21's prior comment on stacking rail at "2.4 metres" was investigated further with staff at Acro (Firm C's transshipment terminal). The findings helped confirm the preoccupation with paperwork and explain the frustration of operational staff over such requirements. The employees at Acro have to work on sections of track. All track workers have to receive accredited training to work in this environment. In the past if they worked alone they had the responsibility to look out for hazards such as moving trains. Now if they work alone they have to keep a log showing the procedures and logic they used at different sections of track. It should be noted that these staff were poorly educated, with one experiencing severe literacy problems, so they had neither the motivation nor the skills to meet the requirements. Audits of the adherence rate to this procedure were almost zero. When the relevant head office person was asked why a procedure was in place which no-one followed his response was that it would determine the cause of an incident when something went wrong. The operational staff were of the view that his sole aim was to produce documentation to protect himself in the event of a mishap. The same staff commented that if someone was hit by a train then there was no need to prove things had gone wrong; the event itself would be proof enough.

The struggle over which form of control to use appears to be driven by two issues. The first is the question of who is responsible for the wider corporate systems, such as safety, compared with what are the responsibilities of individuals or teams. The latter are measured on business performance as well as compliance. For the former, compliance equals performance. This point is at the heart of the second issue. One obvious way Firm C can demonstrate to its owners that it is meeting their requirements is by providing the masses of documentation demanded by the various other arms of government, an activity which demonstrates that it is complying with all requirements placed upon it. As the careers of very senior managers in head office are linked to pleasing their owners (who appoint them – refer Chapter 4) they tend to support head office functional staff out of a perceived necessity. In an environment where "second guessing" political requirements is common, there is considerable uncertainty around how to interpret government requirements. Functional specialists can and do use this uncertainty to their own advantage by either implying that the Minister wants something when this is not the case or by biasing the response to a government request in a way which serves their own agendas.



### ***Stakeholder/Shareholder***

The interviews highlighted a key difference in governance structures which was reflected in the extensive variations in attitudes of the staff of both organisations. Firm A was shareholder focussed and, provided employees could demonstrate how a proposed change could add to shareholder wealth, they were confident of getting a good hearing. This point was reinforced through the presence of an electronic bulletin board which displayed the latest share price. In contrast, Firm C's staff were far more conscious of all types of stakeholders and the need to consult widely in order to bring about changes. Despite these differences, it was the local changes generated by Firm C staff at Yanbo (rail welding facility) which attracted the greatest praise from both organisations. Yanbo was a bottleneck and the team-based improvements made at this location rendered the entire chain more productive.

The earlier comments made by LQ22 and RE21 about being measured in terms of avoiding negative headlines and trying to second guess government, point to a strong concern to meet the needs of Firm C's owners. These concerns are political and cover a wide range of constituents. Figure 4.2 made reference to the State Purchasing Policy which acts as a filter between Firm C and its suppliers. Its purpose is to shape Firm C's interactions, including being able to direct it to act in a noncommercial manner in order to meet political objectives. Managers in Firm C were very aware of the need to produce such outcomes. For example:

*The funny thing about it is you could easily, under State Purchasing Policy, justify that importing rail actually creates more jobs for State C (state where Firm C is located) so it would be better for State C but not necessarily better for Australia, so importing rail means that you need more staff to do the trans-shipment at the port. Need more staff than you need just to trans-ship it from wagon to wagon, so it would create jobs for (State C people) if we imported rail. Might be a bit detrimental to State A (where Firm A is located) but you could easily argue it was a good thing. (LF21, lines 205-212)*

Such a view shows a strong preference to meet the needs of the owners even if it means dumping a supplier. However, other Firm C subjects responding to Question 6 (on the noneconomic benefits) tended to point out that inefficiencies were justified on other grounds around meeting government objectives. For example:

*We are not using best practice but we are keeping people of this state in jobs. Which from a state government priorities viewpoint - which is about jobs for people of this state, etc, - then there are benefits that way. Keeps us in good favour with some stakeholder, part of the trade-offs. We buy goodwill in other ways, other than efficiency.* (JD21, lines 232-236)

Industrial sensitivities were far higher in Firm C than in Firm A. The dominant theme was around having owners who also had strong relationships with unions. Some subjects pointed out that negotiations had taken place for Yanbo to be relocated and its welding activities to be given to Firm A. This outcome didn't eventuate due to a perception that Government would not support such a change if industrial pressure was brought to bear. Supporting this perception was that despite requests from Firm C's managers over many years for more flexible industrial relations policies, Government still demanded that all employees be given a job for life and that staff could not be forced to relocate even if there was no longer work in the area. As stated in Chapter 4, the State Government has four roles with Firm C which encourage a stakeholder perspective (owner, customer, regulator and community representative). The net result is that Firm C is far more sluggish in responding to changes in the environment as many people need to be consulted and trade-offs made before changes can be implemented. It appears the ownership and governance structures of railways have generally made it difficult to bring about swift change. The following quote is indicative of the view of many of Firm C's managers:

*I think it's why railways take an awful long time to change, with a long history of government ownership and ... and um ... um old mechanisms, that of necessity exist in a railway organisation from an operational perspective seem to spread out into all aspects of a ... of a business called a railway.* (AD21, lines 246-250)

The role of historical legacies and the difficulties associated with moving away from the established ways of solving problems was a recurring theme with many of Firm C subjects. These legacies made it difficult to respond to markets in a timely manner. *"The trouble is the market is moving ten times faster than Firm C can handle"* (LC21, lines 136–137).

Firm A staff found it far harder than Firm C staff to discuss noneconomic benefits associated with being in this supply chain. FD11 was the exception when he referred to the following intangible benefits:

*In terms of other business, we are always proud to say we have got Firm C as a customer, because I think there has been a lot of rationalisation and disintegration of railways in Australia and there is still a lot of people around that still hold in high respect for (state) railways, what they are achieving up here. So as most companies do have a list of major customers, so having Firm C on the list is certainly a benefit to us. [Helps] Imaging and credibility and who knows.*

(FD11, lines 336-342)

### ***Governance Overall***

The differences between the governance structures of Firms A and C were most pronounced in several key areas. Firm A took a narrow shareholder perspective; it was more customer focussed and able to make decisions more rapidly around markets; its policies and compliance were centred more around critical issues such as safety; it had low head office intrusion; and the management culture was very positive about the organisation being more able to shape its destiny now it was free of its previous corporate parent. Even its focus on noneconomic benefits was directed towards intangible assets such as higher market credibility by having Firm C as a customer. Firm C, on the other hand, was almost at the opposite end of the spectrum on each of these attributes and had not been able to free itself from its owners in its 140 year history. While both firms were risk-averse regarding large financial outlays, Firm C's governance structure meant it was less able than Firm A to act on commercial opportunities in a timely manner. The impact of this low risk appetite shaped most aspects of the organisation's life which was aptly summed up as: *"The whole organisation is based around security rather than the customer"* (AZ22, line 120).

### **5.3.3 Infrastructure**

The findings under this super construct most generally align with the second subordinate research question: What has been the impact of the widespread adoption of IT in generating innovation in supply chains? However, the findings were also relevant to other questions such as those on space design.

Three constructs – technology, explicit information and location – are captured within the infrastructure super construct. While all three antecedent variables are well suited to research in the critical realist stratum, this super construct is by far the best suited to such an approach. The reason is that all its components tend to exist in the

physical world and can therefore be more easily validated by conventional positivist means.

### **Technology**

The term technology is used in the widest sense and includes all factors of production, except labour, involved in the steel rail chain. Firm A had invested in excess of AU\$300 million over the previous 5 years to systematically upgrade manufacturing equipment to increase efficiency and meet increased environmental legislative requirements. Firm C, by contrast, was using a butt welder which was over 20 years old and considered to be very inefficient. It did, however, have expensive and fairly efficient track laying equipment. Both firms were continuing to invest heavily in information technology, including ERPs but this technology was not being used in the manner expected. Firm C had also invested over AU\$5 million in an e-learning system (SARBA) but no direct links between the training offered and no courses on SCM could be found in the SARBA system. In Firm C in particular, the use of IT was largely limited to emails and faxes. This was generally to confirm arrangements which had already been made by face-to-face or by personal telephone contacts. Similar arrangements were in place between Firms A and C with complex technology interface issues such as firewalls and rigid systems being cited as the main reasons for not linking such capability across the supply chain. Firm C appeared reluctant to use IT interfaces with external organisations for fear of making their own databases vulnerable while Firm A appeared more open on the topic if it could be demonstrated it was going to deliver commercial benefits.

While technology is defined as a broad term, in this study the primary focus is on IT. A low uptake of modern IT was found in the operational arms of the supply chain (Firms A and C). Usage of phone, fax and, to a lesser extent email, dominated. The primary purpose of using fax and emails was to confirm what had already been arranged through the social system to manage the supply chain. The areas offering greatest potential for improved efficiencies provided by IT were common everyday functions with high volume, frequent usage, strict timelines and industrial relations implications (for example, timesheets). However, when specifically questioned on this point BI23 responded: *“No we had a time book, yeah. We just signed it. Everything we did was by fax or phone”* (lines 344-5).

BI23, who was in charge of the Acro’s transshipment yard, has demonstrated how his relationship with the key player (LU23) in Firm C’s supply chain was the main

channel by which information needed to carry out day-to-day operations was transmitted. “Well, LU23, he’d send us a fax with details,” (line 229). Elsewhere when BI23 talks about the role of the fax machine, he describes them as “our lifeblood to the outside” (line 547).

LU23 clearly uses the telephone communication channel to build relationships. “We’d probably have ahh everyday we’d practically ring them [Acro staff] up. Just to see how things are travelling with their rail requirements, if needed to be changed really” (LU23, lines 208-210).

The following quote highlights that even when BI23 does have to get information from IT systems, he still uses people to gather such data. “[IK21] did have access to all that stuff [SAP data bases], and so we relied on [IK21] to tell us what is in the system. I didn’t use it myself” (BI23, lines 309-310).

FQ23 (Yanbo) makes a similar case for technology being a support to the social arrangements as opposed to providing a new way of working. “Initially it’s the phone call that starts the ball rolling. That allows me to know what’s available out there and then I can arrange things accordingly” (FQ23, lines 177-178).

“[LU23] deals with our customers and the needs of customers so he relays that to myself, then I ummm, I calculate how much rail is needed from our supplier which is [IO23] at [Acro] and then uhh the amount of rail is sent over.” (FQ23, lines 119-122). However, this subject also goes on to state that: “Yeah, we usually receive yeah ... delivery dockets for rail, also receiving fax with the supply of rail they are expecting and also where it starts from is an email from [LU23] to cover customer’s needs” (FQ23, lines 140 – 142).

ZP23, while more sophisticated in the range of IT he uses, also tends to follow the predominant pattern of using technology as an aid to managing the supply chain through social interaction.

*Um, e-mail and telephone. Yep, I sometimes have meetings with material logistics face-to-face. Face-to-face, if I’m in Brisbane I generally call in and say g’day to them. I have a good working relationship with LU23 so, general chit chat but if he has a few issues we can talk about it then, but it’s ah ... send a lot of information to them to keep their records up, like the little spreadsheet that we keep to track where we dump rail just to keep [LU23] in the know about where it is as well as we can. (ZP23, lines 1342, 1349)*

ZP23 does, however, use far more of the capabilities available in IT. For instance, *“Do use it [intranet] very limited for supply, would like to use it more with supply”* (ZP23, line 1318). He is stating that while he uses the technology, it is rarely used for work in this supply chain. He also uses the ERP system but interfaces with it via systems he or his predecessors have developed locally. Subsequent interviews with ZP23 confirmed that most of the time LU23 spoke to him in person first.

BI23 goes on to explain that faxes are more often used to confirm something which has been discussed and decided through conversations over the phone. For example, BI23’s response to a question about what information he needed to do his work: *“So, umm, he’d ring us up saying ‘Listen how many of this size rail you got on hand?’ and we’d say whatever you know, say a hundred lengths”* (BI23, line 229).

ZP23’s comments provide a clear articulation of how technology is used to sustain key pieces of work done through the social system. The more sophisticated technology is then used to confirm scheduling and production arrangements made verbally using mature technologies such as telephones and faxes. *“The planning and sorting out and arranging things is done over the phone and the confirmation of what they will actually do gets sent by e-mail so that’s the way it sort of works out”* (ZP23 lines 1424-1425).

It should be noted that LU23 was mentioned 110 times in transcripts but the majority of instances were by other category 3 subjects. The frequency with which he appears in the preceding quotes is representative of a wider pattern. The key point to emerge is that LU23 is central to the social network which is in turn the major system which drives the operational arm of this supply chain.

At Firm A, a similar social pattern appears to be in play. MI11 makes it clear that while both social systems and IT are used, his preference is to conduct work through the former and use the latter for record management purposes. *“I am more the communication that’s talking to people but I need the computer side as well so the backup is what we have been talking about”* (MI11, lines 196-197).

When subject AL13 was asked to list in order of importance the technologies he used to gather and transmit information, he stated *“phone, fax, email”* (line 276). Again it seems that faxes and emails were used in Firm A for confirmation of what had been discussed beforehand to establish capability and feasibility. *“Cause usually if [AIII] has got some orders coming up we get some enquiry, he’ll contact me by phone or email and we will discuss it on how best we can do it.”* (AL13, lines 189-191)

AR11 perhaps best sums up the range of communication technologies used and how the balance between technological and social varies on a range of topics. He also points out that while technology may suit formal communications, informal social systems also play a major role.

*There is a whole raft. There are some formal communications which are by emails and by memos and there are notices on notice boards, presentations at the team meetings, activities where the team gets together in small groups, and we have discussions about safety and profitability or all of the above. But yeah there are informal discussions which are ..., there are things you have in the corridor and you go and see someone. Very frequent and very varied. (AR11, lines 426-431)*

While both companies have spent large amounts on providing hard infrastructure networks with enhanced capabilities and channels, these do not appear to have led to a significant departure in how work has always been done in this chain at the operational level. A minor exception appears to be that mobile telephony has freed up certain managers to work in more productive ways. For example, FD11 of the sales force found mobile telephone, emails and faxes diminished his need to be tied to a geographical location in order to get his work done. *“Very useful tools. I think maybe being in the one spot is not as important as it once was”* (FD11, lines 785-786).

The bulk of the staff at Firm A’s manufacturing plant tended to express the opposite view and felt having a fixed location was important to help them get their work – and, in particular, improvement activities – done.

No evidence was found to suggest that the emergence of sophisticated IT had resulted in radical innovation and there was little conclusive evidence that it had led to architectural innovation. The use of mobile telephony and emails has created greater flexibility for certain people in the supply chain such as managers. However, these improvements are minor and local and, as such, are classified as incremental.

### **Explicit Information**

The research looked for examples of explicit information which could be independently verified in the form of documents, electronic recordings (emails, voice recordings, and electronic photographs). Explicit knowledge tended to be localised rather than spread across the chain. “Feral systems” were being developed in isolation with no apparent integration across the network. A feral system is defined as a private system created by an individual or part of an organisation that is not recognised (or not

sanctioned) by the corporate system. Often these systems are “work-arounds” because the corporate system may not provide the capability required (Houghton & Kerr, 2004). Feral systems were found in both organisations but the incidence was far greater in the focal firm (Firm C). Some users appeared to appreciate that data integrity and reliability issues would be made even more difficult by feral systems. However, they justified their actions on the basis of having unique needs and wishing to avoid having to interact with complex ERP systems, which did not give them the reports they wanted. It would require too much time to develop the desired reporting capability. Records management was also found to be fragmented and this contributed to both a lack of sharing of information and the duplication of records. Interviewees in both organisations generally reported that they did not trust information systems, with telling responses such as “*no one trusts SAP*” (ZP23, line 1253).

While some anticipated administrative efficiencies may have resulted from the large IT investments made, neither Firm A nor Firm C was able to produce a postimplementation study which verified a return on investment. Firm C attempted to do so after it implemented SAP R2. Specifically, it approached all parts of the corporation which predicted a reduction in staff requirements as a result of implementing SAP R2. While the reasons varied, the net effect was that no section was either willing or able to reduce staff as a result of the implementing the ERP system.

Increased technological capability may have removed some barriers, as it was certainly now far easier to transmit and receive records. However, little evidence was found to suggest this technology had changed the records management system in a fundamental sense. First, paper systems had continued, as had the duplication of paper and electronic systems. Second, IT did not appear to have replaced existing modes of communication, such as face-to-face dialogue and telephone conversations and, as shown, key actors in the chain indicated a strong preference to keep it this way.

Records management was very important to Firm C which had to meet all the usual records requirements of corporations as well as the additional requirements placed on it through the Public Records Act (2002). Proof of compliance to both external regulators and Firm C’s GMF was largely satisfied by producing records. Advanced IT had claimed to be able to meet the increasing need for more records at lower costs. Firms A and C had collectively made a capital investment of several hundred million dollars over the previous 10 years which, combined with maintenance and upgrade costs and service fees, resulted in a combined total in excess of AU\$1 billion (estimate based on



annual reports). A detailed analysis of the various IT investment submissions in Firm C justified such expenditure on the grounds of various types of returns, such as information, could be better managed by electronic record keeping systems (ERKS), electronic document management systems (EDMS) and ERP systems and that this in turn would produce savings through greater accuracy, seamless transactions across the entire enterprise, and reduced “administrative effort”. The latter phrase was code for reduced staff numbers. The industrial sensitivities made the use of a truthful statements too blunt and, therefore, unacceptable. It was further implied that systems such as ERP required a centralised records management system.

The governance requirements around “ring fencing” in the focal firm would also suggest a strong need for a centralised record management system, given the requirement to demonstrate competitive neutrality by the rest of the organisation to bodies such as the SCA (similar to Federal ACCC).

No coherent centralised record management system was found in the focal firm. While less well investigated in Firm A, subsequent questioning did not reveal that any centralised records system existed. In fact, the opposite was inferred.

*And given our geographic isolation to the rest of the business and also 190 sites around the country. There is a lot of vagaries and differences we go from a site of 1300 to Rockhampton to a site of 2 so we run a loose-tight arrangement. (RQ12, lines 278-271)*

More specific to the information used in the steel supply chain, BD23 stated that he received information from Firm A in a combination of “faxes and emails” (line 50). Subsequent analysis revealed that the information provided on the same product (steel rail) was presented in a variety of ways depending on the source. To make sense of such information BD23 developed his own record management system. He used a feral system which was: “*an Excel spreadsheet I have made up which allows for extra information*” (BD23, lines 181). He used this Excel system to record all the despatch details on the faxes he received and also kept hard copies of the faxes. Several other subjects were found to have developed their own, apparently unique, records management systems.

Another key theme was the accuracy and reliability of the records in various systems which meant it was necessary to check via the social system before acting. For example: “*I don’t think anybody in Firm C trusts the inventory, and so even if you had a derailment and you wanted to look up the materials you’d look at SAP first but you’d*

*always have to ring the person there to say, have you got this material?” (ZP23, lines 1250-1252)*

No consistency was found as to the type of technology used to develop record management systems.

*I use, if I'm sending information and stuff like that and it's got to be recorded, I use e-mail a hell of a lot and I keep a lot of e-mails. I find them as my record keeping so if there is something that has to be written down or kept as a record I'll use e-mail a lot and that would be a hell of a lot... (ZP23, lines 1414-1416)*

Subject RG23's comments on how he keeps records shows a mix of technology plus very old techniques: *“Some books we keep plus emails”* (line 87).

Still others point out that while records are important, the tacit knowledge in the system has been able to keep it going. In such circumstances there is little energy to attempt to make such knowledge explicit. *“... they (records) are important. The general comment is that it is such a complex chain. If somebody came in from outside it would be hard to recreate. Our failure to document and listen. We have not done as good a job as we could have...”* (BH21, lines 1312-1215).

Reference to failure to listen is interesting as it suggests that even if those who had tacit knowledge were willing to share it, there was no cultural desire to receive it and no process in place to make it explicit.

There was no evidence that the central information technology group in head office had provided structure, policy or guidance in how to set up software packages in order to better manage records. This again encouraged a feral system approach, as the following quotes suggest: *“...Oh, very basic, we did it ourselves. The database was done internally a long time ago...”* (ZP23, line 1117).

*Probably a few spreadsheets unfortunately around. My schedules are out of there. My schedule to [supply chain partner] is sort of on a spreadsheet, but the information I sort of work it out of the material out of Matman. But it's not a press the button and just spit it out, unfortunately. I'd like it to be that way but it may get that way one day. We're working on tools to help us cut down ... (LU23, lines 709-713)*

“Matman” is an information system which sits outside Firm C's standard operational environment for information systems. Given the number of feral systems and the range of record keeping systems found in Firm C, there was no evidence to suggest

that the decentralised records management approach being used was assisting innovation at the level of the entire supply chain. The widespread practice of keeping paper copies, and then sometimes duplicating them in electronic systems, again suggests little or no innovation had resulted from how the investment in technology had altered records management practices. (Sources: External Consultants Report, 2002 and Internal Report of Firm C, 2003.)

Research revealed that parts of Firm C had indeed been grappling with records management, and had managed to get senior management's attention on the subject. Firm C has had four separate corporation-wide projects to date to rectify its perceived risks around records management at a combined cost of over AU\$1 million but all had failed to sort out the problem.

Two members of the projects were interviewed to determine what factors were responsible for the implementation failure. The conclusions they reached were that first and foremost the problems were cultural and technical. Cultural problems included not only that Firm C had worked on a federated model for its entire history, but also that key functions passively blocked reforms which they did not like. It was claimed that the IT personnel, while key to the success of such a project, undermined it through a combination of neglect and making suggestions that emerging technologies (such as the portal) would make the need for such a project redundant. It was claimed the IT people always took a technology perspective rather than a business driven one and, as the cultural aspects also required attention, they sought to undermine this and any other project which worked outside their own technology centric paradigm.

A second conclusion was that the rest of the organisation had a poor comprehension of the issues and therefore did not value the projects. A third was that railways had developed successful records management systems over a century and the historical patterns of supportive social and technical systems were deeply ingrained. These systems could meet external reporting requirements but not very efficiently. Finally, it had been concluded that the bulk of the organisation was just too busy with other priorities to address these particular concerns.

### **Location**

This refers to both the physical location and the design of offices and work areas. When asked about office layout policy, only four managers were even aware that a formal policy existed and only two knew its specific content (one of these being the author of the

policy). No-one from the manufacturing firm was aware of such a policy in their organisation. Approximately half of all respondents expressed the view that allowing the various players to come together would improve supply chain performance; however, there was little consensus on how this could be done.

With respect to design, two of the respondents expressed a view that offices should be built around processes but did not express views on how this could be achieved. Over three-quarters of interviewees expressed the view that collocation of staff involved in the supply chain in a single office was highly desirable for two reasons. The first was around tacit knowledge and the view that one needed to be near those who had it in order to gain it. The second issue was around efficiency and speed. Specifically, being around the action meant one could pick up on issues in a timely manner and thereby avert future problems in supply chain operations.

Firm A did demonstrate they had done something to arrange office space in a way which could assist key relationships. For example: “[AR11] has virtually his whole senior level and support staff all in the one building, so open team offices generally and so it is sort of the hub of the mill is - all in the one spot” (RQ11, lines 461-463). Firm A also had key suppliers located on their work site but housed in separate buildings and branded in the various suppliers’ corporate symbols.

No evidence was found in Firm C of deliberately collocating staff to enhance the effectiveness of key interfaces in the supply chain. Firm A’s move needs to be understood in a context where production technology had reduced staff numbers so there were surplus offices spread across the mill. A rationalisation of office space was taking place anyway. It does not appear that this was the result of a deliberate strategy concerning collocation.

### **Infrastructure Overall**

The compliance aspects of governance have created a need for a solid records management system. Both Firms A and C have invested in technology which should have enabled the development of records management systems. At the level of the supply chain this investment appears to have delivered poor returns. The uptake of the technology has been largely used to confirm socially negotiated arrangements or statements. Nonetheless, there is a tension between the powerful functional group of IT specialists and operators. The technological view of the physical supply chain is at odds with the work preferences of the operators.

The strongly expressed preference to work through the social system would suggest that buildings and offices may show evidence of being designed to facilitate social interactions. While Firm A had moved in this direction, it was not the result of a deliberate strategy. The overall picture for both firms was that there was no clear strategy, investment, or even deep awareness of the issues associated with location. This is supported by the response to Question 10 on workplace design. It was most notable that all respondents were able to express opinions on all questions asked of them but really struggled to articulate responses to the concept of workplace design in any depth.

#### **5.3.4 Operations Knowledge**

The findings in this question are most clearly, but not exclusively, related to the second subordinate research question: What has been the impact of the widespread adoption of IT in generating innovation in supply chains? The category of operational knowledge was generated from the data when it was discovered that much of the information that was needed to run the supply chain existed in people's heads rather than in formal information systems.

This super construct refers to the labour component in the production process. In particular, the factors which are seen to impact innovation are in the form of tacit knowledge, how such knowledge uses both soft and hard information systems to make decisions and, finally, what learning takes place. The three constructs captured within Operations Knowledge are tacit information, decision support, and learning.

#### **Tacit Information**

The same supply chain data were coded differently by different actors as materials moved between people across the chain. This may account for the high incidence of people reporting a reliance upon social rather than technical sources for key information. Despite having extensive QA systems in both organisations, very little knowledge on how to make the chain run smoothly was made explicit. The data overwhelmingly revealed that staff in both Firms A and C expressed high trust in the reliability of the information offered by people and very low trust in that generated by information systems. This can be seen, for example, in the frequent references to LU23 by other interviewees in connection with a range of issues from planning through to correcting operational day-to-day issues across the entire chain. Specific quotes are not presented in the discussion of this construct as the bulk of quotes used to justify other constructs also fit here.

## **Decision Support**

Decision support systems (DSS) were used by some of the key players but were not being used in any obvious way by the entire chain. This finding was at odds with the data where several senior managers reported a strong desire to have a complete picture of the entire chain. The measurement and information systems used to manage the supply chain also showed considerable variation. Despite Firms A and C having an ERP in place, several information systems were found at various parts across the chain. While the SCOR Model comes complete with measures, it was found to be inadequate for the purposes of planning across the supply chain. Specifically, the measures used in SCOR were found to be relevant to some (but not all) of the activities of the focal firm within the chain as opposed to the entire chain.

The production arrangements at Firm A did impose an operations management discipline on the site and, therefore, indirectly on the entire supply chain. As QR11 put it: *“Our approach in balancing production is very fair, we make everyone equally unhappy”* (QR11, line 419).

While the subject went on to say that this was done through cooperation, there was a clear understanding in this organisation about the need to schedule work in ways which did not deliver customer outcomes at the expense of profit by increasing production costs.

Firm C had a unit responsible for planning the smooth delivery of the materials needed to make up the chain. However, due to environmental factors such as storms, accidents and a mobile workforce, they found it far more difficult to coordinate in a way which led to architectural innovation. The most obvious example would have been better inventory management for production of such an expensive item. In fact, what was found to be the case was that staff were managing in a way which worked against conventional good inventory management practices. The following quote is illustrative of this point: *“People get caught in the owner supply situation because they do not want to be caught with no rail. We cannot be everywhere and so the people in the field feel it is in their interests to put some padding in their figures”* (BH21, lines 316-317).

These quotes illustrates the type (or lack) of planning which is related to the DSS available and the historical patterns which have led to such reasoning around inventory handling and planning.

A partial explanation of why some staff work around the requirements of the governance system with, for example, grass stocks, is their perception that meeting operational requirements has higher priority than meeting compliance requirements. This is associated with the performance measures for which these staff in the supply chain are held accountable. In railways, having track available is critical to operations so recovery after a failure is highly valued. ZP23 illustrates how a crisis such as a derailment alters normal work priorities. *“You run out of rail, derailments, we deal with derailments quite a bit, so you’ll get a derailment and we’ll divert the rail to that. We’ll pick up rail and get it up and out there very quickly”* (lines 864-866).

The problem with diverting rail is that the records often fail to note such events. Diverting goes on for a range of reasons other than derailments. The net result is that large stock write-offs occur every year in Firm C. For example, in the financial year 2004-05 AU\$1 million in steel rail could not be found. An internal audit investigation concluded that the rail was in the track and the cause of the loss was not poor policy or poor controls but failure to record data. As a result, the accuracy of the data deteriorates and in such circumstances real-time information is best gathered from people. They provide a major benefit by being able to sense and respond to contextual and real-time information in a way that hard systems seem incapable of doing. Another variable which was found to have considerable impact upon recording movements of the steel rail was that track workers were found to be motivated by doing “real work” (track laying) as opposed to “shiny bums” work (paperwork).

The governance structures in Firm C, with its emphasis on hierarchical control, appear to be odds with operational requirements for horizontal coordination in a supply chain. This again encourages hoarding and hiding of inventory, as staff with such reserves can get their work done without having to work through management. The following quote illustrates the point: *“It is harder to work upwards than across as the higher-up managers seem to have less time yet I usually approach them about things which require more money”* ( ZP23, lines 1077-1079).

Another view was that inventory hoarding could be logical because SCM was such a complex topic which has not yet developed the tools to work out all the necessary trade-offs between various partners in a chain.

*The question will become do I build a bigger storage tank or do I take a better transport link. Cause there is always a struggle between stockpile size and the transport size of robustness. Who takes the hit? Where does the risk sit? Who is*

*best able to defray the risk in the event if the supply chain crumbles?. (LQ22, lines 344-352)*

Being able to make such decisions would imply having advanced financial tools such as ABC to track the cost of activities across the chain (Cokins, 2001). Firm C had even more fundamental problems in its inventory system where the financial models were developed in isolation from the inventory data structures and so the two could not be married up. Firm C had acknowledged the need to develop better financial tools for process activities but had not yet implemented them. Firm A seemed to have such tools for its manufacturing process but not for the total supply chain, as the following response on ABC suggests:

*Well it's a good question because there are many definitions but I guess the view would be that you have a process view of the world and within those processes you have activities and you can cost those activities such that you can attribute costs to a product specifically rather than just smear it with vegemite which is misleading. (ZH12, lines 425-259)*

The lack of ABC in Firm C could be seen as a symptom of a wider issue associated with not valuing DSS in general around SCM. Whatever senior managers focus upon, they do not seem to be closely related to SCM matters. A sample of six (two from category 1 and the other four from category 2) annual performance reviews of subjects in Firm C was examined to determine if this was the case. With the exception of very senior managers, it was found that the performance appraisal system was around what people achieved within their work area, and in a calendar year. The very senior managers were more concerned with broader strategy and financial matters but no evidence was found to suggest they were interested in, or actively developing measures around, SCM.

The senior management performance management system then cascaded in a way which generally tended to drive suboptimal outcomes relative to the supply chain. This situation was overlaid with decision-making being kept at the management level due to the hierarchical accountabilities conferred by the governance framework and a cultural legacy of command and control management. No evidence was found to suggest present management and supervisor accountabilities actively assisted cross-functional improvement activities within the supply chain.



An analysis of the HR policy and systems revealed that the performance management system was individually based. There were no team-based incentives and the performance measures by which such staff were held accountable were suboptimal as they often focussed on the short term, rarely on the supply chain and always on the individual. For example: *“It [organisation structure] is generally at odds because there are too many links and the performance management systems encourage people to drive for sub-optimal outcomes – that is look good in their silos and ignore the impact on the entire chain”* (BH21, lines 380-382).

As a result of the above findings, the research reviewed the performance measures and found they were driving the wrong behaviours and resulting in unintended consequences. It was found that this supply chain had been modelled using a simulation model (Planimate). The operators were aware of this, and reported that while they were impressed they would not use it as it did not give information in the way they wanted. In 2004, this research sought the assistance of a modelling group in Firm C known as the Capacity Dynamics Unit. This group had been successful in modelling logistics flows with customers. They developed a model which enabled a more detailed scenario planning capability. Again the operators found it impressive but did not use it. LC21 and LU23 stated that they knew the limits of their supply chain. LC21 could easily extrapolate operational limits into long range planning forecasts: *“We know 5 years ahead that we will weld 4200 rails a year”* (lines 84-85). So modelling was not seen to offer much for key players while others said they found that the model developed was too complex to be practical.

Firm A staff seemed to reflect a similar attitude to those of Firm B, based on a combination of experience and the knowledge of the capacity of the total supply chain based on the bottleneck for the entire chain – Yanbo. For example:

*I suppose I rely on it [weld rate]. I do not personally get involved in that. But if [A111] said they are welding it, x hundred per day or whatever, I would just translate it into how many pairs (2 wagons which carry 27.5m rail) does that mean, you know what's the through-put or what is the limitation of Acro, are there shorts up there, there's a lot of space taken up with shorts so I'm only interested in the point of view, I don't get involved in what your rate is but I have a view okay so if they are welding three pairs a day in theory they should then we can push three pairs coming in. So it is sort of push pull.* (LE21, lines 179-185)

The development of measures which are effective for practical purposes appear to inhibit adopting other ways of learning about how to better measure and manage supply chain performance.

### **Learning**

Managers and supervisors in both Firms A and C showed a strong bias for learning on the job for both staff and themselves. Responses such as, *“it’s a complete waste of time sending them off to courses”* (AL13, line 241) and *“better if I train them myself”* (FQ31, line 198) were common.

Some saw merit in training being delivered in context and by the person who had local knowledge of the issues, and they were critical of traditional course based training delivered outside the work context. For example:

*I’ve got guys out here, supervisors that I want to use a spreadsheet so I’ve got to teach them how to, it is better for me to show them how to use the spreadsheet, using the information that I want them to capture off the spreadsheet rather than sending them away to a spreadsheet Excel course, bloody in one ear and out the other ear. Unless I actually get them to actually use the spreadsheet here with me it doesn’t work.* (ZP23 lines, 1922-1927)

Emphasis on “in one ear and out the other” and “unless I get them to actually use the spreadsheet it doesn’t work” suggests that learning outside the actual context in which the skill is applied is totally ineffective. ZP23’s approach requires a teacher who knows clearly what the body of knowledge is that people need for their work, who wants to pass on that knowledge and who has devised a structured way of doing so. However, when these conditions are not available, a self-directed learning approach is required by individuals. The following quote provides some insight into how enquiry skills are used as a learning strategy. *“I’m involved in so much of it. But people say ... but I actually know what they’re talking about now. I’ve got no training so I ask a lot of stupid questions and find out why things happen and get it explained to me”* (LU23, lines 121-125).

Learning from local colleagues was also common. *“The database I built I learned off other people. It is quite simple and it blows up and more people use it and get shared around. Just interacting with other people and sharing around. People are prepared to share that info”* (RG23, lines 432-435).

As shown in Chapter 4, the bulk of employees had worked in their own industries for over 20 years, with an average tenure of 27½ years in Firm C. Most of the category three subjects had spent the bulk of this time in this supply chain. Until the late 1980s, HR policies regarding promotion were based on seniority rather than merit. This historical pattern based on lengthy tenure and seniority explain in part why experience was highly valued and seen as an effective way of gaining knowledge. The belief in formal training being ineffective may be due to a style which conflicts with historically entrenched learning styles. However, the issue of identity around those who do real work was doubtless also a contributing factor. In particular, keeping information within an occupational group which can only be accessed by experience in the work helps generate power and decreases the ability of head office to impose itself into operational matters, as the following quote suggests: *“So we can say we are going to do this sort of thing and people say, they don’t know what you are doing so they say oh well, do whatever you want. You know people can’t comment on you because there are not many people that have got experiences on this area”* (ZP23, lines 1699-1704).

### **Operations Knowledge Overall**

The knowledge required to maintain the operations of this supply chain is largely tacit. In large part, the failure to keep accurate records adds to the proliferation of work practices based on tacit knowledge approaches. As a result, much of the decision support is tied up in the rules of thumb of key individuals, such as MI11’s focus on the weld rate at Yanbo and LU23’s understanding of what is needed for the system to operate at full capacity. Such heuristics are sufficiently pragmatic to be able to negate the attempts to introduce DSS. Not being able to make such knowledge explicit makes it hard to learn outside of an experientially based approach. There have been some attempts to make this knowledge explicit as the following photograph of the inventory management process demonstrates.



Photograph 1 – Inventory Process Map

The above map only includes key high level steps in the inventory management process. Appendix H illustrates how this process links in to wider SCM and corporate processes. Despite the use of standard size text the map is several metres long. An exercise was undertaken to map and then link all of the key processes in Appendix H but it soon outgrew a 30 metre long room and was definitely too complex to comprehend. This complexity may explain why the practical knowledge used to run the chain is accessed through the social rather than the technical system. Functional specialists have increased the complexity by dictating extra accounts which SAP then locks into electronic cement. As the physical system tends to be dynamic, staff find it easier to share knowledge through a dynamic social system. Under what conditions this social system encourages or discourages sharing such knowledge provides a logical bridge to the next section for discussion – social climate.

### 5.3.5 Social Climate

The findings in this section relate most closely to the third subordinate research question: What is the role played by IONs in generating and imbedding innovations within supply chains?

In the Conceptual Framework (Figure 5.1), Social Climate is depicted as the intervening variable, or lens, through which the antecedent variables are filtered. It consists of four constructs: trust, power, collaboration and interaction-participation.

Before examining each construct it should be remembered that the demographics discussed in Chapter 4 make it clear that this workforce was all male, past 40 years of age and with long periods of service. It is, therefore, far from typical of the wider Australian workforce profile.

Not many quotes follow to demonstrate what led to the development of the four constructs. The reason for this is twofold. Firstly, virtually all subjects responded to the importance of these constructs so the strength is drawn from a high convergence of quantitative and qualitative data. Subjects' responses to the range of subquestions under question 5 of the questionnaire revealed all, irrespective of category, placed high importance on relationships. All subjects claimed this chain worked largely through informal arrangements, that this was desirable and that if they had to go to formal arrangements between firms then something had gone badly wrong. Secondly, several of the other quotes used throughout this chapter also reflect the importance of these variables. It is therefore important to keep in mind that despite the relative brevity of quotes considerable evidence was found supporting the importance of these constructs.

#### **Trust**

All across the chain, interviewees reported the trust they placed in others to get their work done. For this reason, they were all conscious of the need to maintain good working relationships. The length of time spent in the work role seemed to help the development of trust, especially where key interdependencies were understood and the parties tried to genuinely assist each other. Interestingly, the governance systems while at odds with this position were nonetheless interested in the construct of trust from the negative perspective. As people could not be trusted governance systems had to be designed accordingly. Governance stressed the need for contracts, formal documented performance management systems, and record-keeping on just about everything in case

something negative happened, in which case such records would provide an evidentiary trail.

The research focussed on determining where staff placed their greatest trust – in systems or people (Question 5). Irrespective of whether the word “system” or “information system” was used in the questioning, most subjects responded by talking about IT. One of the strongest findings in this study was that reliance was placed on the social system, not the technical system, to gather information in order to maintain the supply chain operations. While advanced information systems did generate some new behaviours and capabilities, their overall impact was low. There were several clear reasons why such systems were used. Chief among these was that staff felt they had no choice but to use their ERP systems because their respective corporations gave them no other source of primary data.

AR11’s comments were indicative of a general orientation found towards people he dealt with in the supply chain: *“I think that people I deal with both internally and externally I find very credible, reliable trustworthy, certainly approachable”* (AR11, lines 260-261).

Why there was such reliance on people over formal management systems was perhaps best summed up by AD21’s comment: *“Personal contact is vitally important, but I suspect that if we had systems that, that um were perfect, then 99 per cent of what we do is quite simple. The transactions aren’t complex ah, but as we don’t yet have such a system we have to rely upon people”* (AD21, lines 497-500).

Even apparent advocates of systems, such as AL13, pointed out that when things started to go wrong they would: *“Go to the same people, usually, if there is a real, a crisis or something that people will know about it, in some occasions before I do and they will come to me”* (AL13, lines 141-142).

Reference to the “same people” highlights that trust is not really based on the entire social system but, rather, in specific individuals within the system. This theme was explored in more depth through subquestions such as those found in questions 3 and 6 which examined keeping promises, and being reliable and credible. The findings for both firms were that such attributes were strongly correlated with varying degrees of trust.

Another finding was that credibility was most valued when the supply chain was in some form of crisis. MI11, who was also responsible for operational performance, illustrates how in such circumstances, using established social relationships takes on total primacy as the way of working.

*I would go to [IK21]. I guess I like the relationship level and I think in transport I guess with very tight delivery windows, a low inventory level and all that sort of stuff, to have those contacts is very important when things are getting tough. You know there are times when you need to be able to contact somebody who you know ... yes is at the coal face you can call. (MI11, lines 163-167)*

Within Firm C, the most credible person was seen to be LU23. LU23 himself appeared to place different levels of trust in information systems and in different people. He viewed information systems as assisting in basic compliance audit activities. “*So you can trust the system and cross all your I’s and dot all T’s, and I know the logistics officers do that and I do that, too*” (LU23, lines 284-285 - note the order of Is and Ts is as actually stated).

How much of himself he was willing to disclose to others is based on his assessment of his experiences with individuals over time. “*I just tell them different levels of personal details based on how well I know them – after a while I can usually gauge how trustworthy they are*” (LU23 lines 789-790).

Once LU23 had created personal ties with such people, he was then happy to use technology because he saw it had other benefits in terms of speed and access to data.

*I feel that I can give answers to questions best when I’m at my office or on the phone believe it or not. And once you met somebody, you do not have to meet them ten times. You know you meet somebody a few times, you work out who he is. And how you can work with him. When I’ve got all the information at my finger tips I can answer their questions quite easily. (LU23, lines 908-912)*

While the subject’s comments such as “at my finger tips” and “at my office” suggest a high reliance on the computer in his office, it needs to be stressed that the prime purpose is still to assist him in interacting with the social system in answering questions, usually generated by a phone enquiry. However, note that he has first built the relationship prior to using such technology.

LU23 also appreciates how to use basic technology to maintain good relationships, provide feedback and facilitate incremental innovation. However, his clear preference is for telephony which still allows person-to-person contact compared with the newer technologies such as email which are far more impersonal and separated in time and space. “*I hear about good stuff too and we try to make sure that when Yanbo had a*

*couple of good runs we made sure that they're congratulated and things like that. We look at trying to make more of the good phone calls" (LU23, lines 1063-1065).*

Some of the dependence on advisors within the social system is due to a combination of a lack of user friendliness and ignorance about ERP capability. One subject suggests this creates a form of forced trust upon other people. The following quote illustrates the point:

*That's what I find mind-boggling is that there are managers out there that don't have a faintest idea about SAP and are at the whim of their admin people. They cannot audit their admin people on what they are doing exactly because they just don't have a clue about SAP, they rely on their admin people totally. (ZP23, lines 522-525*

While the subject sees the potential danger in a situation of managers having to rely on administration staff for vital information, it nonetheless suggests they find it easier to trust those staff than to master SAP. The proliferation of feral systems provides clear evidence that even if SAP were understood, it would not necessarily assist the key actors in doing their work. As management involves getting others to do the work and the data in information systems comes under independent audits, it could be argued managers have several ways to assess how trustworthy these arrangements are and what the trade-offs are from a risk management perspective. They appear to have made some form of assessment which finds it more expedient to trust such individuals.

Firm C leave its staff with little choice but to work with information systems. Yet LU23 and others suggest that the corporation imposes a form of fictional trust on SAP and the usefulness and reliability of its data. Those at senior levels (Category 1) have a different view to those who do the actual work (Category 3). The latter argue SAP is not reliable to the degree required for them to do their work and they therefore turn to the social system which they do trust. The following quote illustrates the point. *"Firm C trusts the inventory so ... and so even if you had a derailment and you wanted to look up the materials you'd look at SAP first but you'd always have to ring the person there to say, have you got this material?" (LU23, lines 1250-1252)*

BH21 offers a slightly different explanation about why there is more trust in the social over the information systems, based around complexity, tacit knowledge and the inability of people with the tacit knowledge to make it explicit and useable in information systems.



*The general comment is it is such a complex chain, if somebody came in from outside it would be hard to recreate. Our failure has been to document and listen. We have not done as good a job as we could have. We can't use that as an excuse for not doing process management more thoroughly, but I suspect the reason the information systems don't work so well is we haven't been able to tell the IT guys what is needed. We know it intuitively but it is easier to do it than document it.*  
(BH21, lines 393-398)

This quote helps illustrate several points. First, it helps explain why explicit knowledge such as that found in QA and IT systems does not appear to have high currency. Secondly, it implies that there is a lack of skill and ability around process management. In effect, managers have not been trained and developed with the core managerial competencies to make SCM information visible. As a result, the actors have to rely upon each other to do their work and to access critical information when required. AD21's prior comments (under Trust) on the absence of perfect systems making it necessary to rely on the social system perhaps best captures the essence of why so many subjects prefer to work through the social system.

### **Power**

The two organisations (Firms A and C) appeared to generally see the relationship as roughly equal in terms of power. Both sides were willing to go to great lengths to maintain a good working relationship and avoid behaving opportunistically. Examples included not seeking liquidated damages for performance breaches despite having such power. In fact, this situation existed not only between Firms A and C but also between Firm A and B.

In the past, Firm A's corporate parent was Firm C's biggest customer and while the rail contract could range from AU\$50 to \$70 million annually, this represented a relatively small amount compared to the contract Firm C had with the corporate parent.

Numerous subjects in Firm C commented on a change in power relationships when Firm A was spun off. SF21's quote that, "*The sole supplier status, 10 years ago, we did not seriously contemplate a supplier other than Big Oz*" (lines 141-142) was typical of comments by JD21, ST21, BH21 and AD21. Firm A staff also noted this ownership change impacted upon SCM: "*Big Oz became Firm A, which is a much smaller company so there have been some changes in that respect in terms of the supply chain, with obviously changing ownership of the firm*" (LE21, lines 139-141).

When asked who had the greatest power (Question 7), the dominant answer was the firm with the money, or the customer, or both. However, there was no universal agreement with some seeing the supplier having more power. Firm A likewise had power over Firm B as they carried almost 80% of Firm A's output. Loss of such a market would not be fatal to Firm B but the loss of economies of scale would cause considerable disruption to their other markets. The overall picture which emerged was that, at the interfirm level, none had sufficient power to dominate any other firm.

At the intrafirm level there were clear asymmetries of power. The section on governance demonstrated that, in general, Firm C's head office discipline specialists tended to have more power over the business group, especially through policies. For example, refer to JD21's lines 78-84 (p. 117) and ZO22's lines 30-36 (p. 124). ZP23's lines 1699-1704 (p. 147) suggests those feeling such power being placed upon them regain some power back by not sharing information upwards. This overlap of policies and power is but one of many examples of how the constructs from within different super constructs interact. Firm A's power relationships did not appear as obvious and the subjects rarely reported concern with this issue.

### **Collaboration**

Collaboration is a key part of social climate and is here taken to include all the cooperative aspects of social interactions which demonstrate commitment and willingness to do the right thing and support others. As inferred in the comments on the responses to question 5 on relationships, this aspect was a very strong feature of this chain. All parties understood that in order to get things done at the operational level, they needed to work with each other in mutually supportive ways.

Many of the quotes provided previously under different constructs highlighted how most players in this supply chain have found it to be in their best interests to take a collaborative approach in all sorts of activities ranging from daily operations through to strategic planning. Every subject expressed the need to collaborate in a range of activities from strategic planning through to daily operations. When asked about the communication approach used (Question 5) on a scale ranging from formal through to informal, all nominated the informal approach. This was despite having formal contracts in place and all three firms having numerous opportunities to seek liquidated damages from each other.

LC21's quote perhaps best sums up why both firms, and actors between and within the firms, chose to collaborate across this supply chain, when he states: *"Because without their cooperation we will not be able deliver the end product to the customer"* (LC21, lines 115-119).

### **Interaction/Participation**

This final construct of social climate had varied responses in that, at the operational level, interactions were frequent and egalitarian in nature. However, this was not necessarily the case with vertical interactions. Interviewees from both organisations expressed frustration at having to work up the system due to a variety of factors such as a lack of time of those higher up in the organisation to make themselves available, and the sheer volume of governance matters which were relegated to them.

A clear majority of subjects were of the view that people needed to be involved as much as humanly possible in order to be effective in the supply chain. Firm C's subjects more frequently linked such involvement with learning in that it helped in breaking down historical and cultural issues which were impeding necessary changes. *"You are changing a culture that is a 100 years old and trying to spin it into something it is not. And also a large portion of it does not see a need to change. I do not have answers, all I can say we are doing things and putting mechanisms in to make people part of it"* (LC21, lines 485-488).

### **5.3.6 Innovation**

As shown in Figure 5.1, innovation is a consequential variable which has resulted from the antecedent super constructs of corporate governance, infrastructure and operations knowledge, and the antecedent construct of planning, all of which are mediated (focussed) through the social climate lens which influences the speed and efficiency at which innovation outcomes are delivered. The four constructs of innovation are transformational, radical, architectural and incremental. Each construct has been defined in Chapter 4 (p. 79).

### **Transformational Innovation**

Transformational innovation was not directly detected as a result of the actions of either firm. It was, however, detected as a result of changes in government policies, most notably the NCP and the flow-on effects of the microeconomic reforms which commenced in the 1980s.

Transformational innovation is broken down further into two subheadings – industry restructuring and corporate parenting. The reason for the split is that the former is imposed on the entire economy so all players in a market are impacted. Strictly speaking the latter is not transformational as it represents discretionary options that firms and their owners can choose as points of difference while operating within a market. However, it is included in this case as the choices made to date by both Firm B and Firm C’s owners, and possibly by Firm A’s, have a strong causal relationship with the wider policy reforms.

### ***Industry Restructuring***

Firm A previously supplied to state-based rail monopolies. The break-up and privatisation of such organisations had made operations more difficult from the supplier’s perspective. For example, subject, A111 comments that:

*In previous years ... you only had a couple of sites ... what is happening now is that the industry is becoming fragmented and you have got a lot of smaller maintainers and constructions wanting to access long length rail but they don’t have the infrastructure in place to handle it ... So that has added significant complexity to the delivery task. (lines 370 – 381)*

While the NCP, in the short-term at least, seemed to have created a rail market with increased competition and a larger customer base that Firm A served, the reverse seemed to be happening with its suppliers. MIII notes how the number of suppliers was shrinking due to the reforms, which has resulted in industry consolidation:

*... in transport there are less and less providers out there. For example, we went from 100 road carriers down to three. We had a hundred plus, we had about twenty majors, now we’re down to two, from it, was also aimed at increasing competition but seemed to be having mixed results. And from that there were financial benefits we gained, but there were other benefits in terms of control, such as safety, policies, all of those sorts of things that we could work on jointly, as distinct from trying to deal with 100 or twenty majors. (MI11, lines 297 – 302)*

The subject goes on to say, “*We have put a lot of things at risk*” (MI11, line 304) as a result of moving into a single supplier approach but on balance concluded that the approach taken is the way of the future and that “*I think generally speaking people are going for less (suppliers) and for longer*” (MI11, lines 309-310).

This trend, while at odds with the aims of the NCP to increase competition, does appear to be consistent with the emergence of a new form of organisational arrangement around SCM principles.

Firm B provides an example of a firm which could not have existed before the previously identified microeconomic reforms and policy reforms. Firm B's two corporate parents now control all modes of production in the transport value chain – ports, warehouses, road, rail and air. The sale by state and federal governments of their rail and air interests, and the new national policy settings, helped make such a firm viable.

Government's neo-liberal reforms of user pays have had secondary impacts upon supply chains in other industries, as the following quote makes clear:

*Because it came from the government, we were there for the social good ... The perception was that railways or government would always provide whatever level of resource, at level of demand, and at a, at a throw away price and what they did was allow all the other elements in the supply chain to rely heavily on this huge spare capacity sitting in the middle to optimise their processes. As you tighten up that ... you gotta reduce our resource levels which then puts pressure on their systems (LQ22, lines 573-579).*

No analysis was undertaken to determine if this “pressure” had led to other industries having to innovate in their supply chains.

### ***Corporate Parenting***

Corporate parenting is not shown as a construct in Figure 5.1 as it involves a complex relationship between several variables. Nonetheless, the issue itself requires further discussion as it provides some insight into the range of outcomes possible as a result of the interaction of governance and social climate. Releasing Firm A from its previous corporate parent was a spin-off which may not have occurred except for the national reform agenda. Likewise, such reforms resulted in state governments either privatising or corporatising many of their business activities. The role that both owners played in setting up governance structures appears to have influenced the role head office staff play. Firm A's owners took a shareholder perspective whereas Firm C's owners took a stakeholder perspective to cover their political concerns. Intrusion by government was mirrored by Firm C's head office which then created an air of discontent within Firm C's business groups because of the bulk of policies generated. Firm A's recent history of breaking away from an intrusive head office appears to be an approach which has so far

given high autonomy to operational areas, resulting in higher performance. This has created an attitude to policies which is almost exactly the opposite to that expressed by Firm C's staff, as the following quote from a Firm A staff member suggests: "*We don't generally have a problem with the general policies of this company or governance*" (LO13, lines 226-227).

As suggested by the literature, the other form of transformational innovation which was anticipated was how IT was changing the role and nature of existing industries. The large investment by all three firms in IT, as verified through the analysis of Firm C's documents used to justify such massive expenditure, indicates that this is seen as a key strategy. The fact that large ERP systems exist in all three organisations suggests that changes have already taken place. However, in this particular case study such technology may have sped up existing activities – through the use of mobile phones and emails, for example, but it did not fundamentally alter the way the chain has operated since its inception in 1983.

Recent microeconomic reform has resulted in total restructure of the Australian rail industry. This provided clear evidence to demonstrate that transformational innovation in this supply chain has been driven by economic policy reforms. However, there was no conclusive evidence to demonstrate that IT had generated transformational innovation.

### **Radical Innovation**

While both organisations have large capital investment programs, neither made direct investments into improving the chain being examined. Firm A's focus was aimed at achieving increased yields and decreased waste in the manufacturing process. Firm C had sought to make large step improvements to its supply chain but the governance regime required threshold rates for return on capital in a specified period. As these could not be realistically achieved within defined timeframes, investments in new technology did not go ahead. This situation suggests that supply chains with expensive mature technology operating within older industries may find it easier to justify this type of innovation in their core assets than in their supply chains.

All three firms (A, B and C) are capital intensive and had a combined spending of nearly AU\$2 billion in technology in the period 2001 to 2003 (Source: Annual Reports). Firms A and C had a long history of achieving large step improvements by investment in expensive yet far more productive assets. Examples include introducing new smelting

technology or moving from steam to diesel or electric locomotives. Firm C's capital expenditure was overwhelmingly concentrated on track and rollingstock to serve both new markets and improve efficiencies within existing markets. Research confirmed that both firms had spent in excess of AU\$200 million on IT over the 2001 to 2003 period.

The risk appetite determined within the governance framework has set the rate of return required to justify the large investments. This in turn has a strong influence on the level of investment which could generate radical innovation in the supply chain. The timeframe to gain such returns has a large impact on the decisions taken. For example, Acro and Yanbo are well-known bottlenecks which Firm C has sought to remove, as subject LE21 illustrates:

*We looked at shifting Yanbo and Acro in the past but the time they wanted to get a full return was too short. If it had been given 20 years the business case would have got up. (lines 320-23)*

Contrast the above statement with that of subject LC21:

*Four years ago I came and bought a piece of a one metre machine at [workshop owned by Firm C]. Particularly useful if the machine would be amortized over ten years, so you reinvent the technology that keeps you at the leading edge of that invention. However, Firm C's position is you pay it off over 20 years and don't worry about it. I do not know what the answer is. That is something you hear more and more of – capital does it pay back, what should you do? (lines 362-366)*

Subsequent investigation revealed that Firm C had indeed changed the timeframe needed to justify returns on investments. While it transpires that neither view expressed above was totally accurate, both were reflecting the basic guiding investment principles at different times. Financial analysis revealed that if a 20 year period had applied at the time of LE21's analysis, the investment would have paid for itself. The other point is that managers form very different perceptions about what they are allowed to do which in turn influences their decision-making around such strategies, irrespective of the policy reality at the time.

Firm A's capital investments strategy and associated rules appeared to be far better understood by staff. This appears to be related to having a far clearer strategy overall when compared with Firm C, and a R&D strategy which was well aligned to this strategy. No formal R & D structure was found in Firm A but each business was expected to carry out R & D as part of the strategic investment plan which was driven by the

strategic plan. Firm C, by contrast, had a R & D committee with funds of AU\$2 million which were to be used to encourage innovation that could not get seed funding from business groups. After 3 years of operation, Firm C decided its R & D strategy was not effective. While JD21 made it clear in a prior quote that Firm C did try to use R & D to get around its own rigidities, he also stressed that these funds were directed at traditional rail technology rather than at SCM. Firm C's conclusion was that the main failing of its R & D approach had been the lack of alignment with strategy.

Firms and A and C had affiliations with various universities to assist them with improving the productivity of their assets. Firm C, for example, was part of a rail cooperative research community (CRC) with \$58 million in funds. It was also part of an asset management CRC. Both organisations had a long history of working with universities because they had an established performance of making improvements through upgrading and refining key assets. Subsequent investigation of the rail CRC revealed that despite the heavy investment in dollars and kind by Firm C, the CRC struggled because the rail industry as a whole could not articulate the key few issues it wanted addressed. Firm B as a railway was also part of the same CRC but its contribution was minor compared to Firm C's. No analysis was conducted for Firm A in respect of the steel industry. Firm A staff did make it clear that due to their historical links with Big Oz's steel division, they shared quite sensitive information on technology through informal channels. Formal channels for sharing such information had ceased since divestiture.

The power of capital investment to improve this supply chain was made obvious through a minor capital works project (AU\$900,000) which extended the roof at Yanbo to allow staff to load trains when raining. This had a massive impact upon the productivity of the entire supply chain by relieving a potential bottleneck. However, as the following quote demonstrates, the improvements were carried out from a local, rather than a SCM, perspective.

*Legally there is only a certain amount rail we can hold at Yanbo for height etc etc. So we have literally choked the business to a stop. No one's fault, it is the weather, but the chain is not flexible enough to be able to control it. Why?*

*Because previously Yanbo was no different to the TLM gangs. When it rained the guys would not work, same as the guys at Acro. So what did we do under the 900k investment? We covered it with a roof, now we can work 24 hours a day. We have*



*created a problem by doing that because we are still working and the rest of the chain has stopped. (LC21, lines 332-338)*

### **Architectural Innovation**

Very little evidence was found of architectural innovation, at either the inter or intrafirm level, resulting from a deliberate strategy. This finding was surprising as it was anticipated that the implementation of an ERP system – which promises to give seamless visibility across entire organisations and potentially supply chains – would have resulted in improved productivity by the reconfiguration of existing assets. The examples found of radical innovation were not linked to ERP investment. At the intrafirm level, Firm A was able to rationalise office accommodation due to advances in core technology which resulted in requiring fewer people. While the core equipment had some IT components embedded in the technology it was but one element involved in enhanced steel manufacturing techniques and processes. The interfirm example was of improvements at Firm C’s Yanbo plant which resulted in a better turn-around time of rail pairs to Firm B. This in turn benefited Firm A, which could then keep the bulk of its production “under crane”. Previously Firm C would have had to stack its production elsewhere, which meant not being under cranes. This resulted in double handling and the need to reserve a larger area of land for this activity. The intrafirm example was due to radical innovations in the production technology which had a side-effect of reducing both the number of staff and the sites to house them. The latter example occurred due to a combination of radical and incremental innovation within Firm C. The architectural innovation in the chain is possibly best described as a fluke.

### **Incremental Innovation**

There was considerable evidence that incremental innovations had been taking place across the entire chain over many years. However, as these were aimed at solving local problems, the impact on performance was not obvious. This finding suggests such improvement needs to be more focussed on critical areas of a supply chain in order to be effective.

FD11’s comments highlight how a locally focussed incremental innovation can, if located in a bottleneck, deliver improvements to the entire chain:

*There have been some big steps taken in the past six months. Having said big steps, little steps that have had a significant effect in making the rail flow easier*

*and getting better utilisation in the assets in the chain including the rail pairs of which there is a limited number that we have to keep backwards and forwards. (lines 131-135) Where we go back we had some issues where we had rail pairs stuck up where they could not get unloaded. And so the efficiency on the supply chain was low. (FD11, lines 153-155)*

FD11 is referring to some work which was done to improve the use of storage space at Acro and Yanbo and which also helped improve the turn around time of rail pairs. These two examples of local team-based improvements tend to be the exception. Numerous other examples of local team-based improvements were found across the entire chain yet none could demonstrate, in quantitative terms, improvement to supply chain performance, nor did any managers report subjective appraisals of such improvements. For reasons already discussed under the “operations knowledge” heading, these findings may more accurately be reflecting deficiencies in the information and measurement systems used rather than the efforts of the local teams.

While local teams such as those at Acro made improvements by taking over the crane maintenance and making better use of yard space, they were unable to make further improvements due the capacity constraints and governance requirements. Subject BI23, when asked about what was needed to improve the chain’s performance, offered a radical innovation solution (requiring large capital expenditure): *“It needs a bigger area for starters as in service area for storage otherwise we are forced to stop and one of the biggest draw backs around the place you know is the holding capacity”* (BI23, lines 61-63).

Such an answer reflects a widely held view about the limits of the system and the capacity constraints this creates. As a result staff felt they were limited in the level of improvement they could make, a sentiment aptly expressed as, *“I am allowed to improve by tweaking”* (IK21, line 99).

### **Innovation overall**

Three types of innovation were clearly detected in this supply chain (transformational, radical and incremental). Radical innovation has historically accounted for most improvements made in such capital intensive industries over the longest period of time. The focus has, however, been predominantly at the level of the firm rather than the supply chain. Architectural innovation was found to be the weakest of the four outcomes.

### 5.3.7 Planning

Planning, as shown in at the top of Figure 5.1, overarches all other constructs. Given its helicopter view, it is hardly surprising that in such a long and not overly visible chain that overcoming weaknesses in planning was often mentioned as an area which could lead to improvements. The main focus seemed to be around scheduling and forecasting. Three senior managers (Category 1, Firm C) expressed the view that strategic planning was needed in order to challenge existing arrangements and to generate radical alternatives. However, strategic planning seemed to be limited to long range plans around upgrading the network rather than improving supply chain operations.

The comments on planning are broken down into three headings to assist in sorting the findings. The three categories are strategic, contingency and operational planning and could be defined as constructs but because they relate to other constructs in the Framework as shown in Figure 5.1, it was felt best to conceptualise the area of planning as a single construct.

#### **Strategic Planning**

Evidence was sought as to whether SCM was seen to be of strategic significance. All subjects were asked if they had documents such as supply chain plans, vision-mission statements and policies on SCM as well as contingency plans. Not one subject could point to a strategic supply chain document.

When asked to provide other supporting documents, the response from QR11 – who describes himself as the supply chain manager for Firm A's plant – suggested that they had a supply chain focus but just didn't formally document it:

*Some organisations actually handle some sections of the supply chain, so here's the supply chain strategy, here is our strategic plan, here is our vision mission and supply chains, others [in the organisation] have production processes and supply chain activities embedded in the map. They don't have anything formal, they still look at the things, as they always did. So it's degrees of formalisation they attach around that. Just trying to work it out, I'm not the type of person that thinks in terms of mission statements and strategies, so I don't have any I can draw on in my department along those lines so I just don't think that way. (QR11, lines 383-389)*

JD21, who was able to produce SCM policy documents for Firm C, takes a different view and suggests that there is still a lot of ignorance around SCM and implies

that such documents generally don't exist because the strategic importance of SCM is not appreciated at a senior level:

*... to make the organisation more appreciative of the whole issue of supply chain and the issues such chains generate in the terms of competitiveness and sustainability, and to position the supply chain strategically. For instance, help them appreciate that the competitive changes we face two years out, grasp that one of their best strategies is to improve inbound supply chains. While having commenced with the third option [organisational wide awareness of SCM] I still have a long road ahead, made more difficult because it is an influence rather than direct action strategy. (lines 168-174)*

This comment suggests planning and learning have, or at least should have, strong links.

JD21 produced SCM policies but, for the reasons stated above, he admitted they were symbolic rather than substantive at this stage and indicated that after making minor modifications to existing purchasing policies, he had put the title SCM onto those. The lack of a suite of SCM policies discussed earlier by RF21 is a far more accurate reflection of Firm C's present policy development. The following comment by RF21 on the link from strategy to policy was explored and, in the case of strategy to SCM, was found to be accurate as there was no link and nothing to suggest a clear understanding of SCM at the strategic level.

*Policy is something an organisation ought to evolve and implement, so that it can um, ... so that it can implement its strategies. So, strategies come first. Then what sort of, what sort of policies and processes are needed to be able to implement that policy, and then um, then some plans around how the strategy is implemented. I'm not sure um, from a planning and policy perspective which, which comes first um, but, but, the only reason that policy in my view, ought to be evolved is so that the strategic intent of the organisation can be effectively implemented. (RF21, lines 150-166)*

BH21 suggests that the lack of strategic vision around SCM is symptomatic of a more general, poor strategic planning process and an inability to sort out strategic vision for Firm C in respect to key questions such as what business are they in and how will they go about executing the strategy (outsourcing, for example):

*The other big thing is that we do not take a far enough view of our requirements - instead of three years we should be looking at, in my opinion, is that Firm C will always be involved in rail in some form or manner. We should make decisions of whether we need rail for 50 or 100 years. (BH21, lines 116-119)*

INT: *Improved forecasting?.* (line 120)

*Not so much forecasting, but acknowledgment of the fact that we will always be in rail you know in some way – do we want to make a decision to control what it's one of the big three things in infrastructure that we have to deal with. Rail construction, maintenance and asset management. It's those three things. We need to make a decision are we gonna control those things ourselves with our workforce and why or are we going to control those things by buying in services. (BH21,lines 121-124)*

Like all constructs in this chain, the role of the social system is of critical importance. In particular, when subjects were asked about joint planning all responded that they felt it was necessary to “cooperate”, especially as the timeframe increased. However, the complexity involved in managing the ordinary operations rather than strategic improvements was also offered as a key reason for such an approach. The following quotes capture the general attitude of staff found in both firms:

*Yeah it would have to be joint planning. I mean you can't work, I can't see that it can work any other way. Umm because it's um, the supply chain has many variables and, and may be relatively complex to other supply chains, um it really requires good cooperation between all parties to operate effectively. (AI11, lines 709-712)*

*I think it's got to be joint, joint planning, in fact multiple party planning I think is the, is the most effective. (AD21, lines 633-634)*

*Most definitely, yes. Long-term plans have got to be developed by yourselves and us. (AR11, line 152)*

The issue of complexity is again implied in the next comment:

*Joint planning. Budgeting project approval, you have to be cooperative, we have got lead times associated with the supply of rail and vice versa. Needs to be – not something that can be controlled. That is the nature of the business. (BH21, lines 248-249)*

While this subject has an aspiration for a longer-term focus and seeks to link formal, well controlled processes such as budgeting with the apparently less controllable forces at play in the operational supply chain, he is also acknowledging that it is not easy to control all these variables. The inference here is that because of the difficulty in controlling the variables, the social system needs to be involved as it can better manage such real-time dynamic complexity. This statement is almost an acknowledgement that since accurate long-range forecasting is difficult, it is easier to work at the operational level.

While all respondents reported that they believed SCM required a long-term commitment, one respondent placed the following caveats:

*I think it's horses for courses. Umm if you're building a coal mine and you want a robust supply chain that's a long-term commitment and I mean years not months. If I'm a small manufacturer moving containers, I will rely on additional capacity somewhere and I will strike up a relationship with the sub-contractor or whatever it will be until I find what works for me. It may only be on a transactional basis, so I think it's a function of the level of investment that has to go into constructing that supply chain or whether you're a shared supply chain, or, or it's been built for you alone, so it's tailored or shared. (LQ22, lines 438-445)*

The above comments again point out that supply chains have a large potential for complexity, due particularly to the fact that trading off the variables, ranging from operational to economic, and sorting out if the costs can be passed on to other parts of the chain are not decisions around supply chains in general. Such complexity creates considerable interdependency as certain actors become very dependent on others to get things done. Such dependence creates a need to work not just on contractual obligations but also in a spirit of "goodwill" to ensure ongoing support: *"I need them [key actors] for planning purposes a whole range of activities that I just cannot achieve my tasks without the cooperation and the good will of other people across the chain"* (JD21, lines 46-48).

### **Contingency Planning**

This was explored to determine if the end user (Firm C) was sufficiently concerned about this product so as to go to the effort to develop plans for recovery in the event of a supply failure. No such plan was found and the general picture which emerged is perhaps best described by the following:

*I do have a sense though that, um there's lots of opportunity through more disciplined scheduling and programming of um, works within the network to um, to, to, to get a better utilisation of the logistics resources, the rail sets, um, the people, and so forth. I mean its, ah I've had a classic example recently where um, where we had to shut down our welding plant out at um, out at Yanbo because it's, because we can't ship rail out of there onto site, because the earthworks haven't been um, haven't been completed. So, um, very little evidence in risk and contingency planning and um, and supply chain alternatives and so forth. (RE21, lines 76-84)*

The situation seems at odds with the risk-averse profile which, as shown under the governance heading, tends to be very strong in Firm C. The subject is also inferring some reasons why Firm C has not been successful at generating architectural innovation.

A different perspective was offered around the view that because Firm C had been protected by government, it had not needed to develop such planning capability as there was no market mechanism to punish it for failures. Having high inventories was a substitute for planning and until corporatisation, at least, there was far less concern with locking up working capital in inventory. This attitude resulted in holding it “just in case” rather than “just in time”.

*Well, historically our interests have been protected by um, very large inventories. Inflating your inventories, and um, and I guess also, a protection has been an absence of the pressures of the commercial market-place. If we were an organisation that was traded on the stock exchange and we didn't have sort of such, such scale and such legacy capability to absorb such large costs in the supply chain. Um, then we would possibly have been more disciplined about strategies and about protecting our interests in the supply chain. (RE21, lines 481-483)*

While the comment above suggests a failure in Firm C's planning capability, LC21 suggests poor planning resulting in poor inventory management is endemic in the rail industry across Australia:

*We looked at [another state – Y] rail and how they control all their inventory. The government supports a \$50m floating inventory. So when they draw down on that inventory the government not the private industries running it back up. I thought that is great that is how you do it. And that is how Firm C do it without \$50m*

worth of inventory. And it can be done. But you have got to have a perfect logistic supply chain or it falls apart. And that is the only way state Y is surviving – they carry huge dollars of inventory and the government prefers to do it. (lines 181-187)

... I understand England is doing much the same. Hundreds of millions of pounds to keep it up and running. ( LC21, lines 191-192)

### **Operational Planning**

This form of planning dominated in this chain. Firm A appears to be quite capable in this type of planning, as reinforced by the following quote:

*I think we've got our process um well under scrutiny and well under control from the basis of production. Um we've got good forecasts from the capacity training processes. And as a result of that we've got a good understanding of where we've got a capacity in the system. (QR11, lines 29-32)*

However QR11's comments on measurement show a clear operations management approach with interest on maximising plant performance. QR11's perspective does not seem to take on a total supply chain perspective and his subsequent statement tends to confirm this point: *"We're the supply chain manager, so we deal directly with all parts of the plan and we deal directly with transport providers, um the operating plan includes the management of the transport contract that we have. So we are all the way through to the terminal."* (lines 206- 209)

The use of the term "supply chain manager" highlights the existence of several definitions in the mind of subjects. As stated, this subject is using the term to define plant performance in terms of moving things up to the next step on the plant rather than the entire chain. The terminal is the point of despatch from the view of manufacture and is in the same complex. MI11 is in charge of the terminal and his comments again show how he is looking at a particular part of the supply chain. While his initial comments suggest he has taken a total supply chain perspective, this is not actually the case: *"I think operations is much more interesting because it broadens my experience and gives me further backing and more understanding of the whole system as it works here. When I worked for a production person it was basically there it is, move it"* (MI11, lines 333-335).



As the next quote shows, his reference to the whole system is different to that of the supply chain and the new arrangements with Firm B have improved his ability to manage the part he refers to as the whole system:

*Since the introduction of Firm B I guess we have a one-stop shop in terms of all our rail line haul across the country. One supplier, basically one supplier of rolling stock, so there's plans in terms of timetables and I guess our ability to keep track of their performance to those timetables. So my view is that they've come from sort of, and I guess technology too in terms of tracking traceability of wagons, where they are, what's going on. It is not quite as good with long length rail, on the basis that we don't have the impact, but where it goes through on a rail terminal where we have computer links, it is very clear to see when they leave here and when they arrive there, and when the products in those wagons are delivered from those wagons. So we can see the whole chain into Acro. In the case of you guys [Firm C] we know it's left here, the information goes into a bit of a black hole and that's why I guess there is all that recording that goes on up there at dispatch. You're supplying back to us, about when things arrive and all that sort of stuff. (MI11, lines 76-79)*

Having a relationship with a single supplier has assisted MI11 in getting better performance measures, but not to the extent that it gives a clear line of sight across the entire supply chain. Note that his comments on improved technology could be seen to refute prior comments. However, this subject is also previously quoted as saying he preferred working through people. He also said “guess technology” suggesting he is not sure because he does not use the technology directly. All he knows is that Firm B is getting better at providing the sort of information he needs to be effective at short-term planning. He also notes that once it gets to Firm C, he loses sight of it as it goes into a “black hole”.

Firm C do not feel they can easily look back along the chain with any confidence for the following reasons:

*First is visibility. Making ways to make some model to show us what the supply chain is like so many process people know bits and pieces along the way but there is no one person presently doing that. I know track material logistics play a bit of a part of that but it is not looking at that supply chain. (JD21, lines 118-122)*

The reference to “not looking” at the supply chain as a whole appears to apply to all three firms. Firm A’s manufacturing arm is only interested in the terminal. The terminal staff are forced to take a wider view – including Firm C’s operations, as this impacts on wagon turn-around time. Firm B does provide information to Firm A because wagon turn-around times impact on the ability to plan future dispatches. While Firm B answers to Firm A in contractual terms, in operational terms it sits between Firm A and C. It is hardly surprising to find that operational staff in Firm B relate to Firm C staff even though the organisations are in conflict at the strategic and market levels. For example, staff at Acro report that they have frequent interactions with Firm B staff: *“Ahh two or three times a week. Firm B pop by when their wagons are in just to see when we can release them”* (BI23, lines 485-486).

Acro staff also interface with Yanbo and again a dynamic operational planning model takes place, as the following response to a question on planning reveals: *“We’d probably have a ... ahh every day we’d practically ring them up, just to see how things are travelling with their rail requirements, if they needed to be changed, really”* (BI23, lines 207-209).

The overall picture which emerges is that the strategic importance of SCM, while appreciated, is not acted upon in a strategic planning sense. The evidence for this is the lack of plans, documents, vision, contingency plans and relevant strategic measures of the chain, either within Firm C or across the entire chain. The SCOR maps also verified that no-one took responsibility for planning across the entire supply chain. Operational planning, while highly valued, is not addressed in a meaningful way through technical information systems. The previously mentioned findings under DSS demonstrated that even where technical information systems were supported by DSS, the information produced did not tend to be used for operational planning. Rather, the key information needed for such planning tended to be passed through the social system using basic technology such as telephones and faxes.

### **5.3.8 Summary of Findings on Innovation**

The different types of innovation appear to be driven by three distinct drivers. These are summarised in Table 5.3 below. The drivers are defined as occurring at three levels: the macro, meso and micro. The macro captures forces which generate innovation at the industry level, the meso refers to innovation generated between firms and finally the micro to innovations generated within firms.

**Table 5.3. Drivers of innovation in SCM**

<b>Level</b>	<b>Driver</b>	<b>Innovation Outcomes and Description</b>
Macro	Government – Economic Policy Reforms	Transformational – in this case fundamentally altered the nature and shape of the Australian Industry. Firm B is a new organisational form designed to generate innovation through inter organisational cooperation between two firms; Firm A was probably divested because of these reforms and now serves new markets and Firm C has had to move to full commercial principles of operation.
Meso	SCM strategies between firms	Radical and Architectural Innovation. Radical – targeted capital investments while aimed within a firm can improve the entire firm. Architectural – while little evidence the improvements at Firm C Yanbo did allow Firm A to reduce inventory holdings.
Micro	Firm	Incremental – at local work sites. When targeted as in Acro and Yanbo resulted in improvements across the entire supply chain.

Table 5.3 summarises the three distinct levels of activities which appear to have a direct causal relationship with specific innovation outcomes. At the macro level government policy can, and does, have a large impact on SCM by setting a framework to allow the emergence of previously unknown organisations in Australia, such as Firm B. Government policy has altered Firm A's market and Firm C's governance. At the meso level, where organisations interact within supply chains, radical innovation and architectural innovation are most likely to occur. Mature capital intensive industries have used investment in upgrading assets for decades and the findings confirmed that, while expensive, this trend will continue. No deliberate strategy around interfirm investment in technology to benefit the supply chain was found. Architectural innovation should follow as information technology and DSS become more sophisticated but such improvements were not reported by subjects and could not be independently verified by other sources. Social factors are not immediately relevant at the macro level but played a major role at the meso and micro levels. Micro level activities, while incremental and local in nature, could nonetheless have impacted on the total chain. In this case, minor modifications to the use of space and work practices at Acro and Yanbo delivered improvements to activities across the entire chain.

A combination of radical (extended roof) at Yanbo and incremental (better use of storage space) innovations at Acro and Yanbo improved the overall operational efficiency of the entire chain by estimates as high as 50%, depending on how it was measured.

Without getting into disputes on metrics, the point is that a combination of innovations also has considerable merit in implementing and sustaining improvements in the supply chain. So while Table 5.3 correctly stratifies different types of innovation on the basis of the different drivers, it is not meant to imply that these drivers are, or should necessarily be, applied in isolation from each other.

## **5.4 ADDITIONAL FINDINGS OUTSIDE THE INITIAL SCOPE OF THE RESEARCH**

### **5.4.1 SCOR**

As stated in Chapter 4, SCOR was not the focus of the research but rather it was used as a tool to assist in defining the supply chain and its boundaries for research purposes. However, it was discovered that the assumptions in SCOR are not without some difficulties. A summary of findings is offered because the unanticipated findings have implications for future research which may choose to use SCOR methodology.

SCOR literature claims that the application of its mapping methodology would provide the following benefits:

- documentation which could be easily applied in a consistent manner by all key players after some minimal training;
- communication documents which are easily understood by the majority of players who work within the chain;
- a platform for improvement by providing benchmarking capabilities; and
- enhanced process measures which practitioners will apply once exposed to the methodology.

The application of this methodology in this study produced the following findings:

- SCOR is a useful tool to generate dialogue and understanding of a technical system;
- Some measures are useful but this needs to be enhanced with an understanding of variation and dynamic systems as found and practiced in operations research;
- Application is problematic – a steep learning curve and little agreement on how to apply SCOR despite prior training by half of the team;
- Methodology - SCOR has four levels. Levels 1 and 2, while very high level, proved to be generic and therefore useful for cross-organisational purposes;
- Level 3 is where most of the action happens; however this level is culture-bound, thus inhibiting the ability to transmit common understanding across organisations;

- SCOR, while acknowledging the importance of the work carried out at Level 4 in the SCOR model, is nonetheless silent on what happens at this low level of operations. As a result, the methodology misses much of the content and tacit knowledge that resides in local contexts and that is needed in order to be able to improve supply chains; and
- SCOR appears to have a large potential to assist in the development of B2B systems – however, this is based on perceptions of subjects and is yet to be tested.

Therefore, none of the benefits claimed to flow from the use of this methodology were supported.

Further details of the SCOR maps can be found in Appendix I. Developing these maps took approximately 150 hours of fieldwork. The findings of this research were represented in the maps and fed back to the subjects who provided the initial information, in order to verify the accuracy of representation. On average, an additional hour had to be spent with each actor to explain the SCOR map. The bulk of this time was spent not so much in verification, but in explaining what the various symbols meant. When this educational aspect was complete, the actors felt confident to comment on the accuracy of what was shown. The final versions of the maps of the total chain and the maps pertaining to their particular area of operations were given to each actor. Each actor was also advised where they could access SCOR material if they wished to use the methodology in their work area. Each actor was followed up a year later in a face-to-face interview to ascertain what they had done with the maps. No workplace was found where any of these maps was on display. While all subjects indicated that they initially found them interesting, none had done anything with them. Only about half of those with maps could still find them. Each was asked why they had not found the maps to be useful. The major response was that while they could see how such maps represented what they did, they were very abstract and too far removed from their operations to be of any practical use.

#### **5.4.2 Multidisciplinary Team**

The rationale for inclusion of this team has been covered in Chapter 4. The team did enhance the research rigor of the methodology by providing extra check points for verification on various sorts of data and the overall research methodology. However, there was much initial confusion and it required several sessions before the team found ways of working together. This blew out timeframes and frustrated team members. It was fortunate that one team member (female) had sophisticated team facilitation skills which were applied to help the group find productive ways of working together. It is clear that

without access to such skills, the group would have taken even longer to work together in productive ways. At least two members were of the view that without the application of the facilitation skills the group may well have fallen apart.

## **5.5 SUMMARY**

### **5.5.1 Findings Relative to Research Questions**

A basic summary is that all four levels of innovation were found in this supply chain. The interplay of the various constructs makes it difficult to draw simplistic conclusions. However, sufficiently strong relationships were found to answer the overall research question: What is the role of social factors in generating innovation within supply chains? Based on these findings, as illustrated in Figure 5.1, it is clear that social factors play a strong role as an intervening variable. A specific summary of results of each subordinate research question follows.

Firstly how well suited are present corporate governance structures of individual organisations to supporting the generation of innovations within supply chains? Governance was found to have by far the most powerful impact of any of the variables upon both the type and quantum of innovation. Governance requirements were expressed through the GMF. The GMF integrated the requirements of policies generated externally and imposed on the corporation through legislation and internally policies generated internally by the corporation after receiving Board endorsement. Of these two types of policies it was found that the externally imposed microeconomic reforms of both the federal and state government were the only factors which resulted in transformational innovation. Policies generated within Firms A and C did result in radical innovation as they shaped investment decisions which in turn guided capital investment decisions. All three firms were capital intensive and the respective histories of Firms A and C confirmed that large step improvements came from investments made on improved core technologies. The four subelements in the governance construct were also found to interact with each other, but the exact strength of the interactions of these subelements was not fully determined.

Secondly, what has been the impact of the widespread adoption of IT in generating innovation in supply chains? The overall finding was that the anticipated innovation outcomes fell well short of expectations. Possible reasons included firstly, that the scale and type of investment made on IT infrastructure was found to be shaped and influenced by governance requirements. Poor investment decisions may therefore have

resulted in inadequate, underfunded technology choices. Secondly, while the investment in IT infrastructure such as ERP systems has been so massive as to be all pervasive and has resulted in some changes to work practices, it does not yet appear to have resulted in any significant innovations which has enhanced productive outcomes. The main reason for such a poor outcome relative to the massive economic investment appears to be the due to a poor fit between the technical and social systems. In particular, it became clear that despite the best efforts of ERP systems to represent the process flows of the supply chain, a great amount of the information needed to make the supply chain work resided in people's heads and was accessed through interpersonal relationships. It is important to note that while the original subordinate question considered the issue of information in a singular fashion the findings on the differences between explicit and tacit information were found to be so vastly different as to warrant separate categories in the framework developed in Figure 5.1. Formal information as suggested under the construct of infrastructure held explicit information only, which unlike the social system was not self-organising and dynamic. Explicit information is captured under the antecedent variable of infrastructure while tacit information is captured under the antecedent variable of operational knowledge.

The antecedent variable of infrastructure was widened to include more than IT systems, and expanded to include physical infrastructure such as buildings and spatial design. Firm A found that altering the physical location of workers in the supply chain to a single location which made social interaction easier also enhanced supply chain performance. Again like the previous variables, the various elements of this construct interacted with each other in ways that were not fully determined.

Thirdly, what is the role played by interorganisational social networks in generating and embedding innovations within supply chains? Staff within the supply chain had frequently delivered numerous incremental innovations to overcome operational issues. There was little evidence to suggest these networks were actively involved in generating higher order types of innovation.

The elements involved in IONs tended to be all pervasive. However, the antecedent variable of operational knowledge and intervening variable of social climate are the two variables which most comprehensively capture the main elements involved in IONs. The term operational knowledge was chosen to capture the notion of tacit information being actively used by staff to generate supply chain outcomes in line with Sveiby's (2001) concept of people using their capacity-to-act in order to create value in

mainly two directions; by transferring and converting knowledge externally and internally to the organisation. Again the subelements in this construct behaved in the same way as the other constructs in that they interacted with each other in ways that were not yet able to be fully understood.

All three antecedent variables had to work through the intervening variable of social climate in order to generate consequential variables outcomes. Again the subelements in this mediating variable were found to interact with each other in dynamic ways. While all antecedent and intervening variables interacted with each other, the unidirectional causal relationship suggested in Figure 5.1 hold with governance being the most dominant.

### **5.5.2 Implications**

How relevant, confirmatory or novel these findings are needs to be established in order to explore what implications follow for SCM. What has been revealed so far is largely what could be described in the empirical domain. However, critical realism argues that reality is larger than the empirical domain and that context is very important. Table 5.3 explores some of the wider contextual factors which may also be influencing innovation in the supply chain. This table represents the first attempt to move beyond a traditional positivist analysis in order to understand the generative mechanisms and structures which are the casual factors not obvious at the empirical level. Other unexpected findings such as the limitations of SCOR also fall under factors which may be involved in the generative mechanisms and structures which may be limiting or enhancing innovation in supply chains. Chapter 6 intends to explore not only the empirical level as suggested by Figure 5.1 but also to address the key research question for critical realism: What are the generative mechanisms and structures which gave rise to the empirical reality?

The discussion in Chapter 6 seeks to explore the generative mechanisms and structures by the use of all forms of reasoning – inductive, deductive, abductive and retroductive. This will involve examining how and where the findings of this case study research sit within prior research and other bodies of theory. This comparison then sets the stage for the conclusions which follow in Chapter 7 on matters such as what aligns well with existing SCM research, and possible areas for future research.



# CHAPTER 6

## 6 DISCUSSION

### 6.1 OVERVIEW

This chapter builds on Chapter 5 by exploring the case study research findings in greater depth. The exploration is conducted within a critical realist research framework. While the prime focus of the discussion is to explore possible causal factors which gave rise to the framework depicted in Figure 5.1 (Chapter 5), wider contextual issues associated with this framework are also examined. Additional and unanticipated findings are also discussed, with a view to identifying methodological implications for the wider SCM research agenda.

Section 6.2 discusses the implications of using a critical realist research paradigm in order to explain the logic which guides the discussion in the remainder of the chapter. This logic highlights the importance of moving beyond the level of “events” to exploring the nonobservable generative mechanisms and structures which give rise to those events.

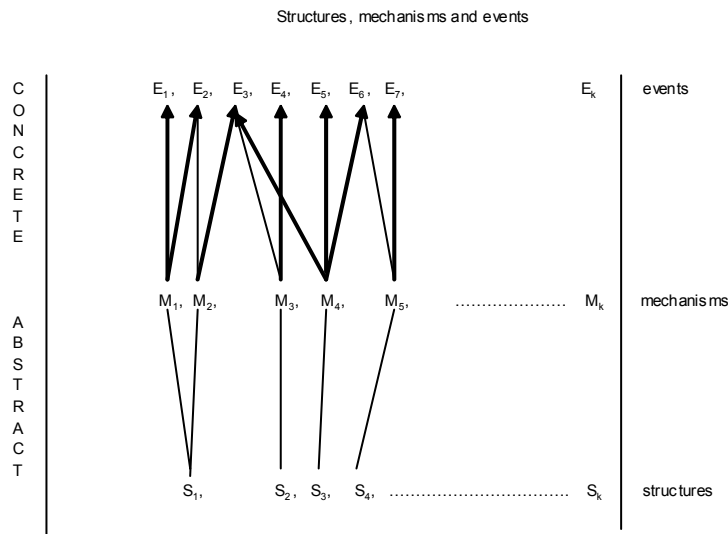
Section 6.3 establishes both the context in which supply chains sit and how different contextual variables generate different types of innovation outcomes in supply chains. Context is conceptualised as existing within three distinct arenas – macro, meso and micro. While the case study supply chain is located in the meso arena, the generative mechanisms and structures which give rise to the framework depicted in Figure 5.1 are found in all three arenas. In order to better understand the generative mechanisms and structures of Figure 5.1, the research findings are compared with wider bodies of literature.

Section 6.4 explores the implications of findings outside the scope of the original research, namely SCOR and multidisciplinary research.

Section 6.5 summarises the discussions and sets a focus for the conclusions which are presented in Chapter 7.

### 6.2 CRITICAL REALIST PERSPECTIVE

Figure 6.1 illustrates the three levels of reality that are of interest to critical realism from a research perspective.



**Figure 6.1 Critical realist stratified research focus.**

The framework presented in Chapter 5 (as Figure 5.1) represents the surface level of reality, or events which may be defined as the “empirical moment”. The empirical moment is extremely important as it sets the focus for exploring the generative mechanisms and structures which gave rise to the events. For reasons already discussed in Chapters 3 and 4, critical realism seeks to move beyond “flat reality” – in other words, that which is reduced to events. Critical realism claims that obtaining knowledge of reality cannot be reduced to the observation of a series of events, where one thing follows on another with empirically observable regularity. Searching for generative mechanisms and structures, which are not observable at the empirical level, involves not only deduction and induction, but also abduction and retrodution. This point is one of critical realism’s contributions to science.

Another contribution is that reality is made up of many different objects which, due to their constitutive structures, also possess different powers and mechanisms. In other words, events are due to many different mechanisms operating at the same time. The outcome of activity is a complex combination of the influences from different mechanisms. Mechanisms may be reinforcing or counteracting other mechanisms. This also means that causal laws must be analysed as “tendencies”, and not as universal empirical regularities. A stratified reality adds to the complexity, as the higher the stratum, the more mechanisms and possibilities there are for combinations between

mechanisms. This is in sharp contrast to the natural sciences which study lower strata, and so can generate knowledge of the mechanisms of nature by isolating them in closed systems experiments. Such experiments are impossible in the social sciences because social strata have emergent powers and properties in the form of human intentionality, language and a capacity for self-change which means that the study of social phenomena is always pursued in an open system.

Critical realism's stratified ontology readily accepts the complexity of social phenomena as a normal state of affairs and does not require a single theory to unify them under one explanation. It accepts that any attempt to define "reality" will be imperfect and, with no absolute point of reference, it is forced to deal with multiple, yet imperfect, realities. The implication that follows is that any discussion on the findings:

- cannot easily fit into a neatly ordered mono-theory or explanation based on a unifying reality;
- will be messy and made even more complex by the assumption that it is occurring in an open system which, by its very nature, is dynamic; and
- has to work within a multidiscipline reality and therefore does not easily fit into neatly ordered patterns.

Since the systematic literature review in Chapter 3 suggested most research in the field has been positivist, it follows that it has been developed in a closed system which, according to a critical realist perspective, often achieves intellectual elegance only by ignoring some aspects of reality. As shown in Chapters 2 and 3, supply chains represent complex activities with numerous disciplines claiming the SCM territory. The view taken was that the field is sufficiently broad and ambiguous to provide supportive evidence for most theories irrespective of the underlying assumptions. A critical realist perspective can accommodate this multitheoretical perspective as it accepts that all bodies of theory have imperfect epistemologies and therefore do not need to use a discussion to get into the debates common in closed systems research approaches of "proving" the supremacy of one over the other. The point of departure from traditional approaches based on closed systems or open systems is significant as it guides the structure of the following discussion.

## 6.3 FINDINGS

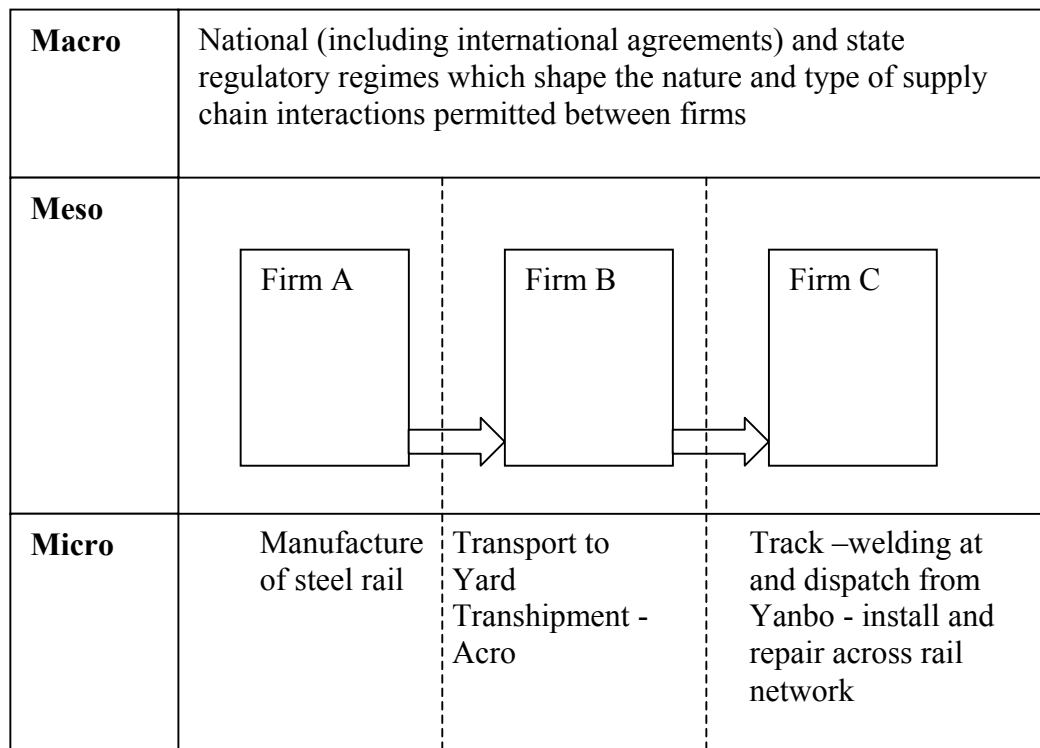
### 6.3.1 Overview

To briefly recap on the findings described in Table 5.3 and expanded upon in Table 6.1, different types of innovation were found to occur within different contexts; these are defined as the macro, meso and micro.

**Table 6.1** *Relationship of different conceptual levels to different types of SCM innovation*

Level	Level of Focus for SCM Enablers	Innovation Outcome Level	Possible Implications
Macro	National Government – Economic Policy Reforms	<b>Transformational</b> – in this case fundamentally altered the nature and shape of the Australian Industry	Government policy plays a vital role in setting the overall framework for innovation Government may also be needed to play a role in setting data standards to assist SCM across firms and nations.
Meso	Interfirm	<b>Radical</b> – historically achieved large investment in asset upgrades. <b>Architectural</b> – poorly exploited to date despite massive investment in IT systems which should have made it easier to generate this type of innovation	Firms need to explore creative ways they can assist each other through SCM strategies such as: a) Asset sharing to reduce costs e.g. ERPs in this case b) Reconfiguration of their combined assets across a supply chain to generate architectural innovation e.g. relocation of welder next to standard gauge line to remove transshipment step c) Treating social network as an intangible asset in to improve activities such as collaborative planning, information sharing and trust.
Micro	Intrafirm	<b>Incremental</b> – at local work sites	Use DSS to better direct efforts of local improvement teams to add value to the total supply chain

Figure 6.2 seeks to demonstrate the relationship between the research findings as depicted in Figure 5.1 and Table 6.1. A supply chain is generally conceptualised as a number of organisations interacting to produce a product or a service for an end-customer. This places supply chains in the meso context of Figure 6.2. However, wider contextual variables found at the macro and micro levels impact upon what occurs within the meso context.



**Figure 6.2 Contextual Variables of SCM Case Study.**

Whilst the emphasis of the discussion which follows relates directly to Figure 5.1, which is located in the meso context, the wider contextual variables of the macro and micro are also examined. This examination is required because of the open systems assumptions of critical realism. The super constructs and constructs within Figure 5.1 demonstrated that the supply chain, when viewed from the perspective of the focal firm, operated within the wider context of legal, physical and social systems. These and other systems have been shown to be dynamic by the findings in Chapter 5 and are therefore assumed to be open systems. These open systems are seen to operate in the broader contextual variables which form part of the deeper mechanisms and structures. These

mechanisms and structures give rise to the events of supply chains operating in the meso context. Supply chains involving social systems are, therefore, seen to sit within and be influenced by wider open systems which involve complex combinations of generative mechanisms. Understanding these combinations requires some discussion of the wider contextual variables within which supply chains are located.

### **6.3.2 Macro Level**

The macro level aligns with the factors which are involved with transformational innovation. At this level, the analysis tends to be panoramic with the focus on the role of government, and social and environmental issues which impact upon all firms in the supply chain rather than any one firm. The following analysis explores the following topics – causal factors, possible theoretical explanations, limitations of macro change and finally the implications

#### **Macro Causal Factors**

The research noted that the dominant factor took the form of power being imposed upon firms through national and state government legislation in a largely unidirectional manner. Irrespective of the governance structure, no evidence was found to suggest the firms had any significant ability to alter this power imbalance beyond minor influencing skills. Such a power asymmetry would suggest that governments need to be well informed on SCM issues if they are to develop policies which support this movement. An analysis of the NCP and the three different governance structures did not provide any evidence to suggest SCM had been considered in setting up these structures. The overarching policy logic was that competition between firms would generate better outcomes and the legal governance framework was premised on a firm centric view as opposed to a supply chain perspective.

The two most frequently cited macro factors in the literature to improve innovation are microeconomic reform and IT. The case for microeconomic reform was well supported with clear evidence that the reforms have resulted in a very different competitive environment which has led to the transformation of the rail industry to the extent it is inconceivable that it will return to its previous form. The case for IT being a macro level causal factor was rejected on the grounds that while there was some, there was not sufficient evidence to justify claiming it was a causal factor. Corporate parenting approaches were also found to have a strong impact but as will be shown on balance this is better defined as a meso rather than macro level factor.

## **Macro Level Theories**

Two major theory options were offered in Chapter 2 to explain innovation at the macro level - economic and sociological. The findings overwhelmingly favour economic theory. While some sociological factors have been at play in both IT investments and corporate parenting it will be shown that in this case, these factors are not sufficiently dominant to justify using a sociological theory to explain transformational innovation in SCM. Sociological theory can only partially explain certain industry trends in IT investments at the macro level. The research did not find conclusive evidence to show IT investment had resulted in a transformation of this supply chain. Likewise corporate parenting, while playing a key role can be best explained at the meso level in terms of the choices firms make about how they will interact between and within themselves.

The single strongest conclusion reached at the macro level was that national microeconomic reforms have demonstrated a clear relationship to delivering transformational innovation outcomes. The evidence offered to support this view is at the level of the rail industry (corporatisation and privatisation) and national transportation chain embedded in supply chains as shown by Firm B. The NCP reforms allowed the emergence of a new form of organisation designed around SCM principles which has never before been seen at the national level. Firm B's corporate parents now control all key assets of the transport chain - road, rail operations (long haul and forwarding), rail track (minor at this stage), warehousing and distribution, and stevedoring (bulk and intermodal). Other evidence of transformation is Firm A having more customers in its rail market and fewer transport providers. Finally, after nearly 140 years of being an exclusively state-based operation, Firm C has adjusted its strategy to include interstate expansion. This change in strategy is based on an assessment that the reforms will result in a national freight rail duopoly and if Firm C wishes to be one of the two dominant players it must expand.

Supporting an argument for economic theory would suggest providing proof of transformational innovation in economic terms. Providing such accurate outcome measures is not possible. While innovation has been defined, measuring the concept in economic terms is outside the scope of the thesis because the exact relationship between economic policy and corporate legislative reforms, while not controversial, is nonetheless not clear. More importantly there is considerable complexity involved in developing such

measures which lack consensus on what the measures should be, how they should be applied and over what time period (Quiggin, 1996).

Achieving consensus on measures of success is difficult in political economics as results are filtered by and assessed through an ideological lens which then determines what is measured and how. At this stage there is sufficient conflicting data to justify a range of ideological stances. Arguments for success would be that Firm A now has to serve more markets and must be more creative in delivery. The same data can be used to argue that this fragmentation is adding unnecessary costs into supply chain activities and therefore will increase overall prices. The forces at play also seem to be sending contradictory messages because while Firm A now has to serve more players in the rail market, it now has fewer transport providers (20 down to 3) to help it serve such customers. LQ32's comment that government railways have subsidised the supply chains of certain industries for decades and that these costs are now being moved back to these industries is yet another area where different stakeholders have divergent views on how to measure success. How the dispute between Firm B and C (as mentioned in Chapter 4) is resolved in the courts may well set other measures of success. While it will be many years before the aforementioned issues are resolved, the lack of agreed economic measures does not refute the overall claim that economic policy reforms have a strong relationship with transformational innovation.

The case against IT having a strong causal relationship at the macro level is now explored. The SCM literature has long postulated a strong causal link between the information revolution and its potential to transform SCM. These links have been explained in both economic and sociological theories. The findings did not support this view despite the large investments made in IT by all three firms. These findings are consistent with worldwide trends where IT expenditure is the second biggest budget expenditure item after labour in large corporations (Kawalek & Wood-Harper, 2002). As IT expenditure is both large and discretionary rather than legally imposed, it is a good indicator of a deliberate strategy. While the majority of subjects were not able to clearly articulate what outcomes were sought by the IT strategy, most stated that it did not deliver them what they wanted. The supply chain has been stable since 1983 with no evidence to suggest IT had significantly changed it in any fundamental way.

Persisting with a strategy which has lacked a return on discretionary investment tends to refute the economic theory explanation and allows a sociological explanation. Wider literature suggests the following reasons for pursuing IT investment. Firstly, wider



institutional settings influence its adoption. While all three organisations had different governance structures they did have similar characteristics in terms of size, structure and culture. Secondly, all three organisations are capital intensive, male dominated, geographically dispersed and have core capabilities built around mature technologies. These industries are more likely to invest in large IT systems (Kawalek & Wood-Harper, 2002). Therefore, common industry characteristics may be more powerful determinants of technology investment decisions than the differences generated from the three distinct governance frameworks. However, this line of reasoning does not refute economic theory as the investment strategies required to sustain such industries may have common economic drivers or the return on investments is not realised for much longer time periods than suggested by the IT marketers.

At best, a combination of economic and sociological explanations for transformational innovation is suggested by such industry factors as the influence of early adopters on the behaviour of other firms in the industry – that is, firms representing the majority follow the behaviour of early adopters in order to seek legitimacy within the industry (O’Neill, Pouder, & Buchholtz, 1998; Westphal, Gulati, & Shortell, 1997). Times of uncertainty result in imitating other organisations and therefore heighten such an adoption pattern (DiMaggio & Powell, 1983). The IT and consulting industries have been highly successful in marketing the need for increased information capability to meet market uncertainty. The NCP reforms have added to this uncertainty. Having once established and set up an expensive ERP system in an organisation, the supplier can force innovations by developing upgrades and refusing to support the older versions. Large exit and switching costs result in organisations reluctantly accepting the ongoing charges as part of being “captive” (Cox, 1999). Again the above points weigh in favour of economic rather than sociological theory because without a large capital base these trends would not be possible.

The overall claim that SCM is undergoing a “paradigmatic transformation” (Sharma, Krishnan, & Grewal, 2001) in order to create value as a result of the rise of IT and increasing competition was generally not supported. Nor were the claims of leading theorists like Castells (1996) that the information revolution is leading to fundamental changes in place and space. While a few subjects made modest claims on the potential of mobile telephony only one (FD11) actually claimed that mobile phones had resulted in positive change to his actual work practice. Likewise, Castells (2001) claims that we can no longer speak of the “social” without speaking of the “technological” was not generally

supported for modern IT. Older forms of technology such as phones and faxes were however used to support the activities of the social system. Proposition 2, that the widespread adoption of IT leads to innovation in supply chains was not supported at the macro level for all of the aforementioned reasons.

Finally, the case against including corporate parenting at the macro level is addressed. This potential sociological variable could be conceptualised at both the macro and meso level depending upon the circumstances. Reforms at the macro level were followed by changes to corporate parenting styles in both Firms A and C. Some of these changes were mandated by legislation and as a result some aspects of corporate parenting had no choice but to change. On balance, corporate parenting is best defined at the meso level because while the degree of choices on how to carry out the corporate parenting is restrained by legal frameworks, it nonetheless leaves considerable space for owners and managers to develop a wide range of attitudes and beliefs on how to run a corporation. The key dimensions including choice are therefore best conceptualised under the super construct of social climate which resides at the meso level.

Many of the improvements made in Firms A and C could have been made without macro level reforms. Divesture and taking a less intrusive corporate parenting role were always options open to Big Oz in relation to Firm A. Big Oz simply made other choices around parenting. Firm C's change in governance structure did not result in any radical change in markets, technology and, most definitely, not in labour reforms. It did result in greater intrusion but this option was always open to Firm C's owners. Firm C's productivity improvements may have been achieved anyway as a result of a AU\$2 billion plus capital investment program implemented in the 1990s. Firm C always had the option of going to an international tender for rail but chose not to for other strategic considerations around Big Oz being its biggest customer. A change in these considerations could have resulted in a change in strategy within the old governance framework. The price of steel was also in decline in the late 1990s so improved prices may have followed anyway. Firms A and C could always have chosen to enter even more commercially focussed relationships within existing governance structures.

Mature industries such as steel and rail have a long history and proven record of generating improvement through capital investment. It is therefore difficult to conclusively determine just how much of the improvements generated in either firm were due to changes in corporate parenting associated with changes in governance as opposed to traditional improvement strategies. It is far more reasonable to claim that the firmly

established historical pattern of achieving large improvements through capital investment would have continued irrespective of governance structure. The one exception would be if the new governance arrangements forbade such a strategy.

The contrast in attitudes between the staff of Firm A and C staff demonstrated that corporate parenting was a significant factor in shaping staff attitudes which encourage or discourage innovation. However, it is not the only factor. The important role corporate parenting plays in innovation warrants attention at the strategic level as it represents a combination of both macro forces and meso level decisions. For conceptual purposes, externally imposed legislation is included under the construct of policy whereas deliberate choice in the attitudes taken by senior managers is treated as a mediating variable under the super construct of social climate. Splitting legislation and attitude this way is not meant to imply that the two are separate independent entities as they, like so many variables in supply chains, do interact in complex ways. However, the processes applied to each are sufficiently different to justify such a split.

In the case of Firm C, the findings suggest that the NCP created a “burning” platform which created a need for significant change. The legislative reforms also created structural frameworks which in turn heightened the need to adopt far more commercial attitudes. The assumption that it is possible to use legislative reforms to change attitudes is common in a wide range of legislative endeavours such as antidiscrimination laws. This assumption appears to have dominated the new millennium in the governance arena. The US Sarbanes-Oxley Act (2002) is a prime example of using legislation to respond to the spate of corporate collapses linked to CEOs who looked after themselves before shareholders through a range of “techniques” such as fraud and deception. While the various Acts have changed, the theory which informs corporate governance legislation has not. As shown in Chapter 2, agency theory has dominated for over 40 years. It sees managers as needing to be controlled to avoid opportunistic behaviour. Legislative responses with tighter controls and greater penalties are logical. Dissent to the legal expressions is rare but a minority question the limits of legal solutions (Fisse & Braithwaite, 1993). While macro level generated legislation can shape meso issues, including in some cases certain attitudes among managers, its real limit is that no matter what attitude is taken on corporate parenting, it cannot necessarily change the fundamental logic which drives an industry structure. Hence, it is defined at the meso level.

## **Limits of Macro Change**

The limitations of technology have been mentioned and will be discussed in more depth at the meso level. The other limitation is around legislative intent versus outcomes achieved. The complex trade-offs and interactions between the legal and attitudinal outcomes were demonstrated in the case of Firm C's owners. Federal legislative changes did not necessarily bring about a change in the fundamental attitude of how the owners (Government) wanted to run and control Firm C. These owners had considerable power and resources of their own which they used to help maintain their preferred values and attitudes of tight control despite the legislation. On the surface the legislative changes at both the federal and state level suggested greater freedom for Firm C to pursue purely commercial goals. The State Government's attitude of tight control over its various arms had a long history which the reforms did not fundamentally alter. These controls included placing a Board between Firm C and Government to suggest an arms length arrangement between the two. Figure 4.2 demonstrates the point where Firm C's arrangements are more complex than the private sector Firm A. Firm C's Board is far less independent and has less powers than Firm A's Board. Firm C's Board cannot even approve the appointment of senior staff. Shareholding ministers had been given the power under the GOC Act (1994) to "direct" the corporation to behave in a noncommercial manner even though the Act specifically states they are not directors. In other words, the head office staff of Firm C could in effect be seen as constituting one of many branch offices of government and that the real head office was in the departments of the two shareholding Ministers (Treasury and Transport). This is because these two departments set the agenda for the four roles that government have with Firm C – owner, regulator, second largest customer and community representative. The State Purchasing Policy (2000) further inhibited the SCM choices available to Firm C. The greatest innovation appears to have come from the legal drafters of the GOC Act (1994) who found a way for government organisations to become commercial while still maintaining tight traditional bureaucratic controls.

Corporate governance is about how owners choose to control their business. Firm C's owners therefore have every right to act as they have. What is confusing is that the owners do not appear to understand, or are unconcerned about, the complexity and costs associated with their governance approach. The conflict between their stated strategic goals (reform and commercial efficiency) and the governance framework (tight and

expensive controls) clearly inhibits innovation. As LQ22 stated these conflicting messages leave staff feeling they are being evaluated against “unstated political measures” which in turn drive risk-averse behaviour. These conflicting messages come from a discord between shareholder and stakeholder perspectives. Firm A, like all commercial organisations, exchanges goods and services for money. Firm C’s owners, at the level of government, exchange services for votes (Sowell, 1980) and money.

As a GOC, Firm C is representative of a nationwide strategy being used by many governments to avoid privatisation. The aim of corporatisation is to deliver the economic efficiencies comparable to those achieved in the private sector while retaining public sector ownership. Schumpeter (1939) and many since have argued that entrepreneurship is a form of innovation which allows managers to mix the factors of production (labour and capital) in creative ways to deliver returns in excess of bond rates. GOCs are denied entrepreneurial freedom and have to “administer” rather than manage the factors of production within tight policy settings. Under such constraints it is difficult to see how GOCs can deliver sustainable ongoing commercial efficiencies. One exception is that governments do have access to large cheap capital. As shown, Firm C’s improvements can be largely explained by capital investment rather than legislative reforms. As utilities tend to be capital intensive, large investment in technology may be one of the few ways open to government to get around its own restrictions in order to generate large improvements. However, GOCs seeking to use suppliers to gain extra improvements are severely limited by policies such as the State Purchasing Policy which inhibits their ability to use SCM concepts to generate innovations. For examples, refer LC21, lines 246-254 (p. 87) and LF21, lines 205-212 (p. 100).

The conclusion reached is not a simple ideological dichotomy of government being poor and the private sector being good at SCM innovation. Recent examples which refute such simplistic thinking are the electricity and more pointedly the rail industry, where in Great Britain it has been beset by numerous difficulties, (Wolmar, 2001) and in New Zealand where the Government bought back the rail network after they privatised it (New Zealand Herald, 2004). Striking the balance between market forces and regulation is clearly a macro level issue which requires more research. Corporatisation may be an interim step until such uncertainty is resolved or may yet prove to offer a new way which is more effective in balancing social and commercial objectives. What the findings of this study strongly suggest is that at present the State Government’s experiment has on

balance severely inhibited the full innovative potential of Firm C. This point will be demonstrated more clearly in the meso level discussion.

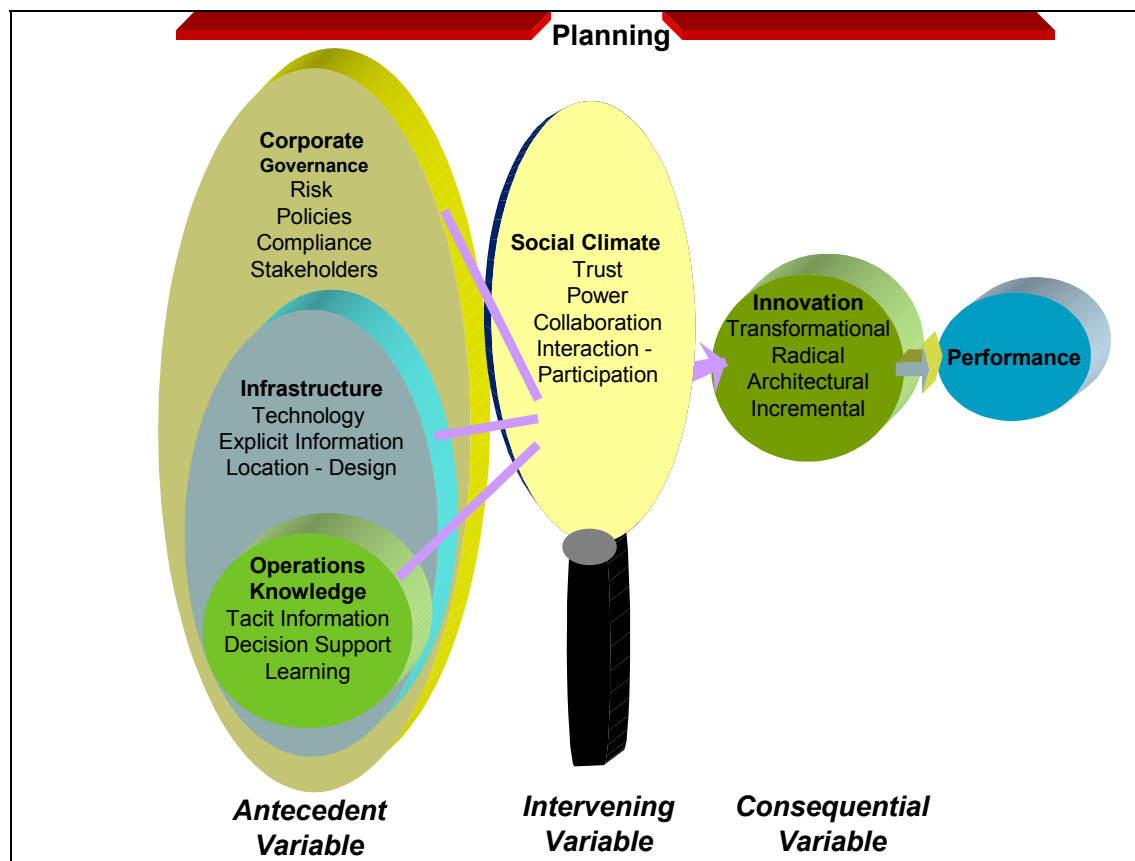
### **Implications**

Firstly, economic policy reform supported by suitable legislative reforms is a far stronger motivator of transformational innovation than any other factor including technology. Secondly, no evidence was found in any of the corporate governance frameworks of the three firms to suggest that policy-makers had consciously considered the role of emerging SCM. Thirdly, legislators appeared to be informed by agency theory and its assumptions of being able to alter the attitudes of CEOs and managers through legislation with little or no critical reflection on either the validity of this theory and how, if at all, it aligns with SCM principles. Fourthly, while government has espoused economic goals for corporatisation it appears to be setting far wider strategic goals for GOCs. As these are largely undeclared it is difficult to determine if the outcomes sought are being achieved. This is very unfair on GOCs as they are then compared unfairly to the private sector on financial terms only. Fifthly, governments should also consider what role, if any, they want to play in synchronising the efforts of regulators, law making bodies, different levels of government, politicians, economists, industrial institutions, investors and the public to support SCM. Finally, industry sectors need to consider how they intend to use SCM for competitive advantage and what stakeholders they need to influence to achieve these outcomes.

This last point has direct relevance to the rail industry which would be well advised to find effective ways to influence government policy agendas on corporate reforms in line with SCM principles. As no evidence was found to suggest legislators are considering such matters, the need for industry groups to have a clear position appears fairly urgent. The Australian Rail Industry (including suppliers) which presently has AU\$58 million in research funds may need to alter its research focus. The bulk of funds is tied up in two CRCs – rail technology and asset management. Based on the above implications the rail industry should consider expanding the research agenda to include economic policy analysis from a SCM perspective. Continuing with its present technological asset research agenda while ignoring wider economic policy reforms runs the risk of severely disadvantaging the ability of this industry to access and shape transformational innovation.

### 6.3.3 Meso level

The analysis now moves to the meso level of interfirm interactions. The findings suggest that supply chains are best conceptualised at the meso level comprising firms interacting with each other within a nationally regulated framework of corporate laws created at the macro level. The conceptual framework (Figure 5.1.) developed in Chapter 5 sits within this level. Given its importance to both the findings of this thesis and the meso level it is shown again as Figure 6.3. The various constructs of this framework are now explored in the light of firstly, the data and secondly, other bodies of theory which have examined similar constructs in greater depth.



**Figure 6.3.** Conceptual Framework of Issues Influencing the Ability to Generate Innovation in the case study Supply Chain.

As shown in Chapter 5, no evidence was found to suggest staff believed they had the power to significantly influence macro level forces. Corporate governance acts like a semipermeable membrane between the macro and meso levels.

For reasons outlined under corporate parenting, firms still have some discretion on how they will choose to implement legislation and on the policies they create to achieve

their own strategies. This is reflected in their having the freedom to make, within their governance structures, key decisions about how to interact with other firms in order to generate improvements. The choices made between firms define the SCM strategies enacted at the meso level.

#### **6.3.4 Corporate Governance**

This super construct, as shown in Chapter 5, was the most powerful of antecedent variables. Macrolevel legislative requirements are experienced through the governance structure of a firm at the meso level. The issues to emerge which warrant further discussion are, (a) the asymmetry of power between the macro and meso levels, (b) the changing role of government and its consequences for corporations, (c) the impact of different types of governance structures, (d) the role of risk management, policy and compliance, and (e) possible factors which drive or contribute to corporate parenting styles and what this may mean for senior staff in leadership roles.

##### **Macro-Meso Power Relationships**

Government has the power to impose its requirements from the macro level onto corporations. Corporations go to considerable lengths to generate information at the meso level and pass it back up to the macro level to demonstrate compliance with the requirements of legislation. Staff in Firm A and Firm C in particular felt such forces were unidirectional and that there was an enormous power imbalance. For any corporation the response choices boil down to either complying or running the risk of incurring penalties for noncompliance, if caught. Firm C's GMF stated it would abide by all legislative requirements so its choice was restricted to questions of how to respond at the meso level rather than challenging the legislation and policies at the macro levels. Firm A took a similar view.

##### **Changing role of government**

The relationship between government and corporation has been changing in line with the emergence of a movement known as "Neo-liberalism" whose principles have been adopted in varying degrees by most western governments (Grabosky, 1994). In Australia, the Federal and State Governments have been progressively reducing both their size and direct costs largely by scaling back interventions in favour of a process of monitoring and reporting activities, choosing to "steer" rather than "row" (Foucault, 1991). The costs associated with such work are now borne by the firms themselves. The



net result is that governments have increased their power while decreasing their size and direct costs. The data demonstrated that some staff felt the demands of compliance (Firm C) consumed so much time there was none left for innovation (e.g., refer LC 21, lines 587-589, p. 95). The trend of increasing the number of government policies means organisations have to share larger amounts of information with external bodies.

The consequences of this change in roles include a rise in the power and number of head office staff who are organisationally arranged around the various pieces of legislation and whose prime role is to meet the information needs of government. This information flow appears to be working against innovation as it engages increasingly more resources in a process of passing information in one direction only up to the meso level rather than across the meso level to other firms in the supply chain in a dynamic feedback loop aimed at improvement. This information flow pattern suggests Firm C is very concerned with legislative risks and that this could be distracting it from managing market risks.

### **Different Governance Structures**

The different relationships between Firm A and Firm C, and Firm B and Firm C support much of the organisational (Williamson, 1996), and marketing (Rindfleisch & Heide, 1997) theories as well as the strategic alliance literature (Elmuti & Kathawala, 2001) which address the problem inherent in conflicting goals and objectives by implementing governance mechanisms to protect one party from the opportunistic tendencies of another. This is done through risk management assessment based in the governance framework. While none of the three governance structures studied was designed to support SCM, there were certainly differences apparent in the extent to which they created difficulties for organisations seeking to work across supply chains. The legal structures which define corporate governance therefore have played a key role in supporting SCM.

### **Risk**

Compliance with the risk strategies and policies developed by Firm C occurred in three ways: firstly, as a response to external legislation; secondly, to meet the requirements of policies generated within the firm itself; and thirdly, to keep commitments such as those entered into under contracts. While the related ever increasing administrative burden associated with compliance is stifling innovation, the root causes are linked more directly to risk management practices. As subject IK12 noted, an external

functional specialist changed the safety height at which rail could be stacked without ever examining the physical context where the work was done. The annoyance felt by staff was not so much about compliance with the workplace health and safety legislation but, rather, how an internal bureaucrat chose to interpret and apply that legislation in a very risk-averse manner. This decision made in isolation clearly decreased the performance at the Acro yard. No evidence was found in subsequent investigations to suggest any functional decision-maker gave serious consideration to SCM – or even to commercial issues.

The reason functional specialist groups appear to gain such power in the focal firm is related to the firm's risk appetite. The risk register in the GMF makes it very easy for functional specialists to escalate an issue as a risk and have their narrow specialist treatments imposed on the supply chain. Governance and power are intertwined, with the former legitimising expression of the latter. The psychological motives of those exercising such power was not investigated but many of the subjects made it clear they felt there was unnecessary zeal and arrogance displayed in the application of the rules by these specialists (e.g., JD21, lines 78-84, p. 88; IK21, lines 20-34, p. 89 and ZO22, lines 30-36, p. 95). What was investigated was the strong interplay between risk appetite, policy development and interpretation, learning and power.

### **Policies**

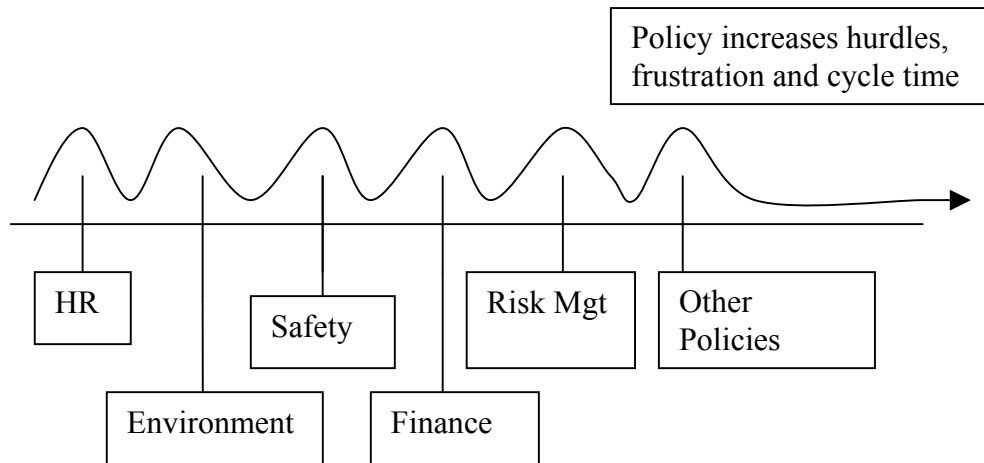
Head office discipline experts have a lot of power to impose on operational staff. The vast majority of policies they have issued which directed organisational operations offer a clear example. As specialists, they do not appear to interact with other disciplines before developing their policies. Specialisation requires considerable investment in learning about a discipline and its own logic so it is hardly surprising that specialists would not know a lot about other disciplines or operational areas. Their higher salaries, greater status and centralised power also help reinforce a view that it is others who need to convert to their world view rather than the reverse. Such circumstances do little to nurture cross-functional team work (Denison, Hart, & Kahn, 1996).

As SCM is based on open systems it requires what Senge (1990) terms “systems thinking” which is at odds with a specialist discipline perspective. Systems thinking requires a multidisciplinary approach which in turn requires the sharing of power. Power asymmetry results in suboptimal solutions. As will be show under the construct power, specialists like many others are reluctant to share power. Consequently, they tend not to

develop the feedback loops needed for learning. They themselves evaluate the effectiveness of their policies yet it is others who must bear the consequences of those policies. Since it is specialists who can and do generate internal policy and who interpret how external legislation should be applied, so they are effectively internal legislators. As the research shows, the result is that head office staff are perceived by operational staff as being both arrogant towards them and ignorant of their requirements. This perception is reinforced by the onerous reporting requirements they impose but which operational staff believe does not contribute to anything that helps the real work get done.

The growing power of specialists in decision-making is reflected in the composition of the focal firm's senior executive. Of the 12 who sit on this senior decision-making body, 5 have exclusive support roles (HR, Risk, Finance, Corporate Council and Secretary, and Shared Services), 2 have internal supplier roles (track and rollingstock), 4 have externally customer facing lines of business (LOBs), and the CEO is the remaining member. In other words, the 4 LOBs who generate the services that external customers are willing to pay for are outnumbered two to one by functionalist specialists. An analysis of Firm C's balanced score-card which the senior executive collectively review monthly have found only three direct customer related measures and over 40 related to demonstrating compliance to government policies. Staffing trend analysis figures shown in Chapter 5 have also demonstrated that this firm continues to grow in terms of functional specialists while decreasing its staff numbers in business groups and internal suppliers.

Figure 6.4 illustrates the consequence of silo policy development. The supply chain flows horizontally yet the functional specialists are increasing the obstacles to that flow by increasing the number and height of vertical interventions across the supply chain. Most process models use cycle time reduction as a measure of efficiency (Towill, 1996a). On this basis the role of policies appears to be creating inefficiencies within Firm C and across the supply chain. The straight x axis represents an ideal or perfect cycle time whereas the squiggly line illustrates the extra time take to complete a process due to vertical functional intrusion into a horizontal process. Subject IK21, lines 20-34, p. 89 and lines 159-163, p. 95 help illustrate this point.



**Figure 6.4. Conflict between policies and supply chain.**

Figure 6.4 helps illustrate why policy development around SCM matters was poor in both firms. Evidence of this claim is the paucity of responses from subjects when questioned on the topic. Additional evidence has been the inability to find reference to SCM in any strategic documents in either Firm A or Firm C. Subject RE21’s response (lines 138-146, pp. 92-93) on the absence of a suite of policies provides additional support for concluding that Firm C’s policy development bias suggests senior managers either do not value, or do not understand how to support SCM. As a result they have abrogated such policy matters to functional specialists who act in the interests of their discipline rather than the supply chain. In Firm C the core business of two groups is involved in SCM with over 80% of the corporation revenue coming from the heavy haul transportation group. This group has recently successfully defended its competitive market position. There is, therefore, little doubt that the business groups have a good understanding of SCM, but as a corporation they appear either unwilling or unable to collectively learn about SCM and view it as something they do for others rather than for themselves. Part of the difficulty in learning could be linked to the demands of having to attend to the needs of the functional specialists. As subject LZ21 noted, he just does not have the “head space” to innovate as most of his time is spent meeting the governance requirements of others.

The policy framework used by Firm C which develops and administers policies from a silo rather than from a systemic supply chain perspective is a major impediment to organisational learning capability. At its most basic it does not encourage

multidisciplinary learning. Interestingly, no clear policies around learning could be found in either firm. An analysis of Firm C's learning systems at the operational level suggested that few formal systems were in place to capture, codify and transmit knowledge. An analysis of Firm C's training of staff revealed it was delivered within a standardised way across the corporation with the content restricted to a single function such as safety or finance, or to some aspect of HR, such as equity. The prime purpose of the training was to show staff what they had to do to comply with a specific policy and to generate documents to show staff had attended such courses. Proof of training was designed to ensure there could be no excuses for noncompliance. None of the aforementioned approaches suggest a systemic approach to learning.

Open sharing of information across organisations has been highlighted as a determinant of learning. Just how much information can be shared appears to be heavily related to the governance structure. Mohr and Sengupta's (2002) proposition that sharing of information and interfirm learning is easier when firms have different competencies and markets is well supported in this case. Firm A and Firm C have different competencies and therefore an open relationship. Firm B and Firm C share the same competencies and therefore do not have an open relationship. However, the relationship they have provides evidence of what has been termed "coopetition" whereby the same firms compete and cooperate in the same space at the same time (Bengtsson & Kock, 2000). Within the steel chain, Firm B could have inflicted damages on Firm C by exercising their contractual rights on Firm A for the late return of their rail pairs. As Firm C was responsible for such delays, they would have had to bear the liquidated damages. Yet as shown in the findings all parties were very careful not to exercise such rights.

These findings on the widespread acceptance by all subjects to work through problems using the social system and using contracts as the very last resort challenges some of the logic of corporate governance and its associated policies. Agency theory has as its platform the clear view that managers cannot be trusted and hence the need for tight controls. SCM stresses the importance of trust and collaboration. The evidence found supports the view that it is SCM principles rather than agency theory tenets which are at play. This suggests that the prominence given to agency theory in informing governance practices are not well founded and therefore unable to meet the challenges posed by SCM.

## **Compliance**

The administrative costs associated with compliance are increasing. The absence of ABC accounting at Firm C means the true costs of all compliance activities are not captured. Crude measures such as the staff number of functional specialists revealed they were growing faster than other parts of the business. Neither firm appeared to have demonstrated an awareness of the strategic cost implications of using a management approach which seeks to ensure compliance rather than stimulate innovation. Other hidden costs are shown by the various responses to compliance. Subject BI32 simplified his work processes by ignoring policies while subjects such as LU32 and ZP32 used feral systems and grass stocks to get their work done. Therefore, innovation was in place, but it was for the purpose of getting around organisationally imposed rigidities to get work done rather than for improving the supply chain.

A worse situation was when innovations offered by the supplier were not taken because of rigidities around compliance. Examples are, LE21's comments that one of the best times to innovate is at contract renewal, and FD11's comments that despite being offered a range of innovations in the new contract they did not realise them because a traditional approach was taken to the contracts and trying to work outside this framework in creative ways was just too difficult.

## **Stakeholder Perspective**

It was initially assumed a stakeholder focus would be better aligned with SCM. However, the results refute this view as Firm A was far more advanced with SCM than Firm C, and had far more potential to continue developing more SCM strategies. Firm C had a strong stakeholder focus, albeit rather narrowly focussed around government requirements. Firm C's risk-averse interpretations of stakeholder requirements and associated legislative focus suggest it would struggle to develop well integrated supply chains designed to meet customer requirements.

This is in contrast to Firm A's narrower shareholder focus supported by symbols such as displaying the stock price to all staff as they entered the factory gate. Firm A also had suppliers located at its manufacturing site with the suppliers' branding prominently displayed on their respective building. The distinction between stakeholder and shareholder is not meant to imply these are mutually exclusive rather they represent the organisation's strategic emphasis. Firm A clearly understands that working with suppliers can help it provide better products to customers which in turn assists shareholder wealth.

The key issue seems to be that because Firm A has clearer and fewer goals, it is far more able to integrate SCM into its overall operations than Firm C, which has so many goals (linked to so many stakeholders) they tend to contradict each other.

Corporate parenting styles were also found to be influenced by whether they were being considered from a shareholder or stakeholder perspective. Firm C's focus on the concerns of its owners around various stakeholders clearly helped strengthen the power exercised by head office staff over other staff. In theory, Firm A always had a shareholder perspective but in reality, when under Big Oz, spent a lot of its time managing its owners and therefore was similar to Firm C. Freed of Big Oz it was able to take a far clearer stakeholder perspective which not only lifted staff morale but also helped make the organisation far more customer centric and more conscious of the need to generate shareholder wealth.

### **Implications**

Corporate governance is such a powerful variable that numerous implications are involved. Firstly, the power imbalance between the macro and meso levels which shapes corporate governance as stated previously will require peak industry bodies to try to influence macro level policy decisions if they wish to advance SCM. Secondly, the changing role of government and its implications for the modern corporation needs to be examined in more depth with a view to obtaining greater corporate value from the Neo-liberal reform agenda. Second order impacts which have followed include the creation of large centralised head office structures to meet information requirements; an elite and powerful head office staff comprising functional specialists and finally, potentially adverse impacts upon SCM to deliver innovations. Thirdly, different corporate governances facilitate different degrees of SCM effectiveness. Fourthly, silo policy formulation supported by measures of functional rather than supply chain effectiveness is working against SCM and organisational learning (van Hoek, 2001b). The cumulative effect is stifling innovation. Policy development based on the assumptions of agency theory is at odds with SCM which works on a very different set of assumptions. SCM development will have to confront and sort out its differences with agency theory if it wishes to make corporate governance frameworks more supportive of SCM. Fifthly, compliance costs are driving up direct overhead costs and may also have long-term strategic costs associated with discouraging innovation. Finally, a shareholder perspective was found to be more useful than a stakeholder perspective for SCM as it tended to

provide a much clearer line of sight from wealth creation to serving customer needs back to involving suppliers to assist in this value chain. The perspective taken was also found to influence to some degree the sort of corporate parent stance taken which, as shown, is also a variable in supporting SCM.

### **6.3.5 Infrastructure**

This super construct is important as it was found to be the antecedent variable that was most likely to result in radical innovation. Firms A and C had a long history of capital investment in this area which most frequently delivered radical innovation. For over a century most of Firm C's major improvements came from investment in assets with advanced technology. Technology and its link to R & D, capital investment strategies and IT is examined as well as the possible limitations in the relationship between explicit knowledge and IT. Location and design are also considered in light of the lack of understanding and interest shown by most subjects on this topic.

#### ***Technology***

Firm A's R & D strategy is aimed almost exclusively at production technology as a way of improving process efficiency. It is also heavily biased toward the development of existing technologies rather than research aimed at generating new technologies within steel production. This is a logical approach as it has been cut off from the considerable resources of its previous corporate parent and is a small player on what has now become a world stage. The key point of contrast is that while this is a low risk strategy, it is also focussed on core competencies and is strategically aligned with commercial outcomes. Investment in manufacturing has been also aimed upstream so that any improvements flowed on to all the products which served all markets. As shown, long rail represents the greatest threat to Firm A's Australian market. The rail is already produced in 87 metre lengths but is cut to 27.5 metre lengths to go onto cooling beds. However, investment in cooling beds, which is at the tail end of the manufacturing process, would only benefit one customer group – or 5% of production. Given steel can be rolled into products which serve any market; the upstream manufacturing investment strategy is well designed.

Firm C, in contrast to Firm A, is a much diversified business in both technology and markets. The key piece of technology which creates a bottleneck is also the oldest piece of technology in the entire chain – the rail welder at Yanbo. Firm C invests up to AU\$1 billion per annum in capital works so it clearly sees the benefit in investing in technology. The decision to not upgrade the welder appears to have been driven by



several factors. Firstly, the financial thresholds required within a specified period could not be met. Yet the first upgrade was proposed in the late 1980s and with the subsequent throughput, the return on investment would have been justified. Secondly, there was concern that emerging welding technologies (such as welding in track) may have removed the need for such a step. Thirdly, Firm C felt other options may have emerged such as sourcing long rail from overseas or getting Firm A to weld rail for them. The idea of relocating the welder was explored but union sensitivities, combined with their links to Firm C's owners and a general risk aversion, saw that proposition shelved. Fourthly, it was not just the welder which was inefficient. The transshipment yard was a source of unnecessary delay and cost and, ideally, rail would be unloaded from the standard gauge, fed into the welder and transported out on narrow gauge to the installation point. Finally, the welder was located in what was in the 1950s a remote part of the city. It is now surrounded by residential development. Noise issues mean they could only work during the day so traditional solutions to overcoming bottlenecks, such as working double shifts, were not viable options. A combination of historical forces, stakeholder interests and bureaucratic rigidities have worked together to maintain the status quo.

On the surface, Firm C appears to have a far more sophisticated R & D infrastructure than Firm A. It funds two CRCs which research rail and asset management, respectively. The universities involved receive additional support in the form of staff from Firm C, sites to do experimental prototyping, and relatively ready access to information as required. Firm C also has a formal R & D committee which provides seed funding to initiatives they deem worthy of development, in order to get around funding restraints. It has also made a number of technological advances within its core competency areas and it on-sells such knowledge interstate and overseas. It appears the reason it has not chosen to improve this supply chain by a capital investment strategy is that it does not see the manufacture and welding of rail as part of its core business. Note, that it has not excluded itself from manufacturing, as it has spent in excess of AU\$60 million in upgrading its rollingstock manufacturing capability. It also funds considerable R & D on associated track issues such as signal systems and track maintenance, including extending the life of steel rail.

Analysis of both firms revealed that R & D activities were exclusively focussed on using technology to enhance traditional core competencies. The few examples of R & D activities involving information were about developing software to enhance decision support to improve the efficiency of existing assets. This was far rarer in Firm A, as the

new equipment tended to come with its own IT and software. The information systems helped reduce the process workers' needed to manage a particular machine. However, such systems did not interact with other systems so a supply chain information system did not exist. Not one example was found in either firm of R & D aimed at SCM.

Staff at both firms were disappointed with their respective ERP systems. The ERP literature suggests this is not surprising as Wood and Caldas (2001) found low levels of satisfaction in their survey of firms having implemented ERP systems, with 45% of firms perceiving no improvements whatever from implementation, and 43% claiming that no cycle reduction had been obtained. ERP system vendors such as Baan (now taken over by SSA Global), PeopleSoft and SAP calculate that customers spend between three and seven times more money on ERP implementation and associated services compared to the initial purchase of the software license (Scheer & Habermann, 2000). Failures of ERP system implementations have been known to cause businesses to lose millions of dollars in shareholder wealth, business confidence or – the worst case scenario – bankruptcy (Davenport, 1998).

However, the adoption of such technology is also consistent with general industry trends. Shehab, Sharp, Supramaniam, & Spedding, (2004) cite a study where more than 70% of Fortune 1000 companies have either begun the implementation of an ERP system or plan to do so in the next few years. This is indicative of the popularity of ERP systems. Research on IT and SCM overwhelmingly argues that IT is an essential ingredient in managing logistics and, more recently, SCM (see Gunasekaran & Ngai, 2004; Johnson & Whang, 2002 for reviews on this topic). Numerous theorists argue in a variety of ways around the value of IT to SCM (Lee & Whang, 2001; Van Hoek, 2001a; 2001b). Levary (2000) argued that IT in SCM has helped reduce cycle time, inventory holdings and the bullwhip effect. Bowersox and Daugherty (1995) found that IT enabled centralised planning with day-to-day operations; Sanders and Premus, (2002) found that IT increased flexibility and agility in supply chains, and Cross (2000) stated that IT resulted in reduced transaction costs between supply chain partners through cost effective information exchange. While some of these outcomes happened in this study, such as reduced cycle time, these were not as a result of IT. The single biggest improvement was creating faster throughput at the welder, and the information used to support that operation was delivered primarily by low-end telecommunications equipment such as telephones and faxes. Emails were also used but hardly in the sophisticated manner suggested by IT. There was

no evidence that the bullwhip effect had been arrested, as shown by the hoarding of grass stocks and poor forecasting practices.

According to Simchi-Levi, Kaminsky, & Simchi-Levi, (2003, p. 267), the objectives of IT in SCM are for:

- providing information availability and visibility;
- enabling a single point of contact for data;
- allowing decisions based on total supply chain information; and
- enabling collaboration with supply chains partners.

While data here were “available and visible” they were not considered reliable by most subjects – “no one trusts SAP”. The proliferation of feral systems tends to refute the idea of “enabling a single point of contact for data”, as does the heavy reliance on the social system for information. As will be shown in section 6.3.6 (operational knowledge), the DSS tended to be largely in subject LU23’s head. The feral systems which were used as a DSS were not designed to allow “decisions based on total supply chain information”. This was despite the fact that those who set such systems felt it desirable to have supply chain wide information systems. Collaboration appeared to result from the sharing of information across the social system rather than through information systems talking to each other.

The findings of this study around ERPs lend some support to the literature (Archer-Lean, Clark, & Kerr, 2006; Hobson et al., 2005; Mingers, 2001;), which suggests the macrotheroretical research framework (positivism) is in fact one of the deeper generative mechanisms which accounts for the failures to successfully implement ERP systems. Critical realism argues it is the metatheroretical assumptions of a study which should inform the methods which are applied to a study. Yet as Gammelgaard’s (2004) literature review points out, often, logistics studies in scientific journals say little explicitly about their methodological approaches. Implicitly, however, it is evident that most research is built on a coherent set of assumptions about the nature of reality and knowledge creation. Pointing to the volume of research with some oblique appeal to “bigger is better” is less relevant than understanding the hidden assumptions that inform such research. “When one methodological approach predominates, such as the analytical approach, only research according to the precept of this approach tends to be seen a valid” (Gammelgaard, 2004, p. 486). It needs to also be stated that different researchers could be using the same research tools and studying the same events yet arriving at very different

conclusions due to differences at the metatheoretical level. It is therefore important in the interests of theory development to do more to expose these hidden assumptions, especially as they could be part of the problem in theory development.

As discussed in Chapter 3, ERPs evolved within a unitary-simple system philosophy which itself is heavily framed within a positivist world view (Jackson, 2003). IT and SCM research approaches tend to use the positivist research paradigm in a taken-for-granted, unchallenged manner. The differences in perceptions among many subjects demonstrated that this supply chain is complex and, as such, needs a multidisciplinary method of analysis. Multidisciplinary methods of analysis ideally require being open to different research paradigms and, in particular, those used by modern sociology. “Traditionally logistics research has been perceived as rational and more or less self regulating systems untouched by human hands” (Gammelgaard, 2004, p. 487). This understanding has progressed logistics management and made it very successful (Jackson, 2003). “But humans govern the logistics systems, and unless they are managed extremely well or for some reason are willing to subordinate themselves to the needs of holistic logistics or supply chain management systems, they will exert an influence on the systems” (Gammelgaard, 2004, p. 488). Yet the fact that the dominant positivist research approach is not well equipped to deal with social systems “is usually invisible in logistics research ... and as a result researchers cannot get a more accurate image of the nature of logistics and supply chain management” (Gammelgaard, 2004, p. 488). ERP has similar and overlapping research difficulties. Lee and Lee (2000, p. iv) have called for a deeper understanding of the assumptions that have informed ERP research in order to “revise, refine or refute existing significant theories.” Similarly, Archer-Lean et al., (2006, p. 28) conclude that “existing ERP research is strongly positivist in nature and inadequate in terms of providing the perfect solution for corporations to successfully implement ERP systems”.

Additional examples of how positivist assumptions are embedded in ERPs are as follows. Firstly, there is an inherent assumption of a single reality able to be applied across all contexts. While ERP systems have some flexibility, the embedded systemic character and procedural logic cannot be undone through contextual adaptation as they are not infinitely malleable (Hanseth, 2000). No matter what the richness of the organisational operations, the system represents a decontextualised accomplishment that may be able to be slightly adjusted to fit local circumstances. Compliance to the procedural logic demanded by the system, which it is claimed is based on “best practice”,

tends to shape job roles and organisational structures to suit the reality of the package. Indeed, it is widely conjectured that the language of ERP implementation “is largely around transcribing the reality of particular organisations into the language of the package rather than the other way around” (Kallinkos, 2004, p. 20).

Secondly, the complex tangle of technology combines with the needs of standards across various components of technology. As these technologies are embedded within a complex network of other technologies and commercial interests, they create justification for further constraints around a single reality. While such integration is generally lauded, this view underestimates that the limits and configuration of this integration are largely determined by the ERP package rather than the unique and specific requirements of the organisation (Ciborra et al., 2000).

Thirdly, the rational embedded logic and assumptions of the system is in line with positivism. Expert systems require knowledge to be programmed into the computer in a timeless propositional form (if a then b) – in other words, to mimic empirical regularities. Yet practical human expertise is temporally mediated and knowledge in human memory is not static – in an active learner it undergoes a perpetual reevaluation in the light of new knowledge. Expert systems are not yet able to learn to solve complex problems that demand creativity. The metaphoric character of language cannot be fully captured in computer programs. The danger from an innovation perspective is that the kind of binary codification of knowledge which expert systems demand may leave out those very tacit elements of discretion which are indispensable in successful human problem solving (Hackley, 1999).

Finally, the reductionist tendencies are in line with certain positivist traditions. ERPs conceive organisations as conventional functions which can be segmented and as subfunctional domains which can be further broken down into a series of procedural steps. These domains are the building blocks of ERPs and it is presupposed to provide the means for connecting operations across organisations. This connecting requires integration of temporal, functional and structural differentiation across organisational operations. This in turn suggests a strong belief in a single accessible unifying reality. Process maps are the shorthand used to sort out and demonstrate such connections (refer Photograph No.1 Chapter 5 for an example of the complexity involved in a single function). Much of the literature, as well as the findings of this study, refute such a view by demonstrating that ordinary users turn their backs on the cognitive complexity

required to work with such a system and retreat instead into their own limited and seemingly controllable zone of duties (Kallinikos, 2004; Turkle, 1995).

While ERP packages influence patterns of cognition, action and communication in organisations, this is not the same as saying that ERP packages unambiguously determine human behaviour in organisations. These packages do not seek to create an entirely closed system but do seek to impose a fairly restricted one, and to subordinate human agency. Yet, as this study has shown and as accepted by critical realism, where a system involves people, that system will be very open and dynamic. Despite the wide and inevitable focus on issues of work, “the behavioural assumptions underlying the implementation of ERP systems are never examined in this technical literature” (Kallinikos, 2004, p. 12). A large part of the reality of SCM has involved, and will continue to involve, unitary-simple systems. The challenge for ERP, ICT and SCM theory development is how to acknowledge the reality of systems beyond unitary-simple configurations to those that involve human agency and creativity. This challenge will require adjusting research methods beyond positivism to meet the challenge created by the social domain (Archer-Lean et al., 2006).

Contrary to the view expressed in some of the literature that IT investment somehow has a profound and positive impact on the supply chains (Chan, Qi, Chan, Lau, & Ip, 2003), this study suggests that while IT may have some positive impact, it also generates other difficulties and creates “work arounds”, as evidenced by feral systems. IT may well be part of the equation but, as this case shows, spending millions of dollars on IT does not lead to the new forms of working or organising as suggested by a sizable portion of SCM literature. There is wide speculation in this literature as to why the potential of IT has not been fully realised, including the inability to engage the social system in the reforms required. This study simply confirms these prior studies. However, it has also been suggested that a contributing factor to the lack of successful implementation is not only what but also how it is studied. In particular, a failure to critically address the meta-theoretical assumptions in positivism may have impacted on the development of both IT and SCM theories.

### **Explicit Information**

The funding and resources which go into governance and IT systems suggest that legislators and managers have a strong belief that knowledge can be readily made explicit and once this is done it becomes more effective. The review of the GMF as shown in

Table 5.1 revealed that not only was documenting things an effective way to manage risk, it ended up being the only way it was managed. The massive investment in ERP technology again demonstrates a strong belief in being able to see what is going on across a large complex organisation. The process mapping movement has a similar bias. What could possibly inform such a belief system around explicit knowledge is discussed in section 6.6. The key point to emerge from the findings of this study is that tacit rather than explicit knowledge plays the more important role and that the modern preoccupation with trying to codify and digitise all forms of information and knowledge is not only impossible and extremely expensive, but very dangerous from an innovation perspective. Such a view blindsides management from the role played by the social system in developing, transmitting and making sense of tacit knowledge, and then using such knowledge in creative ways to improve performance.

### **Location-Design**

Question 10 was the most poorly answered of all questions suggesting a complete lack of thought on the possibility of a relationship between SCM and how and where buildings were designed. While most subjects stated collocation was desirable, no evidence was found to suggest this was an organising principle which informed decisions around the location and design of buildings. Firm A had moved this way as a result of technological improvements to its core technology leading to excessive office space. Firm C could not demonstrate such actions in even a single instance.

### **6.3.6 Operations Knowledge**

This third antecedent variable is qualitatively different to the other two (governance and infrastructure) in that it resides in people rather than legal structures, physical artefacts or IT systems. Issues associated with each construct are discussed including reasons why much of the critical knowledge needed to run this supply chain is tacit and retained in the social system, how this arrangement disrupts the assumptions which dominate the decision support literature, and the impact this has upon learning.

### **Tacit Knowledge**

As discussed previously in Section 6.3.2 tacit knowledge is necessary to run this supply chain and is critical when the chain is under stress. The absence of any formal systems which acknowledged this point suggests the bulk of knowledge gained by subjects is done so in ways not visible to the wider organisation through being immersed

in the operations. These findings support much of the social network literature in its various guises which argues the importance of social interactions, experienced in specific contexts, as being key to the creation and transmission of noncodified knowledge used to achieve outcomes. Evidence of the lack of codified knowledge is that no formal training on SCM or anything resembling it was given by either firm. Neither organisation had attempted to put in place learning and knowledge capture systems for the entire chain, nor indeed most of their internal operations. The closest evidence found was localised QA systems. Most training from the central organisation was delivered from a single function perspective such as safety or HR. The flow of information in such training was unidirectional. Subject IK21's comment with respect to safety suggests functional specialists do not consult or consider the operational needs of those in the supply chain. The tenure (average over 20 years) of those in the chain combined with BH21's comments on documentation being so poor that an external person would not know what to do, suggests tacit knowledge is so deeply ingrained that there may be no conscious awareness of it. If so, this may explain why the learning needed to generate innovation is difficult as the players cannot reflect upon their mental models (Senge, 1990). It also highlights the frailty of IT literature's assumptions around the ease of translating experiential knowledge acquired on the job into explicit knowledge.

Despite the frailty of IT assumptions, the investment made by both firms in developing a capability in IT as opposed to HR, is consistent with world trends where research over a 20 year period has revealed a two-to-one ratio. Such a ratio can be challenged on the grounds that much of the IT investment was in systems designed to develop staff capability, such as an e-learning centre (SARBA system), and to reduce "hygiene" factors (Herzberg, 2003) by developing a state-of-the-art payroll system. Closer examination of the e-learning investment strategy reveals it was accepted primarily on the basis that it could deliver mandatory training more cheaply than by traditional means, and provide an effective record keeping system for legal purposes primarily aimed at reducing potential corporate liability in the event of, for example, an accident. The findings on the crucial role played by tacit knowledge when contrasted to the energy and resources placed in generating explicit knowledge raises concerns about how effective improvement strategies, which appear to deny the importance of the social system, can work.

Denial of the role of the social system is linked to wider United States and possibly world trends of organisations favouring investment in IT over HR in order to



advance SCM. The Center for Advanced Purchasing Studies (CAPS) (Fawcett & Magnan, 2001) conducted extensive research into 51 global firms and noted considerable anecdotal evidence when it came to HR:

... that US companies are in many ways more comfortable focusing time and money on technology resources – especially in the realm of HR ... despite the fact that some studies have shown that investments in people provide twice the return on investment on technology. (p. 38)

They also found training in SCM was ranked 18th out of 24 practices that could assist in improving supply chains, and found little to suggest that more than a few organisations had invested in such training. IT solutions for enabling SCM seems grossly overrated, given the findings of this study which confirmed the well established links between culture, innovation and organisational performance, and the fact that tacit knowledge is embedded in culture which is difficult to consciously understand, let alone codify.

### **DSS**

The specific issues to emerge were the lack of a DSS for the entire chain; the lack of control of the Forrester effect, the lack of ABC measures within Firm C, the absence of corporate data models, the failure to use free in-house modelling tools and expert staff (Capacity Dynamics), and the increasing complexity being driven mainly by the functional requirements of head office staff.

### ***Chain Wide DSS***

Specific questions around SCM performance measurement highlighted the fact that none existed for the entire chain. This was supported by the results of the SCOR mapping which showed no-one was responsible for the entire chain. Performance measurement is an essential element of effective planning and control and, therefore, forms the backbone of any decision-making. In the SCM context, performance measurement can facilitate integration among supply chain members and provide feedback on supply chain strategies and operational performance (Chan et al., 2003). Performance measurement has also been seen to have a vital role in supporting learning and innovation (Ellinger, Ellinger & Keller, 2002; Molleman & Timmerman, 2003). As the role of a well developed DSS clearly impacts most of the critical variables in a supply chain, it would be reasonable to anticipate it being an area of intense organisational interest and support. What was found was that subjects such as LU23, ZP23 and MI11

had all developed their heuristics and feral systems which could not talk to each other. It is therefore not surprising that the Forrester effect was strong in this chain (as evidenced by inventory hoarding in grass stocks). Firm C's annual internal audits on inventory were examined for the financial years 2000-01 through to 2002-03. While approximately \$6 million per annum was written off each year, it was not possible to determine how much of this was directly due to the Forrester effect due to poor records management, and hiding of inventory from systems such as SAP.

### ***DSS -Forrester Effect***

Supply chain integration aims to reduce the Forrester effect by enabling the sharing of information, as close as possible to real time, in order to improve decision-making in ways that are optimal for the entire chain. Within Firm C, where the ERP system presumably provided such a capability, this was not found to be the case. Feral systems were used to make decisions which optimised local activities and largely ignored the bigger supply chain beyond the inputs and outputs associated with that activity. The measures used in these feral systems were also designed to report on local function and, therefore, had little capability to assist in managing cross-functional and interorganisational processes. Firm A, with a tight industrial process, had good smoothing techniques in place. Subject MZ21 notes that once the rail arrives at Firm C, he is largely blind as to what occurs afterwards. To overcome this lack of visibility and the Forrester effect pushing back into Firm A, he has developed a hermeneutic – the rail weld rate at Yanbo – to assess the performance of the entire chain and thereby make operational decisions. In Firm C, hoarding inventory grass stocks has become a substitute for having to deal with planning and forecasting deficiencies. The overall result has been that the bullwhip effect expanded enormously once the rail entered Firm C.

### ***DSS – ABC Accounting***

While advanced SCM operational measures are difficult to define (van Hoek, 1998) and not yet available in many organisations, financial measures of varying quality are always available. ABC is considered to be very well suited to supporting SCM by tracking cost drivers. As suggested by subject ZI12, Firm A appears to be making advances in ABC which in turn has helped it understand the cost drivers associated with its internal manufacturing processes. ABC knowledge did not extend into supply as a whole.

Firm C, by contrast, is not well advanced in determining its cost drivers. At least three possible reasons could be given. The first is that financial accounting won out over management accounting because the latter was not required in the GMF. Financial accountants also drew power because they served the needs of governance reporting (e.g., annual reports and board reports). Those working in the supply chain therefore had less say in getting their needs met. The second reason is that while senior managers were willing to fund expensive IT acquisitions, they were unwilling to spend modest amounts on the development of management systems such as process management models thereby undermining the ability of an ERP to deliver to its full potential. The third reason was offered by Firm C's chief management accountant, who confirmed the first two reasons and added that ABC worked well in manufacturing but not in a network organisation, especially one like Firm C where most costs were fixed rather than variable. Labour was fixed due to industrial agreements which had public service conditions of no forced redundancies and limited outsourcing capabilities, assets had set depreciation models and operational expenses were largely fixed. Irrespective of the reason, the point is that claims of ABC being the best financial tool to support SCM (Cokins, 2001) may be overstated and more research is needed on how to establish practical financial models which support SCM.

### ***DSS – Corporate Data Models***

Ideally, such a model ensures master data is comprehended in a universal manner and the relationships between sets of data are understood. In Firm C, the data structures for financial and material categories did not match. Firm C purchased SAP because it was judged strong on financial accounting reporting but poor on operational reporting. The Mincom system, which has the reverse capabilities was preferred by the operators. The lack of clear data definitions and poor understanding of the relationships between different fields of data, such as financial and operational, explains in part why Firm C has difficulty managing inventory. Weak master data undermines the ability of senior managers to improve supply chains because even if they could develop relevant measures, they would lack confidence due to issues of poor data integrity and accuracy in the existing system.

### ***DSS – SCM Measures***

A mounting body of literature has warned of the need for a wider range of measures to avoid being misled by traditional cost information (Johnson, 1992; Kaplan,

1990; Kaplan & Norton, 2000). More recently there has been a movement requesting better alignment of financial measures with SCM measures (Lockamy & Smith, 2000). Apart from the costs associated with developing SCM performance measurement requirements, senior managers showed little interest in moving beyond traditional measures. Those managers who accepted that new measures had other problems. JD21 tried to get SCM measures introduced but expressed the view that the traditional requirements of the functional specialists drowned out such requests.

### ***DSS – Increasing Complexity***

The silo approach taken by functional specialists appears to be constantly increasing the complexity in this and other supply chains. The complexity suggested in the photograph in Chapter 5 of the inventory process may explain why the social system is a preferred way of working as it is dynamic and can respond to and manage issues much faster and more effectively than formal systems. SAP has locked this complex process into “electronic cement” to meet requirements of functional policy makers. As these technical systems cannot easily change rapidly and without considerable cost, staff simply rely on each other and feral systems to work around SAP rigidity. Most of the steps shown in the photograph are to meet the reporting needs of functional groups such as finance. Complexity and rigidity is increasing as functional groups demand ever more reporting requirements which is then locked into SAP. Clearly, it would be desirable to re-engineer this process but resource constraints and the fact that the chain in Firm C operates within silos with no-one having overall accountability, means this fundamental work has not been carried out. Functional groups are therefore adding cost and complexity but the absence of the ABC means the costs of their activities are not detected or managed. While this example is within Firm C, similar examples of working through the social system was that Firm B staff talk to Firm C staff at the transshipment yard on an almost daily basis even though the formal system suggests they should not.

### ***DSS – Capacity Dynamics***

Firm C had an advantage over most firms in developing SCM measures as it was its core business and it had a dedicated group of specialists with the expertise and tools to create such measures in a work group known as Capacity Dynamics. The section’s role was to provide this assistance to the organisation’s external customers. They were brought into this research and offered their expertise in the form of a model. It was rejected by the operators as being irrelevant. This suggests that even if ERPs were made

user-friendly operators would not use them. The problem may be wider as suggested by ZP23 in that operational staff may well lack the skill sets needed to structure information for conducting analyses which would lead to improvements. It also highlighted that DSS is very complex and that those who develop the systems may have to put more emphasis on finding ways to match systems capability to the cognitive maps of the users.

The overall picture which emerges is one that combines functional policy-makers acting in isolation, a belief in IT as a panacea, the continued use of traditional financially biased reporting systems developed in an era before SCM was ever considered, and a general lack of deep understanding by senior management of SCM, and which coalesces in a manner which is hindering the development of a DSS that would support SCM. These factors may go some way to explaining what sits behind a wide body of literature which has concluded that in spite of the importance of the performance measures, there is very little that has been developed on measurement selection and decision systems for SCM (Beamon, 1999; Chan et al., 2003; Gunasekaran, Patel, & Tirtiroglu, 2001). The absence of SCM measurement systems and inappropriate IT, may help explain why the social system is so important to most staff involved in making this supply chain work.

### **6.3.7 Social Climate**

This super construct makes up this mediating variable of the conceptual model in Figure 6.3. Its four constructs are often mentioned in the supply chain literature under a range of headings associated with social variables. It is therefore not surprising that the strongest finding of this research has been that this mediating variable is extremely relevant to SCM. What is surprising is that, as Chapter 2 demonstrated, the SCM literature has paid scant research attention to social factors. It is speculated that this is due both to the fact that it is far harder to demonstrate clear strong causal relationships with mediating variables than with independent variables and the general positivist bias of SCM which, as shown in Chapter 3, may not be well suited for exploring complex social variables. These overall findings under social climate therefore provide support for a call to SCM literature to widen both its research agenda and methods of enquiry.

The issues associated with each construct in social climate are now discussed.

#### **Trust**

The topics for discussion here are: developing a basic model which covers the components of trust; the role played by trusted staff; the limitations caused by trust placed

in IT systems, the role of governance structures in working against trust; and an overall conclusion.

**Trust Model**

The following formula developed by Maister, Green and Galford (2000) aligns well with the findings of this study.

$$T = \frac{C + R + I}{S}$$

Where:	Realm	Examples
T = trustworthiness		
C = credibility	Words	I can believe what he says about ...
R = reliability	Actions	I can trust her to ...
I = intimacy	Emotions	I feel comfortable discussing this...
S = Self-orientation	Motives	I can trust that he cares about ...

The point of this formula is that “winning trust requires that you do well on all four dimensions” (Maister et al., 2000, p. 70). The findings supported this view in that the various elements behind trust in this case study built upon each other.

At the operational level, subjects reported they had determined who they could rely on to help them. They were aware that while many people had good intentions, they were not necessarily accurate in what they were reporting. Subjects specifically indicated that they determined who to trust based on both credibility (C) and reliability (R). Intimacy did not emerge in the sense of deeply emotional relationships but there was evidence of feeling comfortable in being able to discuss supply chain matters. The self-orientation of individuals also did not emerge in this research. It is speculated that irrespective of the personal motives of individuals they knew it was in their self-interest not to act opportunistically as they were involved in long-term relationships and any misuse of the relationship would have detrimental consequences. The weakness of the model is that it infers, but does not specify, the importance of time in either building trust or in altering decision-making strategies relative to the projected life span of a relationship. All parties expressed the view that long-term commitment was needed for SCM to work. Trust and good working relationships were built up over many years between various actors. The long tenure of subjects working in the chain provided time for the development of trust. Therefore, time also needs to be considered in how supply

chain relationships develop. This would require longitudinal research which was outside this study.

At the interorganisational level there was very strong evidence that while Firms A and C had formal contracts, they also had very high levels of trust as suggested by the responses to question 5 in the questionnaire. Trust was very low between Firm A and Firm B for reasons already discussed under governance and because they were competing for the same markets. However, the lack of trust did not prevent them from working together at the operational level as evidenced by the checking with each other on the availability of rail pairs. The lack of trust at the corporate level did however appear to inhibit the desire of operational staff to extend information exchanges. These exchanges were largely limited to ensuring smooth supply chain operations rather than improvement strategies. The lack of incentives to work on improvements combined with the total absence of learning systems ensured that any improvement potential was unlikely to be realised.

### ***Trusted Staff***

Boundary-spanning roles were highly trusted. The findings of these boundary spanners shows some fit with Kleiner's (2003) Core Group Theory (CGT). This theory accepts that a learning organisation exists "within the context of the organisation's power and governance structures" (p. 666) which are not immutable and rigid. CGT argues that certain core groups stand as tangible but fluid repositories of knowledge, influence and power in organisations and that these are necessary to get around the rigidities of bureaucracy. There is no doubt that FD11 and AI11 were viewed so highly as trusted repositories of market knowledge that Firm A had the confidence to schedule their production based on their information. However, as discussed elsewhere, their influence does not appear to extend much further and their power even less so. LU23 played a similar role in Firm C. However, the power and influence of these boundary spanners did not seem to extend beyond the operational level. This may partly explain why senior management did not have a keen appreciation of SCM matters. In particular, information may not easily flow across organisational hierarchical levels or if it does, it is not trusted. Senior management appear to show far more trust in systems such as the GMF and IT. The overall point is that trust and learning appear to be interconnected and the symbols involved with these two factors may vary at different organisational levels.

### ***Trust - Information Systems***

As already discussed, governance generates a strong need to develop monitoring systems, as no-one can be trusted. IT with its capacity to handle vast amounts of data is seen as a tool which can improve surveillance. The findings demonstrated that while some respondents in Firm A expressed trust in information systems in certain contexts, the vast majority indicated that they wanted access to individuals, not information systems, when things went wrong. A deeper analysis of the reasons why they trusted people more than other systems revealed they needed access to rich contextual explanations in order to work out what to do next to recover situations – something IT systems could not provide. Trust in people rather than formal systems therefore plays a very important role in recovering operations. The view that placing faith in IT as the vehicle to communicate and share knowledge has been described as “mission impossible” by Hislop (2002) and such a view is supported by this study.

### ***Trust - Formal Governance Structures***

Governance worked against trust formation by inhibiting and limiting information between organisations. The social system managed to navigate through this as all subjects reported a strong preference for working through informal communication channels in supportive ways and not resorting to formal mechanisms for dispute resolution. The findings revealed that staff across the chain appreciated that in order to work together to get the job done they needed to share information and support each other. They were willing to get around bureaucratic constraints as demanded by governance in order to do this. While much of what happened could be explained in pragmatic terms of getting the work done, in spite of, rather than because of governance structures, the process nonetheless requires personal loyalties and unwritten psychological contracts around reciprocity and caring for each other's interests. These loyalties appear to have been built on trust over time and have a profound impact on the day-to-day operational efficiency.

The dynamic social arrangements in this chain do appear to have been enhanced by the fact that no single entity appears to have the capability to use power in dominating ways. This equal power sharing seemed to assist in generating supply chain learning. In such an environment, the actors across the chain were able to share their problems and issues openly which allowed them to solve operational problems. Clearly, how power is used has implications for how open actors will be in the type of information they share. This in turn has implications for learning in SCM. A clear conclusion is that SCM theory



may need to look at sociological theories in more depth to understand supply chains where the parties must work together over long periods and to improve its overall efficiency. It is not suggested that this is a requisite of all supply chains for, as Cox (1999) has demonstrated, in many supply chains the power asymmetry is such that coercion rather than cooperation can be used to obtain results.

### ***Trust - Overall***

The findings on trust simply support the vast body of SCM literature which highlights the importance of this construct. It is a necessary ingredient in any supply chain in which large numbers of people interact. As shown in Chapter 2, trust interplays with power.

### **Power**

Social science has always given prominence to power and the findings confirmed that it is an extremely important construct. The issues to be discussed under this construct include how power is perceived between firms; the application of self-imposed restraints on the use of power; how social factors such as caring tend to weaken the arguments of power being an economic factor; the importance of empowerment to generating improvement; how bureaucracy's way of dealing with power limits SCM; and an overall summary.

### ***Perceptions of Power***

While subjects expressed a range of views on who had power, none disputed that power relationships existed between Firm A and Firm C. The majority of subjects believed both firms had roughly equal power. This view was supported by the fact that rail represented 5% of Firm A's output of which half went to Firm C. Should the rail market collapse, then Firm A would produce other nonrail products, although with lower profit margins. Firm C was not entirely at the mercy of Firm A because Big Oz (Firm C's biggest customer) no longer owned Firm A and they had already determined they could source rail from Austria if needed. As subject SF21 pointed out, if Firm A ceased supply then Firm C would use part-worn rail in the interim which while causing initial short-term difficulties, would not be catastrophic as they would have the other supply chain in place within a year.

Firm B's withdrawal from the supply chain was of no long-term consequence to either Firm A or Firm C. Firm C had modelled the operations of this supply chain and determined it was economically desirable, technically capable and strategically

appropriate for Firm B to do so. Firm A was aware of Firm C as an alternative transport provider. A shallow analysis of Firm B suggested that losing Firm A's work, while having severe short-term economic consequences, would not be fatal.

### ***Restraints on Power***

The overall picture which emerges is that no firm had overwhelming power over the other. ION literature argues that equal power relationships support cooperative and collaborative relationships; that centrality (concentration of power to one firm in the network) does not lead to goodwill in working relationships; and that, conversely, the lack of centrality does. ION theory would therefore explain the lack of desire by any party to resort to the use of contract penalties. The avoidance of seeking liquidated damages despite the opportunity it presented for Firm B to inflict harm on its main competitor (Firm C) and the willingness of all parties to openly share information across the social system suggest high cooperation despite formal governance structures inhibiting such information sharing. Examples include: MI11 being excluded from Big Oz's databases yet still accessing them through relationships; and Firm C's staff willingly sharing operational information with Firm B even though no contract has existed between the two organisations and they are in conflict at a higher level. All subjects have reported a strong preference for working together through informal communication channels in supportive ways and not resorting to formal mechanisms for dispute resolution. These findings are highly consistent with the view that distribution of power between firms is a prerequisite for generating the social architecture needed for SCM, such as trust and cooperation.

### ***Power - Caring***

The most common response from subjects was that whoever had the money had the power. Despite this statement the findings also suggest that a purely economic theory is impoverished in attempting to explain and predict the behaviour of the social system. Responses to the questions on noneconomic benefits suggest a more complex picture. FD11 noted that supplying Firm C was prestigious and enhanced Firm A's corporate reputation. This response tends to support institutional theory. Operational level staff responses suggested these actors were barely aware of economic considerations. They had built up personal loyalties and unwritten contracts around reciprocity and caring for each other's interests over a long period and these ranked high in their decision-making. It is clear that psychological variables are at play in supply chains and they interact in ways which are not entirely explicable within either purely governance or economic theories.

### ***Empowerment***

A common view is that governance frameworks support and reinforce bureaucratic behaviour which characterises all large organisations. Dumont's (1970) book, *Homo Hierarchicus*, argues that hierarchies survive because they are valued. They manage to suppress internal rivalries, thereby preventing organisations from tearing themselves apart. Empowerment poses a dilemma in that while it feeds innovation, it also has the potential to generate rivalries and changes which disrupt existing organisational integrity. Sharing power is, therefore, seen to carry a high risk. This raises questions about the power exercised by functional groups. This is explained by bureaucratic theory which claims that "no one section or person will be allowed to dominate the organisation for long, but they can impose constraints upon one another" (Douglas & Wildavsky, 1983, p. 91). This is precisely the situation in Firm C. The cumulative effect of policy makers is to erode away the power to act autonomously, to experiment and to be creative. Therefore, power overlaps with learning and collaboration. Not letting those with the greatest knowledge (usually those who do the work) have a greater say in how to integrate different functions in creative ways across the chain severely limits their ability to innovate.

The CAPS report (Fawcett & Magnan, 2001) cited cross-functional teaming as evidence of empowerment. De Toro and McCabe (1997) stress the cross-functional nature of process management and highlight the need for empowered employees to be given authority to examine, challenge and change work methods. McAdam and McCormack (2001, p. 114) argue: "Empowerment has long been one of the stumbling blocks of process-focussed management" because managers are reluctant to relinquish their conditional control. It also appeared to be a major stumbling block in this case study. Little evidence was found to suggest that the operators of the supply chain were empowered to use their knowledge to improve it. In this supply chain, cross-functional teams did not tend to form.

### ***Power – Bureaucracy***

Bureaucratic structures are good at acquiring, concentrating and centralising power and then jealously guarding it. Part of the solution to this may lie in realising that all people crave a degree of power and prestige (Denton, 1997). The Head Office staff at Firm C are one example. Empowerment will require new governance structures to address the issues inherent in managing job boundaries which, because they are in supply

chains, cannot be contained within normal organisational boundaries (Burdett, 1991). The new forms of organisation will have to relinquish most attachment to bureaucracy and its ability to attend only to surface features. At the very least, it will have to adjust to accommodate irrational human forces and the role of context and politics (Buchanan & Badham, 1999).

It is necessary to use organisational power and politics to progress innovations (Frost & Egri, 1990). Power in supply chains is distinguished by various types and when these should be used. Coercive and legal powers have harmful effects on SCM. The social system in this study appeared to understand the dangers of coercive power and actively avoided using it. However, other forms of power used correctly can enhance SCM (Maloni & Benton, 2000). The ability to withhold any scarce resources represents a source of power. SCM makes much of sharing information but this alone is not enough. As shown, it is also necessary to share knowledge and trust. Unlike information, knowledge is context-based and therefore requires various actors to understand each other's realities in order to be able to use such knowledge.

### ***Power – Overall***

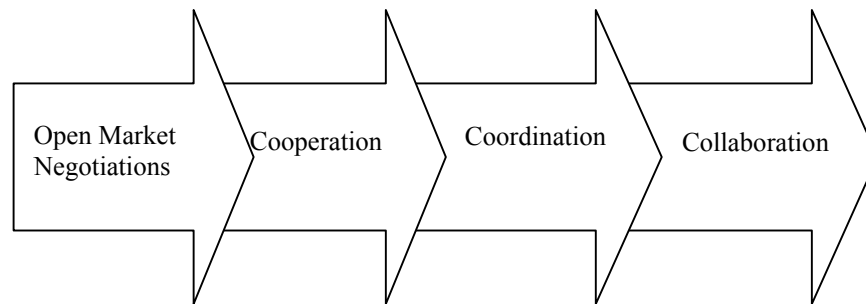
A clear conclusion is that SCM will need to look beyond governance and economic theories and embrace sociological theories in more depth in order to deal with power more effectively. Cox (1999) has shown that coercion rather than cooperation is commonly used in high technology industries to get results. However, as the discontinuous change in these industries is not as common in mature industries, methods which involve sharing power appear to set a better platform for innovation. The road to sharing power will not be easy for reasons already shown as people and bureaucracy crave and accumulate power. However, as present bureaucratic structures do not appear to support SCM, future research is required to address these competing needs of empowerment and control.

### **Collaboration**

The themes to be discussed under this construct within social climate include: explorations of models to explain its development in this chain, the importance of empowerment, problems with definitions, and an overall summary.

## **Models**

Interfirm relationships move along a continuum according to Spekman, Kamauff, et al.'s (1998) model as shown in Figure 6.5. This model is useful for assessing where this supply chain is situated and what it may need to do to move further along this continuum.



**Figure 6.5. Key Transition from open-market negotiations to collaboration.**

*Note:* From “An empirical investigation into supply chain management: a perspective on partnership,” by R. E. Spekman, J. W. Kamauff, and N. Myhr, 1998, *Supply Chain Management, An International Journal*, 3(2), p. 57.

The data suggest that Firms A and C are best described as being at the cooperation stage. The goodwill and support various actors offer, combined with the length of time they have worked together, demonstrate they are well beyond open market negotiations. If it is accepted that this model suffers bias toward technology rather than information, then it could be argued the firms are moving into the coordination phase. However, for the reasons already outlined in IT, Firms A and C will struggle to fully enter this phase. Nonetheless, they may need to master this phase as IT literature suggests they will have little choice. Forrester’s research (2002) has predicted that B2B e-commerce will jump from AU\$48 billion in 1998 to AU\$1.5 trillion in 2003. Organisations are being forced to adopt this technology by more powerful trading partners (Hart & Saunders, 1997). Entering B2B through noncoercive means is seen as more desirable to achieving success as neither partner feels vulnerable and there are therefore fewer impediments to interorganisational relationships (Ratnasingam, 2000). This model does have one major

flaw in that it assumes technology can help the social system achieve collaboration, which the findings of this study refute.

Spekman, Kamauff, et al.'s (1998) model has been modified so that the term "coordination" gets past seeing technology as the panacea and instead focusses on what information is transferred and the spirit in which it is transferred. Unlike consumer industries, some industrial markets may not need real time and access to the social system for certain types of information. One reason is the recurring theme that for data to become information and knowledge, an appreciation of the context is needed. Brown and Duguid's (2000) argument that information has a social life and that modern IT has failed to comprehend how important it is to have both, is well supported by the data. The clear implication which follows is that such SCM theory development needs to reconceptualise the role IT plays in bringing about collaboration. Terms like cooperation and collaboration need to be understood firstly as social constructs with technology being an enabler. If the social relations are sound, technology may be of assistance but there appears to be no justification for the implicit and largely untested argument that technology can somehow create the social system needed to serve it.

Porter's (1990) work points out that unless value is being added then no matter how strong the trust and commitment in the relationship, it will not be sustained. Husted (1994) accepts this basic argument and develops a different staged approach to that of Spekman, Kamauff, et al.'s (1998) model, arguing that there are degrees of interorganisational cooperation (not necessarily collaboration). Three forms of cooperation are high trust, low trust and, finally, opportunistic cooperation. This model seems far better suited to describe the forms of relationships into which organisations can enter, as its focus is on social and legal variables rather than IT. The details are shown in Table 6.2 below.

**Table 6.2. Three Forms of Cooperation**

	<b>High Trust cooperation</b>	<b>Low Trust cooperation</b>	<b>Opportunistic Cooperation</b>
Commitments	Long-term, indefinite, diffuse	Short-term limited, specific	Very limited or nonexistent
Attitude toward Problems	Expected as a normal part of doing business	Not anticipated, except within the contract terms, if it occurs it is due to negligence	Expected – bad faith
Recourse to formal contract penalties	No	Yes	Extra-contractual Remedies, self-help
Dispute resolution	Integrative	Distributive	Exploitative
Self-interest orientation	Stewardship of mutual interest	Simple self-interest seeking	Self-interest seeking with guile

A strong point in favour of this model is that it addresses the interplay of variables such as trust and commitment in cooperation. Such a multifactorial approach is consistent with the findings of this study. Within the above model, Firms A and C appear to be operating in high trust cooperation while Firms B and C appear to be operating in low trust cooperation. Subject to how their court case goes, this could see Firms B and C move into opportunistic cooperation. However, the small number of players in the rail industry in Australia means there are limited choices so it may not be in anyone's interest to move to full opportunistic cooperation. In such a context the argument for "coopetition" (Bengtsson & Kock, 2000) is also well supported.

### ***Empowerment***

Empowerment has been covered in depth in the section on power. The link to this construct is the CAPS report that noted that in order to achieve the effective coordination and cooperation for SCM, "people empowerment" was needed, yet little was found (Fawcett & Magnan, 2001). The numerous ways power was concentrated at the centre tended to be overcome by past strategies such as cooperating with other operators on grass stocks while keeping them hidden from the organisation, and working through informal means such as consulting the boundary spanners. Yet even boundary spanners such as FD11 who worked beyond the direct gaze of those with centralised power, pointed out how he went through all the protocols, both formal and informal, required by those with power before approaching other subjects in the chain directly. Finding the balance between governance and empowerment clearly requires more research. This

research will be difficult as there are many variables which interact within collaboration in complex ways but which, based on this study, may be context-specific rather than universal.

### ***Definitional Issues***

The term collaboration was chosen in preference to cooperation for three reasons. Firstly, it is the most commonly used term in SCM literature to describe this range of activities. Secondly, multidisciplinary research concluded it was easier to continue using the term. Thirdly, presentations to a range of audiences on the Framework in Figure 5.1 revealed the majority preferred the term collaboration to describe what sat under this construct.

### ***Collaboration Overall***

Collaboration is vital for the smooth running of the supply chain and, as shown in the various models, provides a lot for strategy planners to consider when seeking to implement SCM in a progressively successful manner (Aviv, 2001).

### ***Interaction – Participation***

STS has long advocated the need to allow for interaction and participation in order to improve worker involvement. The widely expressed resentment against governance in Firm C could in part be explained as a reaction to not giving staff the “elbow room” in a psychological sense. In contrast, Firm A staff felt good at being able to interact and participate more in shaping their own destiny.

As most subjects agreed that this construct was important it was remarkable that so few appear to have given any serious thought as to how to design buildings and office space to foster such activities either within the firm or across the supply chain. The potential to make better use of physical space to support interactions which assist in sharing information and developing trust is an issue which clearly warrants more research. The present trajectory on SCM appears to be toward virtual teams. The evidence of this study would suggest that this path is fraught with danger as it appears to minimise the importance of social and contextual factors.

### **Conclusion Social Climate**

The conclusion reached in the CAPS report (Fawcett & Maignan, 2001) applies equally to this case study, namely that “much work remains to be done before the average organisation can leverage its people as a bridge to greater supply chain integration” (p. 42). It has been argued that the variables under this construct interact with each other in



complex ways which are not yet fully understood. However, they do seem to build upon each other and are best conceptualised systemically rather than in isolation. Their main role is as mediating variables and, as such, they appear to have been largely neglected in the SCM research to date. How the constructs interact with other variables, which have often been considered to be independent, sets a clear direction for an area requiring further research.

### **6.3.8 Innovation (including Performance)**

Transformational innovation has already been discussed at the macro level. The meso level is best suited to radical and architectural innovation while the micro level is best suited to delivering incremental innovation.

Radical innovation has overwhelmingly been driven by capital investment in new technology over many decades in both Firms A and C. The capital intensive nature of these industries suggests this will continue in the foreseeable future. A weakness found with this capital investment strategy is that it tended to look at optimisation at the level of the firm. Yet a minor investment at Yanbo, by accident rather than design, resulted in reduced inventory holdings all the way back to Firm A. This suggests that taking a wider perspective could improve the overall performance of the chain. The difficulty as mentioned by subject LQ22, is that other firms obtain benefits without making any investment. The same problem applies to R & D strategies where investing upstream would improve the chain but could create difficulties around how to share the benefits. The other issue yet to be explored in this chain, which is driven largely by a price sensitive market (margins in steel and rail are small), is the possibility of sharing assets. The expense paid in noncore assets such as ERP is one such possibility. The other alternative is that Firms B and C could look at using common assets more effectively such as locomotives and wagons. This would reduce operating costs but would require alliances which could run into legal problems. Airline industry alliances have shown how price sensitive markets have resulted in reduced direct competition and by working common assets harder in an integrated transport chain.

Finding other ways to generate radical innovation will, as has been shown, require a fundamental change to present SCM Australian practices on the range of issues already discussed such as governance and learning, and how social climate is dealt with. It will also require very long-term commitment between the parties. This is discussed under planning.

Architectural innovation was rare at both inter and intrafirm levels. At the interfirm level the apparent lack of architectural innovation could suggest that differences in organisational cultures will overwhelm similarities in ERPs between firms (Krumbholz & Maiden, 2001). However, at the intrafirm level it is reasonable to assume that as these differences did not exist, and the large investments in IT and ERPs in particular would result in this form of innovation. IT capital investment strategies have already been discussed as not delivering radical innovation. ERP investment is based on it opening up the architectural innovation through better process management and the seamless flow of information. That this did not happen and given the massive investment strategies in ERPs architectural innovation, it appears to be the single biggest opportunity for SCM in mature industries. Firm C has AU\$8 billion in assets spread across 10,000kms and suppliers with similarly large asset bases. The opportunities for these organisations to reconfigure assets across the supply chain therefore appears large yet unrealised. One reason which has been demonstrated by this study is that far too many false assumptions have been made about the nature of the social system and how to engage it with technology. Architectural innovation is cheaper and easier to implement than radical innovation and offers more improvement than incremental innovation. Yet until new ways of bringing the social and technical systems together are found, the potential of this form of improvement will not be realised.

#### **6.4 MICRO**

Micro level issues happen with a firm. This study showed that on balance such innovations did little to improve the overall chain. The exception was where the incremental improvements at Acro and Yanbo helped remove bottlenecks. The clear implication for SCM is that these innovations need to be understood in the context of the total chain to be effective.

#### **6.5 PLANNING - SPANNING MESO, MACRO AND MICRO LEVELS**

Planning was represented as overarching all of Figure 6.3 because it is concerned with all aspects of SCM. Planning itself can be conceptualised in many ways. Within this case study, planning has two dominant aspects – strategic and operational. The operational aspects have been covered elsewhere and are largely concerned with keeping the supply chain running. The strategic aspects are concerned with orchestrating activities across the three levels – macro, meso and micro – in order to generate all forms of innovation.

There was little evidence of effective strategic supply chain planning. This is somewhat surprising as the supply chain has a lead-time of approximately 6 months from order to delivery and from 1 to 3 years in receiving the funds for such orders. Strategic planning concerns itself with issues which are more long-term and may involve large investment decisions and changes in organisational direction, such as entering new markets, developing new products and capabilities, and withdrawing from other activities. By its very nature, strategic management remains an intuitive and philosophical undertaking (Brockmann & Anthony, 2002). The philosophical aspects include whether it should be a top-down or bottom-up process, involving a few voices or many, and how choices are ultimately made and evaluated. Strategy formulation is linked to the top executive's personal philosophy of how an organisation should function (Priem & Butler, 2001). The evidence of this case study suggests SCM does not occupy a lot of space within senior management's philosophical views.

From Firm C's perspective, it is hard to image that the supply of steel rail is not of strategic importance. Yet neither firm could produce, when asked, any documentation which demonstrated the strategic importance of SCM. Other very senior managers when asked about contingency planning stated this had not been done. Subject LU23, while active in operational planning, did not interact with the managers who made strategy decisions. The SCOR maps revealed no-one was responsible for planning across the entire chain at either the operational or strategic levels. These factors support the view that SCM may have reached senior management in terms akin to other management fads in that they are aware but either do not understand it or, if they do, they believe they have more critical issues to address.

For reasons already discussed, governance and power appear to stifle learning, which in turn inhibits strategic planning. Strategic planning has been subjected to a standardising process with most strategies favouring its treatment as a science rather than an art. Under this model, strategic managers are encouraged to use a systematic range of techniques to generate myriad alternatives which are then exposed to rational decision-making processes in order to select a strategy. The forces of positivism and bureaucracy combine to "proceduralise" all aspects of organisational life. Advocates of strategic planning as an art form point out that strategies should incorporate substantial creativity and intuition in order to design a comprehensive strategy for the firm (Ford & Gioia, 2000). Mintzberg (1987) refers to the craftsman metaphor which involves incorporating

individual skill gained from experience. Such tacit knowledge is not easily codified. This debate raises the question as to what camp does SCM belong and really it is both.

If the science approach is used then, as shown, SCM has problems as it is not seriously considered by senior managers and therefore is unlikely to be selected as serious strategy. If the art approach is used then the artists do not appear to have any experience of SCM from which to intuit. The evidence of this study suggests the strategic planning aspects of SCM as suggested under Spekman, Kamauff, et al.'s (1998) collaborative model, where joint planning considers joint investments in technology and different organisational structures, will not be part of strategy formulation. Raising consciousness of senior management on SCM remains one the major weaknesses of this movement.

Should senior management want to engage with SCM at the strategy level, the absence of DSS on the supply chain would add to the difficulties. Subject RE21 noted the absence of measures to help him gauge what had been happening. Learning strategies used by senior managers to enhance strategy were not explored. However, it is reasonable to suggest that part of this would involve the knowledge they can apply to the quality of the information available. Evidence of such learning would be reflected in policies they formulate to support strategies. However, as shown in Firm C, senior managers rely on policies generated by single functions policy advisors. They have limited DSS to support strategic SCM. The combined emerging picture which relies on senior managers directing SCM appears a dubious proposition. The SCM movement will need to do a lot of work to assist senior managers better understand the importance of SCM and why it should be part of their concerns under strategic management

## **6.6 ADDITIONAL FINDINGS**

The positivist approach which has dominated supply chain research may have assisted in avoiding grappling with the complexity of such research with its assumption of a singular and unifying reality. The power of these assumptions is all pervasive as most of the governance strategies and requirements for documentation are based on them and on a further assumption that the records produced through monitoring procedures are asocial and context free. SCOR is yet another example of this sort of logic. The maps could only be understood within specific contexts and no evidence was found to support these maps being represented as universal and asocial.

The critical realist approach taken in this case study revealed that there are multiple realities and many disciplines operating within several strata but within the one

entity which has been conceptualised as the supply chain. The use of the multidiscipline team as a means of checking findings was therefore invaluable. One clear and immediate implication of this is that the way forward for future research is to seek to better understand that supply chains do have to work at several levels and that successful SCM will require finding tools and techniques which can address such complexity. Interdisciplinary research complemented by multimethod research appears the most promising way forward.

## **6.7 SUMMARY OF DISCUSSION**

The implications of using a critical realist perspective were first discussed to explain the focus on looking for generative mechanisms and structures which create the “empirical moment” described in Figure 5.1. The discussion explained that this surface event of reality sat in a much wider context described in Figure 6.3. Three discrete contexts with different causal relationships in SCM and innovation were discussed. These were the macro, meso and micro. At the macro context no evidence was found to suggest that the national corporate regulatory framework which underpins the dominant corporate governance framework of Australian organisations has considered SCM. The clear relationship between government policy and transformational governance suggests more may need to be done in this area to facilitate SCM nationally. The present situation suggests that the current pattern of corporate law reform is following a developmental trajectory based on neo-classical economic theory of competition. There is nothing to suggest deviation from such trajectories in the near future and as a result legal responses to major new challenges, such as posed by SCM, may be difficult to institutionalise. Given that transformational innovation occurs at this level, there is an urgent need to ensure policy makers are better informed on SCM matters.

At the meso level considerable findings were explored based on the conceptual framework developed in Chapter 5. The following comments on various super constructs provide a summary:

- Corporate governance as it is presently practiced inhibits innovation so adjustments in this area could free up innovative potential. Differences in governance structures and corporate parenting style were also found to be important variables which could influence innovation outcomes.
- Infrastructure may be placing too much emphasis on technology as a panacea for all the communication, data transmission, and information transfer problems of

organisations involved in supply chains. The introduction of feral systems in isolation with no integration across the network challenges much of the logic driving the multimillion dollar investment that both Firms A and C are presently making into ERP systems. The role that location and physical design play in SCM is clearly not something managers appear to have thought about in any depth. This is an area requiring far more research.

- Operations knowledge appears to work well through social systems. The role of tacit knowledge and why it seems to be so highly valued are areas for further research to determine what is driving this approach and how it can be better utilised and supported through knowledge management and HR strategies in order to generate greater innovation. This could in turn assist in increasing the speed at which a supply chain can learn and improve. Traditional HR and organisational development strategies could enhance learning capabilities by working out and adjusting policy settings to support strategies that best nurture the supply chain learning capability. Factors which would increase the learning include better use of operations research, consistent process mapping methodologies, data referencing and agreed measures, and a general sorting out of the management system before leaping into costly and ineffective IT solutions. This approach would require a shift away from an essentially IT focus towards using technology to provide business improvements. Such a change in focus would better support the DSS which several organisational levels appear to crave. It would assist operations knowledge by providing increased, and timely, information to those who have to make the supply chain work.
- Social climate is a mediating variable which has a profound impact upon SCM innovation. This area has been poorly researched in the SCM literature. Future research in this area will also require widening not only the content areas researched in SCM but also the methods of enquiry used.
- Achieving the four levels of innovation requires working in different ways at the macro, meso and micro contexts. Transformational innovation requires influencing policy makers to ensure they make decisions consistent with SCM principles. Radical and architectural innovations are the two types which can most readily be generated by SCM. Incremental innovation, which predominantly occurs within the micro context, while capable of playing a role in SCM, is generally not effective in SCM unless it is supported by a suite of SCM tools such as supply chain wide DSS.

- Planning is another major issue requiring urgent attention. While all actors claimed it was necessary, it appears little was known about how to plan successfully in a single large organisation, let alone across several corporations. There is a need to assess the capabilities of senior managers in respect to strategic SCM. As senior managers' comprehension appears to be at the management fad level, there could be merit in developing a comprehensive methodology that covers issues such as skills and competencies; social facilitation methods; technical processes; measurement systems; technical compatibilities; and mutual decision support tools.
- There were additional findings around the role played by positivism in SCM research and governance and the dangers posed by positivist assumptions around a single unifying reality. There is a need to widen the research agenda in both content and allowable research methods in order to progress SCM.

Having discussed the above points and what this means for the subordinate research questions posed in Chapter 1, Chapter 7 now explores future research and SCM in a broader sense.

# CHAPTER 7

## 7 CONCLUSION

### 7.1 LESSONS

There are several relevant lessons that can be drawn from this study. Firstly, the social system of a supply chain plays an important role in the uptake and generation of innovation. It therefore warrants far more consideration than has been given by much of the literature to date. Secondly, supply chains are complex phenomena which are best examined using multimethod and multidisciplinary approaches. Thirdly, effective management of supply chains requires a methodology which allows managers to identify key elements in technical and social systems, and to manage both systems in an integrated manner. Finally, the integrated framework (presented in Chapter 5) provides a platform for future multidisciplinary research.

Prior to discussing the implications of these conclusions, the findings are examined against the overall research question along with additional findings not directly included under the propositions – namely the SCOR and the use of a multimethod approach.

### 7.2 RESEARCH QUESTIONS

This study initially set out to explore the following overall question:

**What is the role of social factors in generating innovation within supply chains?**

Within this overall question three general and largely distinct subordinate questions were also explored. These were:

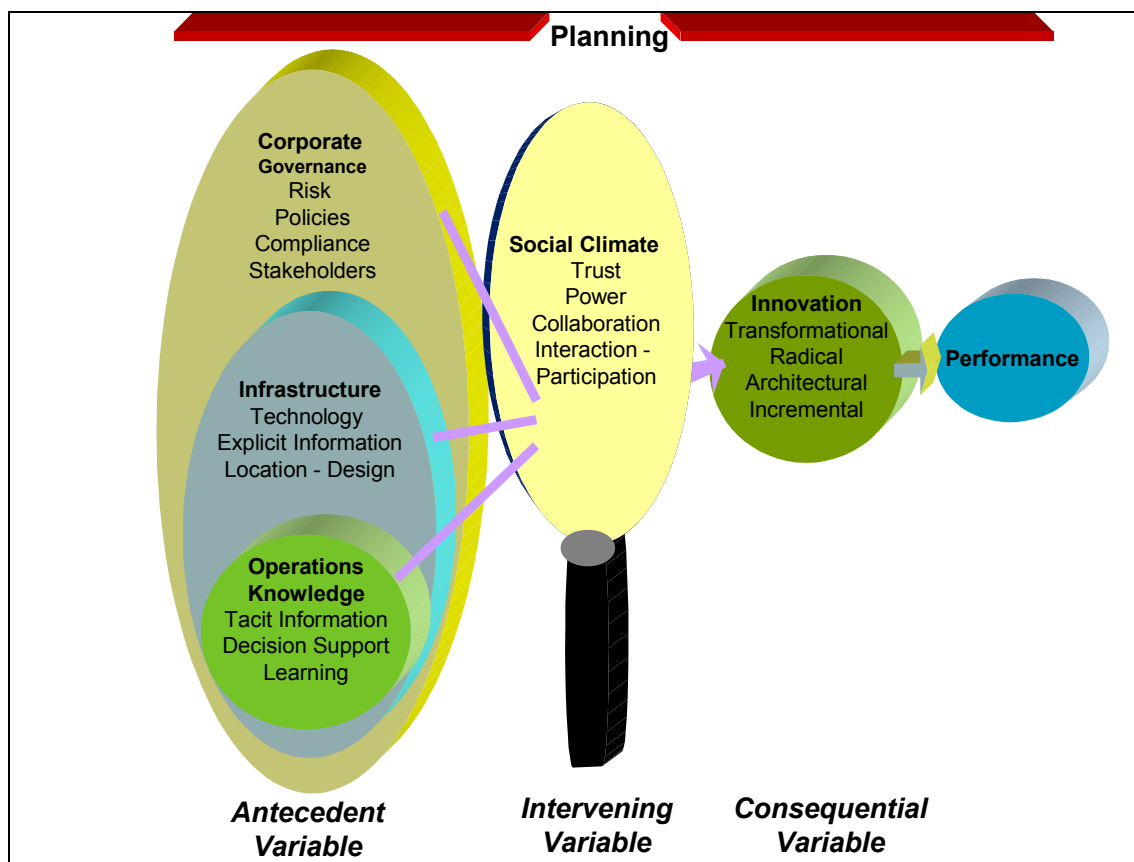
**Subordinate Question 1:** How well suited are present corporate governance structures of individual organisations to support the generation of innovations within supply chains?

**Subordinate Question 2:** What has been the impact of the widespread adoption of IT in generating innovation in supply chains?

**Subordinate Question 3:** What is the role played by interorganisational social networks in generating innovations within supply chains?



**Overall Research Question:** The findings in respect to the overall research question were that the social factors did play a major role in both how supply chains operate and in innovation. Innovation was divided into four types, transformational, radical, architectural and incremental. It was found the role of the social system varied depending upon the level of innovation achieved. Innovation was itself found to be the outcome of a range of interacting variables. The variables which were found to have the strongest relationships in contributing to innovation were developed into a conceptual framework as initially shown in Figure 5.1 and reproduced here as Figure 7.1.



**Figure 7.1. Conceptual Framework of Issues Influencing the Ability to Generate Innovation in the case study Supply Chain.**

The framework itself could best be described as a meta-analysis in that the interconnectedness of the elements is crucial to appreciating the systemic nature of SCM in creating innovation. The framework was also found to sit within a wider context consisting of three distinct categories – macro, meso and micro. While Figure 7.1 was located primarily in the meso level, it was also shown that events occurring in

the macro and micro contexts had an impact upon supply chain events in the meso context.

The significant finding in terms of the overall research question is that the social climate was found to be a mediating variable rather than an antecedent (independent) variable in respect to innovation. The social climate was defined as consisting of four variables – trust, power, collaboration and interaction/participation. All four variables were found to interact with each other in such a way that the more they overlapped and supported each other, the more of a virtuous spiral they created. Conversely, the weaker the overlap between each of the variables, the greater were the chances that difficulties would emerge. Such a virtuous spiral was found to provide a lot of assistance in the efficiency of operations, especially when operational recovery was required. Its role in both the diffusion and implementation of innovation was also found to be important, albeit in a less direct way than was found with normal operations. While the four mediating variables were not able to stop a range of reforms and changes imposed upon them, they were able to exert power over the speed and effectiveness of those reforms and changes. Such social variables have clearly been shown to have a strong relationship in operational effectiveness. They also appear to increase in importance as the SCM increases in sophistication, with a consequent need for greater trust and collaboration. The clear implication which follows is that such variables need to be considered and managed as part of the development of any SCM strategy seeking to ensure smooth operations and enhance innovation capability.

### **7.2.1 Subordinate Question 1**

How well suited are present corporate governance structures of individual organisations to support the generation of innovations within supply chains?

The overall findings suggest that present corporate governance structures, while they appear to have high potential to bring about improvements, are not presently well suited to support supply chains, let alone the innovation within supply chains. The most conclusive evidence found in this study was the very strong relationship between the governance structures of individual organisations and their impact on all forms of innovation, including those found in SCM.

Within the macro context, the emergence of Neo-liberalism and associated policy reforms has generated organisational legal structures which have not been

specifically designed to support SCM. This situation does not appear to be the result of some deliberate decision. Australian national legal systems are in line with those of most modern western countries which have, for more than a century, drawn on an historical firm perspective. This perspective is built on an even older economic theory about markets being most efficient when they are served by competition between firms. This has created a trajectory which, supported by laws such as the Trade Practices Act (1974) is likely to continue for a long time into the future. The recent string of high profile corporate failures has resulted in governments having little appetite for experimentation with new corporate forms, and a strong drive to reduce risk and create market certainty. Governments seek to do this primarily through strengthening governance rules. Theories of interfirm governance (Gulati & Singh, 1998) which focus on the mechanisms used to structure and manage interfirm relationships and more complex issues such as interfirm learning, do not appear to be included as an issue worthy of consideration for this apparent legal trajectory. A likely result is that hierarchical command-control dominated organisational structures will continue to dominate the corporate landscape for the foreseeable future.

The emergence of partnerships, strategic alliances and joint ventures suggest firms are grappling to find ways around current limitations. While all three firms studied have entered into variations of such arrangements, these are the exception rather than the rule. To date, the general approach taken by all three firms is to act where possible from a single entity perspective. As yet there does not appear to be clear agreement in legal or other circles as to what constitutes a partnership, strategic alliance or joint venture in the supply chain, or what constitutes best practice to manage such arrangements. These arrangements involve close collaboration and typically span many functions and levels across at least two organisations, often entailing close working relationships between operating personnel. As of 2004, joint venture cases had only gone as far as State Courts, and the High Court had not yet been required to resolve such a case. This suggests that such arrangements sit within a grey area, and that traditional corporate governance structures will interpret the SCM interfirm relationships with caution, perceiving them to be a high risk until the legal precedents around such arrangements are clarified.

The three dominant yet different types of governance structures for profit-driven organisations (as illustrated in Firms A, B and C) were examined and it was demonstrated that such structures have very different SCM potentials. Firm C, with its

stakeholder perspective, appeared the most disadvantaged. Taking a wider stakeholder perspective meant there were far more risks beyond profit maximisation. As a result, due diligence requirements appeared stricter and created difficulties for Firm C in entering into SCM activities, even when it could be demonstrated that to do so could generate innovations which had the potential to increase profitability. The privately owned joint venture (Firm B) appears best suited to enter into SCM. The apparent success of this integrated hybrid firm model in terms of speed and ability to seize strategic opportunities suggests a possible organisational form, which could emerge to exploit SCM opportunities. Firm A had developed a more arms length arrangement with its suppliers yet many of them were located on its manufacturing site. They were, therefore, well placed to develop and maintain good social bonds. This study did not involve “not for profit” organisations. The conclusion for profit-driven organisations is that while no governance structure appears to actively facilitate SCM, they do have a very large impact in terms of an ability to inhibit the speed and degree of engagement allowed in SCM.

### **Two views of SCM**

Firms A and C presented a “rosy” view of a relationship well suited to SCM. There were high degrees of trust, commitment, information sharing, and balanced interdependence. By contrast, the relationship between Firms B and C was considered risky. Firms A and C had vastly different competencies whereas Firms B and C had very similar competencies. The key point is that all three firms worked within the one supply chain. The findings suggest that the view of SCM requiring trust and collaboration is far too simplistic, and support the view that “coopetition” applies in some supply chains.

### ***Risk***

Appropriate governance structures must be crafted to match the perceived level of risk determined as acceptable by an organisation. Supply chain activities have within them an array of inherent risks such as disruptions (strikes, terrorism, natural disasters), delays (inflexible supply source, excessive handling), systems (integration), forecasts (inaccurate, bullwhip effect), intellectual property (vertical integration), procurement (exchange rate), receivables (financial strength of customers), inventory (obsolescence) and capacity (cost, flexibility). The three governance structures examined here demonstrated different approaches to risk on different matters. For

example, both Firms A and C demonstrated low risk tolerance where large investments were involved. The GOC with a stakeholder perspective was concerned with a wider range of risks such as those of a political nature. Entering into SCM does entail risk. The findings of the focal firm suggest that it is very good at using its governance to manage downside risks but it is less capable of managing the upside risks associated with SCM.

Risk management involves risk taking as well as risk avoidance. Firm C is primarily concerned with creating rules which reduce certain types of risks but in the process it may increase others. By working to avoid and eliminate risks, Firm C appears, paradoxically, to be creating them. Examples include missing innovations offered by suppliers at tendering, and generally have so many rules in place on how all the factors of production can be used that managers have very little room for entrepreneurial activities. The variables which are driving such a risk-averse approach to SCM are multicausal but appear to include a lack of legal clarity, concerns with leakage of competitive knowledge, and a general lack of deep understanding of SCM by senior managers.

Corporate governance and its associated risk assessments has profound impact on activities considered key to effective SCM – such as information sharing, knowledge exchange and interfirm learning. The fact that the social system found ways to get around governance requirements suggests that there is some, albeit minor, limit to how far corporate governance can inhibit actors working in the interest of a supply chain. This strongly suggests there is an urgent need to assist corporations better define and develop treatments for what they perceive to be high risks associated with interfirm relationships. Unless such work is done, it appears innovation in supply chains will fall well short of its potential.

### ***Compliance***

The wider economic and social reforms of the past 20 years –known by several names but commonly termed Neo-liberalism – has seen governments progressively shrink in size but not in influence and control. They have reduced taxes by getting others to do the work. The decrease in government size has been complemented by an increase in regulations which now fall back on corporations to comply. Government have in fact increased their power to ensure this work gets done by increasing the level of surveillance activities on corporations. This has resulted in a

massive blow-out in the time staff spend on meeting corporate governance requirements. The direct implications are that a risk-averse culture is reinforced and there is little time left available for creative thinking and local experiments.

Legislative initiatives such as the Trade Practices Act will ensure a “fortress firm” trajectory continues in traditional legal structures strengthened by the ever-increasing burden of more regulations. The prime purpose of this unitary entity in a publicly listed company has been to maximise shareholder wealth as opposed to maximising the wealth of the supply chain.

### ***Policies***

Organisational policies are specific elements of the work environment that directly impact employees’ daily work activities, their interactions with co-workers, and their employer-employee relationships. As explicit articulations of implicit credos (actual and intended), organisational policies embody corporate values that guide decision-making of managers and supervisors and shape work employees. (Foote, Seipel, Johnson, & Duffy, 2005, p. 205)

No evidence was found to suggest that policies formulated at both the level of government and within the firm, and which were implemented in Firm C, had considered SCM – with one exception. The Supply Division area of Firm C had developed a supply chain policy. Closer analysis revealed it to be essentially a series of rules and regulations about how to purchase and treat inventory. The procedures were essentially generated from financial policies around delegations and how to classify accounts for inventory. Apart from the change in name, it was essentially a reflection of policy documents which had been in existence for several years.

The number of policies developed in isolation led to conflict between the procedures required of various operational staff. Further encroachment by government into directing and controlling all aspects of corporate life by regulation increases the power of each functional policy maker, who can point to immediate and dire consequences in a way that failure to attend to market issues cannot. As a result, such policy groups appear to be gaining in power and have far less need to consult and integrate with other functions. External legislative directives were found to be adding to the increasing and conflicting functional demands being placed upon the focal firm. Such forces stand in stark contrast to the aspirations of SCM with its emphasis on integrating functions. The study found that while the present governance system gave

powerful voices to specialist functions, there was no apparent countervailing mechanism to generate integration. A review of the corporate policies confirmed this position.

Firm C was aware that conflicting policy requirements were creating additional costs and dysfunctions, and had sought to rectify this situation. A series of initiatives such as the “Policy Doctor” and “Discipline Head” committee helped reduce, but not eliminate, such conflict. This suggests that the governance framework and the outcomes it drives towards have an implicit bias which favours functionalism. Surprisingly, respondents complained about the impact of compliance activities and the conflict these created but they still maintained they were clear about their role in the supply chain. More detailed analysis suggests that they understood their prime operational requirements but were irritated by the conflicting governance requirements placed upon them in a unilateral manner without concern or reference to the impact upon their work requirements or the hampering of their effectiveness in the supply chain.

Senior managers at both firms acknowledged the strategic importance of SCM. Firm C as a transport provider was well aware of the need to master SCM to achieve market success. It had even set up a Capacity Dynamics Unit with specialists who could model supply chains and could make improvement recommendations. Despite the apparent acknowledgement, nothing was found in the strategic plans of either firm which related to SCM. Neither firm could demonstrate a supply chain strategy or even a high level statement on the role of SCM in their own context. It appears, therefore, that there is considerable difference between the rhetoric and reality of SCM in the minds of the senior managers who develop policies.

It is widely accepted that innovation should be supported by a range of learning and knowledge management policies. Both organisations were able to point to documentation and corporate statements around learning. Firm C used protection of intellectual property as justification for not entering into SCM with certain organisations. The interview data suggested little had been done in practical terms. It appears the policy makers in both firms are unclear on how to develop and support an innovation strategy in a systematic manner. Greater appreciation of SCM issues by senior managers and policy makers therefore may not lead to improvements, as the basic infrastructure needed for all forms of innovation, including SCM, does not appear to be in place.

### ***Stakeholders***

Clear differences were found in governance structures and whether they took a stakeholder or shareholder perspective. While it was anticipated a stakeholder perspective might be better suited to SCM because it considered suppliers, the opposite was found to be the case. Firm A, with a clear and single focus on shareholders, was much more able to engage in SCM if it could be linked to wealth creation in the stock price. The stakeholder perspective of the GOC appeared to create so much role conflict between the various stakeholders that it led to a form of gridlock where SCM was traded off against other needs. This conflict appeared to be intensified by the tendency to have even more functionalist specialists generating policies aimed at maximising the needs of their policies in an isolated manner.

### ***Governance Overall***

The overall picture which emerges on governance is that it is a very complex topic which has to cover a wide range of economic, political and social issues. Corporate governance was found to be the most powerful and truly independent variable in this study. Its power was primarily demonstrated in its ability to inhibit innovation. There is, therefore, a need to conduct more research into this topic on several fronts. Firstly, policy developed at the government level needs to be explored from a systemic perspective to examine why policies are apparently developed in isolation from each other. The governance model explored was within an Australian context but as supply chains are often global in nature and the complexity of rules and regulations increases when operating across several countries, direct research is needed into resolving the international legal context which supports global SCM. Secondly, the knock-on effects of Australian policy development in terms of strengthening “internal legislators” who are encouraged and rewarded for functional excellence need to be examined to assess their consequences for activities such as those which seek to achieve efficiencies by functional integration within reengineered inter and intrafirm processes. Thirdly, government policy makers need to conduct more research into the new and emerging forms of extended organisations in order to create legislative frameworks which can meet this emerging reality. Fourthly, the role of the present corporate legislation in generating organisational design built around bureaucratic command-control hierarchies within functional silos needs to be examined. This organisational design research should be focussed on determining if it



is possible to develop governance structures around a process approach which can stretch beyond the bounds of the firms compared with the current functionally driven, firm-centric approach. Fifthly, and perhaps most difficult for government policy makers, there is a need for a far deeper analysis of how to develop legislation which enhances rather than crushes the ability of the social system in supply chains to be creative, to engage in interfirm learning, and to generate and implement innovations.

Moving corporate governance from its present trajectory will be very difficult and all those involved in advancing the cause of SCM will have to become far more effective in influencing government policy makers. The TQM movement had some success in the past by creating a peak body (Australian Quality Council) to advise government on best practice and widely disseminate practitioner knowledge in a range of forums. An initiative different in nature but similar in scale and objectives will be necessary if SCM is to be given the support it needs in order to be effective. Failure to influence key stakeholders such as government will significantly retard the widespread adoption of SCM practices in Australia. To create such engagement creates many challenges for SCM practitioners who appear traditionally to have been drawn from a narrow range of disciplines. Effective influencing strategies will require a reaching out to, and an attempt to comprehend the needs and aspirations of, other disciplines. In short, SCM is a truly multidiscipline activity and it needs, therefore, to operate within such a methodology so as to be effective at influencing and generating support from key stakeholders, including government.

**Subordinate Question 2:** What has been the impact of the widespread adoption of IT in generating innovation in supply chains?

The findings were that the widespread adoption of IT did not lead to innovation in the supply chain. This contradicts some of the SCM literature which argues that there is a causal relationship between the uptake of such technology and SCM. These findings suggest there may be a fundamental flaw in the logic of SCM. This flaw has been highlighted by a minority of thinkers in both the IT and SCM literature. Specifically, the positivist bias in SCM research, and its underlying assumption that information is asocial and that knowledge is context free, has generated an unconscious logic which guides the technical design of IT. The apparent failure to design social system requirements into the technical systems appears to create a major disconnection between the two systems being able to work in a unified manner. Most disciplines which guide modern corporations from management

theories, legal frameworks, and bureaucratic policies to IT, process management and logistics are all founded on strong positivist assumptions. However, the discovery of feral systems to overcome what were perceived as shortcomings of the ERP system, the high degree of variability between different subjects on how to interpret symbols when using a single process mapping tool, and the wide difference in interpretation and reactions by various staff to the importance of policy and compliance matters provide conclusive evidence that multiple realities were to be found across the supply chain and even within the one organisation.

Two errors in relation to IT appear to be in play. Firstly, there is the bureaucratic belief – fuelled by legal requirements – that all knowledge can be codified and located in policies and procedures. This denies the role of tacit knowledge which innovation literature has repeatedly demonstrated as key to the major source of innovation. This study both confirmed the innovation literature and demonstrated how tacit knowledge was also important for maintaining normal operations. Secondly, the positivist assumptions justify centralisation as required by large IT systems such as ERPs. Such a view overlooks the significance of the location of knowledge. The overwhelming evidence of this study was that knowledge is created within a local social context. The centralised IT approach supported by cost reduction arguments confuses two important concepts – geographical distance and social distance. As this study has shown, the latter is very important to communities of practice. The overall picture which emerges is that the organisations make the error of confusing standardisation of information with that of meaning.

Contrary to the positivist unitary assumption of process management approaches in particular, context is very important to knowledge management and learning. It is precisely the contextual variables that are stripped away by sending data across IT channels. There is an urgent need to research the role of context in supply chains. As was found in this study, in an environment overcrowded with information, context not only helps people decide what to read, it also tells them how to read it, what it means, what it is worth and why it matters. There is an obvious and strong link between context and the creation of knowledge, learning and innovation. The present array of HR policies and, in particular, training and development policies, suffer the same positivist bias with respect to the transmission of knowledge. Firm C's "sheep dip" training courses and on-line e-learning all demonstrate a disregard for the importance of context. This is further exacerbated by the lack of interest shown by

functionalist policy makers to consult with those in the field prior to developing training courses. The inability of managers to comment on the sorts of physical environments they felt should be created to support and enhance cross-functional teams again highlights how widespread the lack of understanding is around creating supportive contexts.

The clear conclusion is that the widely-accepted assumption that IT is a panacea for SCM needs to be seriously challenged. This line of reasoning has led to a touting of the next logical level of alleged sophistication – establishing virtual teams. The findings from this study suggest that, as in the case of investment in IT, a lot of money will be wasted unless consideration is given to how staff actually behave and how knowledge is created (as opposed to transmitted) in a social context. Any future research into virtual teams should widen the agenda to include consideration of the importance and role of social context, especially in regard to innovation.

**Subordinate Question 3:** What is the role played by interorganisational social networks in generating innovations within supply chains?

The findings in regard to this question varied with the context and type of innovation. While the findings were not clear-cut on the role that interorganisational social networks play generating innovations within supply chains, there was very clear evidence that these networks played a major role in diffusing innovation.

As shown with transformational innovation, government policy around microeconomic reforms was simply imposed on the regulatory framework within which organisations worked. Within this macro context, the interorganisational social networks were therefore not found to be significantly involved in generating innovation.

Radical innovation involving large capital works investment was affected by networks. However these networks were primarily associated with communities of practice around a specific asset rather than an ION spanning the supply chain. The application of rational economic decision-making criteria was the ultimate determinate of what types of radical innovations should be supported. While not specifically explored in this study, it is suggested that those who are effective at working with and influencing key social networks would be more likely to succeed in marginal cases. However, at the level of radical innovation the evidence did not generally support the view that supply chain networks play a major role in generating innovations across the supply chain.

Architectural innovation is difficult to comment on because the heavy investment in ERP and other IT systems suggested it should have been present. For the reasons already outlined under the response to Subordinate Question 2, the logic behind this question presupposes a unified reality in terms of understanding the supply chain and how best to improve it. The proliferation of feral systems and the awareness that reality is defined at the local level are seen as the main reasons why the potential for such innovation was not realised. The absence of a supply chain-wide DSS was also seen as a contributing factor. However, the supply chain was modelled in Planimate and made available to all key players. The lack of uptake again strongly suggests the recurring theme that without some standardisation of meaning among the various actors, standardised information and measures will not be effective. While architectural innovation was not detected, there was evidence that the ION was active in working around the ERP systems which theoretically should support this type of innovation. The subjects expended an enormous amount of effort staying in touch with each other, preferring access to the social over the IT systems so they could ensure the meanings they were constructing were correct.

This finding on the importance of having common meaning across the supply chain to bring about architectural innovation is perhaps the most significant for the firms involved in this study. These firms are technologically mature, capital intensive and asset rich organisations. Collectively these firms have sunk costs of almost AU\$1 billion on IT which ideally should provide the necessary infrastructure for such innovation. Working in essentially commodity markets with low margins, capital rationing is a reality which reduces radical innovation. Strategically, architectural innovation represents the opportunity to make supply chain-wide improvement without additional investments. It is proposed that such a potential has not been realised because ERP systems in particular made the same false asocial assumptions about information already outlined. This finding has profound research implications, as large firms all over the world continue to spend massive amounts on ERP systems for negative results. ERP and ERP II in particular are also frequently regarded as key technology for enabling SCM. Despite the advances in web-based technologies, ERP and the massive investments made by large corporations with the ongoing sophisticated SCM functionality by ERP manufacturers suggests ERPs will continue to be a major force for the foreseeable future. Future research on ERP systems and SCM should direct its focus to exploring how to design such systems in a way which

works with rather than ignores – or worse still, works against – the needs of the social system.

Despite the findings around the lack of effectiveness of IT in this study, the implied relationship has been maintained in Figure 7.1 for the following reasons. Firstly, large sections of the literature have empirical evidence which refutes the finding of this study in respect to IT investments. Secondly, the massive amount of ongoing investment by modern corporations in IT suggests faith in their ability to realise the potential of their investments. Finally, as shown under Jackson's (2003) systems typology, operations research issues are well supported within a simple-unity system and these systems provide the foundation for many supply chains. Researchers and practitioners alike will continue to explore these issues in order to generate a source of improvement in SCM.

#### ***Conceptual Framework of Issues Influencing the Ability to Generate Innovation.***

It is widely accepted that firms need to understand and master SCM if they are to successfully transform themselves and survive into the future (Bowersox et al., 2000). However, how such mastery is gained remains less obvious. The conceptual framework developed in this thesis goes some way towards unravelling this riddle. Firstly, it has confirmed what others have advocated – namely that SCM involves many elements (Larson & Halldórsson, 2002; Mentzer et al., 2001). Secondly, it has demonstrated that such elements come from very distinct disciplines yet interact as a whole within the supply chain. Thirdly, it has demonstrated that SCM can generate innovation and therefore aligns with the literature stressing the linking of SCM to sustainable competitive advantage. Fourthly, it has demonstrated that while all variables were important, governance exerted an especially strong influence on the other variables. This raises several challenges as successful SCM involves horizontal cross-functional integration both across and within firms. Such arrangements involve relinquishing control and distancing operations from traditional functional hierarchies which the present governance structures encourage. These findings align with the view of many theorists (van Hoek, 2001b) that the changes will involve moving away from formal arrangements and developing interorganisational relationships which increase trust and collaboration. This appears to be a daunting task given the present trajectory of governance arrangements. Fifthly, the findings revealed that the relationships of the antecedent (independent) variables of governance, infrastructure

and operations knowledge are moderated by social climate factors. A social climate which balances and blends the social variable in ways which are conducive to innovation will have a large bearing on how easily changes are implemented. Conversely, a poor social climate will stifle innovation. The metaphor of a lens is used (in Figure 7.1) to demonstrate how the social climate factors mediate the relationships between the antecedent in and consequential (dependent) variables in the model.

### **Mature Industries – Technological Markets**

The Blaydon et al. (1999) argument about innovation in mature industries is supported by this study. They suggest that such industries – and in particular those selling commodities – tend to use routine technologies, and that product innovation is often low. Steel rail as a product has been in existence for over 300 years. Nonetheless, firms belonging to mature industries enter partnership arrangements with other firms in order to generate process innovation. Carnegie and Butlin's (1983) comprehensive study on innovation in Australian industries confirms this point. Decreasing profit margins are seen as the catalyst for such a strategy. This became especially pronounced for Firm C when it was exposed to more competitive pressures as a result of NCP reforms. For example, profits in the coal market have been squeezed so tightly as to necessitate large-scale improvements. The implications which follow are that innovation in mature industries is likely to occur in business process management which provides a logical extension into SCM. The strategic theory informing such organisations is most likely found in the core competency literature. However, it was also demonstrated that the role of learning cannot be ignored in SCM. For innovation to be successful in such industries it would appear the theoretical foundation suggested by Smith et al. (1996) which combines both the resource based and learning theories, is presently the most promising way forward.

### ***Process Management***

While governance may address the legal structures which exist between firms in a chain, operations need to be represented in more tangible forms. Specifically, SCM seeks to improve the linkages between firms. Process mapping has been the dominant approach used to represent the linkages both between and within firms. The prime reasons for creating a map are to link corporate strategy to supply chain strategy, distribute key information for survival in a dynamic environment, and offer a

basis for supply chain redesign or modification (Gardner & Cooper, 2003). The SCOR model is the nearest mapping approach to a *de facto* standard (Huan, Sheoran, & Wang 2004; Lockamy & McCormack, 2004b). However, the study demonstrated that while SCOR and other BPM tools such as the method to model the methods, decisions and activities of an organisation (known as IDEF0) can be used to define the technical system, they have severe limitations as to how much of the supply chain they can accurately represent. The development of a universal set of mapping conventions to represent supply chains would greatly assist firms choosing to enter SCM as these would enhance their ability to not only exchange information but, more importantly, to get closer to achieving common understandings of what was meant by such information. However, it should be noted that this study strongly suggests that having a common standard in place will not guarantee a common understanding due to the way in which knowledge is created within local contexts and communities of practice. It will therefore be necessary for individuals and teams to interact with other groups along the supply chain to ensure common understanding. This will help avoid the error of present BPM methodologies which assume that application of a common process mapping codification convention will lead to common interpretation across the entire chain.

### **Research Paradigm**

It has been demonstrated by this case study that it is not necessary to restrict research to the positivist paradigm. As suggested in the literature review, there is clear evidence that distinct biases in the literature are possibly retarding the development of SCM knowledge. Apart from a lack of consensus on the theoretical and historical determinants of SCM, there is also considerable bias toward extrapolating principles from consumer markets (most notably the automotive and computer industries) to other types of supply chains. Such research has most often been conducted within a single discipline and generally within a positivist paradigm. While the SCM literature stresses the importance of social and political factors and places emphasis on the need for collaboration and trust, research in such topics outside of a positivist paradigm is still relatively scant. Furthermore, research on how industrial markets using mature technologies can use SCM principles to improve their effectiveness is even more scant. There is considerable scope to widen the SCM research agenda in terms of comprehensiveness in order to better meet present and future challenges.

The literature review also revealed that the SCM is a relatively “young” field with exponential growth in interest from researchers. However, a set of dominant characteristics was found. Most notable of these are: the reliance on the manufacturing and consumer goods industries for empirical as well as analytical illustration; conceptualisation of SCM as a process; transaction cost economics and strategy-based competitive advantage theoretical grounding; the presence of mostly descriptive-type theories; strong positivist paradigmatic stances in the research methods employed; and the utilisation of analytical conceptual, as well as empirical statistical sampling and case study methods. These dominant characteristics appear to have prevented plurality of ideas in terms of how the area is conceptualised, theoretically described and researched, making the development of the field a narrowly concentrated one. This, in turn, has prevented wider dissemination and greater acceptance of ideas outside the functional areas that SCM has traditionally been associated with. As a consequence, the soundness and robustness of the ideas underpinning SCM have not been fully tested. If this pattern continues, then there is a risk that SCM will become confined to a narrow intellectual base. This could lead to SCM being considered unworthy of serious scholarship by the broader academic community.

How can a more encompassing approach be achieved in developing the field? The answer to this, at least partially, is provided by the meta-analysis presented earlier. From the philosophy of a knowledge perspective, there are several options. This study has demonstrated that the Critical Realist perspective is viable. The evidence generated on the importance of the social system in SCM, and the multiple realities within such a system, also add support to using such an approach. The clear advantage of such an approach is that it can embrace a wide range of research methods. A plurality of research methods which can be contained within an ontological and epistemological framework would be of great assistance to an area of research which this case study has demonstrated is multidisciplinary in nature, still very young, and struggling to determine its scope and boundaries.

Another, and perhaps more viable, approach may be to adopt the Lakatosian research program as suggested by Arlbjørn and Halldórsson (2002). This may be the best way to conceptualise the SCM body of knowledge as it could assist in overcoming the “operations management-manufacturing-process-positivist” (Burgess et al., 2006, p. 72) dominance while also being able to integrate research designs that



are outside of these focal points. It has the advantage of being a fundamentally positivist research paradigm and, as such, would not run the risk of being too alienating to the traditions which have informed and dominated disciplines such as operations management, logistics and BPM. Lakatos's distinction between core and belt allows such traditional disciplines to remain in the core and provides a solid platform for SCM knowledge. The protection belt, however, allows far more scope for alternative research activities to inform, expand and, eventually, transform the core over time.

If the present trend continues of researching from within a traditional positivist framework, then one implication is that doing more of the same type of research will most likely produce more results of the same order. Given that SCM appears to be "struggling" to develop a coherent body of knowledge, such an approach seems both illogical and wasteful of scarce resources. SCM needs to rapidly expand the methods of inquiry if it wishes to speed up its rate of knowledge development. This study has confirmed that the social system is extremely important in SCM. Social science has had little trouble stepping outside a traditional positivist research paradigm precisely because it has viewed such an approach as inadequate. As it is, SCM stands at the crossroads. The choices within a Lakatosan model are either to retreat to the narrowly defined core of operations management approach, or to expand the research framework to embrace the rapidly emerging protection belt. Many of these issues are found in the social climate as discussed in this thesis. The former is not a feasible option if the area is to develop broad appeal.

At least two additional options are open to SCM research. The Critical Realist approach, as mentioned, is by far the most promising in that it can embrace the emerging and rich insights offered from other approaches such as postmodernism as well those of positivism without becoming captive to either. However, the inherent positivist bias which has informed SCM suggests a radical departure may seriously damage the fledging theoretical development of SCM. In particular, SCM is largely practitioner based and, as such, needs to keep links between theory and practice. A sudden move outside this research paradigm may result in researchers spending more time on philosophical disputes which are alienating to practitioners. The paucity of theoretical development suggests that SCM will suffer the fate of many management theories – that it will be a retrospective commentary for the short-term at least. The findings of this study in respect to the bullwhip effect, for instance, suggest that many,

but by no means all, of the issues and problems faced by supply chain practitioners could be addressed by the application of operations research and logistics methodologies. Future SCM research, however, needs to acknowledge the limitations of such techniques which appear unable to firstly address the full range of issues found in SCM and, secondly, to deal with complexity between the interaction of independent and mediating variables.

The Lakatosian approach provides a viable way forward for SCM which can both embrace the emerging challenges of SCM, and assist in resolving the present ontological and epistemological confusion. Such an approach could by expanding what is permissible research, provide useful insights into the SCM body of knowledge. The limits of such an approach are not yet known. It is argued that even greater insights are possible if SCM can find effective ways of integrating insights from the nonpositivist approaches of the social sciences.

In the short-term it is suggested that one possible avenue for achieving greater knowledge of SCM is through the further development and improvement of the analysis framework presented in this thesis. This could be in the form of including additional disciplines, intellectual traditions, theoretical perspectives, practitioner activities and historical trends associated with SCM. Another possibility is through further inquiries into SCM by means of content analysis and cross-tabulations of data reported in this thesis. Finally, the accuracy of the findings reported here on the forms of bias in present supply chain research can be confirmed by other researchers who can independently classify the set of articles, choose larger samples, use databases other than ABI/Inform Global Proquest, and include articles that are not limited to the English language. These inquiries will need to test the findings of this study and thus facilitate the development of knowledge in a manner by which researchers might better adjudicate the different claims of those seeking to cover SCM. Accelerated knowledge development should also follow such endeavours which in turn will assist industry to determine if SCM is a serious subject which warrants ongoing investment or if it is a fad which should cease to be supported by scarce resources that can be more effectively used elsewhere.

### **7.3 LIMITATIONS:**

As with all case studies, the usual restraints around generalisability apply. Internal validity was achieved by the application of data analysis techniques that

involved primarily the application of grounded theory and tools such as pattern matching and explanation building (Yin, 1994). A multidiscipline team was used as a QA check for each construct and relationship which was developed in the framework in order to avoid single-rater bias and ensure enhanced research rigour. Triangulation was used wherever possible by referring to other documents to verify or refute the claims made by the subjects. However, external validity has not been addressed effectively in this study. This is a common drawback of most single case study findings, as it is difficult to generalise from the data to a broader context. Research studies should have an appreciation of the importance of comparison, which is not possible with a single case study. Thus, the findings presented here have to be explored further. More case studies would need to be followed to further explore the validity and reliability of the constructs and strength of the hypothesised relationships shown in the framework developed in this thesis.

#### **7.4 CONTRIBUTION TO SCM THEORY DEVELOPMENT**

Firstly, the outcome of this study provided a framework (Figure 7.1) that gives two primary benefits:

- it shows the relationships between relevant variables from different disciplines (i.e., corporate governance, infrastructure, operations knowledge, social climate and innovation), and how they impact upon performance; and
- the framework provides a way forward in synthesising multidisciplinary and multimethod research into a coherent whole.

Secondly, the study has demonstrated that it is viable to employ multimethod research techniques involving different research paradigms in SCM in order to better understand and generate fresh insights into this complex and relatively young field. It has suggested some possible ways forward to expand the research agenda for future SCM research.

Thirdly, the study was based exclusively with firms that were working within the corporate laws and regulations of Australia. It was able to demonstrate that such laws and the governance frameworks they create for industries do have a relationship with how well organisations can develop and implement innovative capability within supply chains. It also highlighted the role that government policy can play in supporting or retarding supply chain innovation.

Fourthly, the study focussed on a neglected area of SCM – namely, mature industries – and helped demonstrate that such industries are more likely to be interested in extending process innovation into the supply chain as a way of improving their performance. Product innovation is not a key concern for such industries. As commodity based industries form the backbone of an Australian economy, and such industries are supported by other mature industries such as transport, this study has considerable relevance for how to progress SCM with large national industries.

Finally the case study has conclusively identified the importance of the social system and the key role it plays in both supply chain operations and supply chain innovation.

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## **APPENDICES**



## APPENDIX A

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## APPENDIX B

	<i><b>Deduction</b></i>	<i><b>Induction<sup>a</sup></b></i>	<i><b>Abduction</b></i>	<i><b>Retroduction</b></i>
Fundamental structure/thought operations	To derive logically valid conclusions from given premises. To derive knowledge of individual phenomena from universal laws.	From a number of observations to draw universally valid conclusions about a whole population. To see similarities in a number of observations and draw the conclusion that these similarities also apply to non-studied cases. From observed co-variants to draw conclusions about law-like relations.	To interpret and recontextualise individual phenomena within a conceptual framework or a set of ideas. To be able to understand something in a new way by observing and interpreting this something in a new conceptual framework.	From a description and analysis of concrete phenomena to reconstruct the basic conditions for these phenomena to be what they are. By way of thought operations and counterfactual thinking to argue towards transfactual conditions.
Formal logic	Yes	Yes	Yes and no	No
Strict logical inference	Yes	No	No	No
The central issue	What are the logical conclusions of the premises?	What is the element common for a number of observed entities and is it true also of a larger population?	What meaning is given to something interpreted within a particular conceptual framework?	What qualities must exist for something to be possible?
Strength	Provides rules and guidance for logical derivations and investigations of the logical validity in all argument.	Provides guidance in connection with empirical generalizations, and possibilities to calculate, in part, the precision of such generalizations.	Provides guidance for the interpretative processes by which we ascribe meaning to events in relation to a larger context.	Provides knowledge of transfactual conditions, structures and mechanisms that cannot be directly observed in the domain of the empirical.

	<b><i>Deduction</i></b>	<b><i>Induction<sup>a</sup></i></b>	<b><i>Abduction</i></b>	<b><i>Retroduction</i></b>
Limitations	Deduction does not say anything new about reality beyond what is already in the premises. It is strictly analytical.	Inductive inference can never be either analytically or empirically certain = the internal limitations of induction.  Induction is restricted to conclusions at the empirical level = the external limitations of induction.	There are no fixed criteria from which it is possible to assess in a definite way the validity of an abductive conclusion.	There are no fixed criteria from which it would be possible to assess in a definite way the validity of a retroductive conclusion.
Important quality on the part of the researcher	Logical reasoning ability	Ability to master statistical analysis	Creativity and imagination	Ability to abstract
Examples	If A then B  A  Thus: B	From an investigation of the attitude of a representative sample of Swedes, draw the conclusion that 30% of the Swedish population is in favour of the EU.	Karl Marx Reinterpretation/redescription of the history of humankind from the historical materialist view.	For a ritual to be just a ritual there must exist, <i>inter alia</i> , emotionally loaded symbols and common notions of inviolable/sacred values.

*Note*

<sup>a</sup> The concept of induction has been used in partly different ways by different philosophers/theorists, and within different disciplines. Here we are talking about induction in the sense of inductive logic. In social science the concept of inductive is also used to describe a certain form of research procedure. It is important not to confuse inductive logic with inductive research, since these concepts in part imply totally different things.



# INTERVIEW KIT

## Note – Questions

### Interview Details

<b>Interview</b>
Date:
Time:
<b>Interviewers</b>
Name:
<b>Interviewee</b>
Code:

### Interview Materials

Remember to take .....	Check (tick that you have these)
Interview Kit	
Tape Recorder (spare tapes, batteries)	
Digital camera (spare batteries, disk to download pics if required)	

Rail  
Supply  
Chain  
Optimisation  
Project

Have you done the.....	Check (tick off when done)
<p><b>Introduction</b> (Lead-up work will have established the Subjects' initial willingness to be interviewed, a scheduled interview time slot, and the forwarding of a "Project Information Sheet")</p> <p><b>(Introduce yourselves)</b> I'm ..... from ..... involved in the Steel Rail Supply Chain Project.</p> <p>We are here to follow-up on the preliminary information you received regarding this project which is being hosted by QR's Supply Division. Have you had a chance to read the information sheet (if you haven't, would you like us to give you a brief overview)?</p> <p>We are gathering information on how supply chains work so that QR can develop a methodology for all its Supply Chains. Part of the purpose is an academic study and we are looking at ways at which people who work in the Supply Chain can make practical recommendations on how the Supply Chain can be improved.</p> <p>The project will initially focus on the Steel Rail Supply Process from manufacture at Whyalla to installation in track. We will involve all critical players in this chain and exclude potential competitors. We're very interested to hear your comments as an integral part of this supply chain.</p> <p>Is there anything that you would like clarified before we start?</p>	
<p><b>Confidentiality Agreement</b> The study team has signed a "Confidentiality Agreement" which states that your input will be treated in the strictest of <b>confidence</b>. The information you supply will be aggregated with other data to ensure <b>anonymity</b>. <b>(Show a copy of agreement)</b>.</p>	
<p><b>Recording</b> Would you mind if our discussion is <b>recorded</b> on tape for transcription later? This will ensure that all of your comments are recorded <b>accurately</b> and will <b>save time</b> during the interview. You can ask me to <b>turn</b> the tape recorder <b>off</b> at <b>any time</b> e.g if you wish to share some information that you would rather not have on tape. Would you also mind if we took some general <b>photographs</b> of your workplace?</p>	
<p><b>Consent</b> If you are now willing to proceed, would you mind reading this Consent Form carefully and sign it at the bottom. <b>(Sign two copies: take one copy and leave one copy for interviewee)</b></p> <p>Are you happy to start .....</p> <p>Is it OK to turn the Tape Recorder on <b>(Turn on Tape Recorder)</b>.</p>	

We'll start off by talking about your job in the Steel Rail Supply Chain, what you think works well and what improvements you think need to be made.

Then we'll move to talking about the organisation-to-organisation relationships and communication in the Steel Rail Supply Chain and improvement strategies.

We'll finish off by further exploring communication and the impact of space design.

QUESTION	DRILL DOWN QUESTIONS	PROMPTS	SUB-PROMPTS
<p>1 Would you explain your role in the Steel Rail Supply Chain?</p> <p>Summarise (using sub-prompts)</p>	<p>→ Do you feel your role is clearly defined?</p> <p>→ Do you work alone or with others in the Steel Rail Supply Chain?</p>	<p>→ Clearly defined role</p> <p>→ Work alone / others</p>	<p>→ Via performance management system, feedback from boss/customers, overtime</p> <p>→ Don't need to worry about what others are doing</p> <p>→ Required for task achievement, information, approval, other?</p>
Response/Comments: :			
Summarise (using sub-prompts)			

QUESTION	DRILL DOWN QUESTIONS	PROMPTS	SUB-PROMPTS
<p>2</p> <p><i>We'd now like to ask some questions on the organizations in the Supply Chain.</i></p>	<ul style="list-style-type: none"> <li>→ Which organisations do you deal with?</li> <li>→ How frequently do you have contact with these organizations?</li> <li>→ Do you know people in these organizations/groups very well?</li> <li>→ Is each of these linkages/connections for only one purpose or can some or all of them serve two or more purposes?</li> <li>→ Are there any organisations that you deal with indirectly and why?</li> <li>→ Do you have any alternative sources?</li> </ul>	<ul style="list-style-type: none"> <li>→ Direct Organisations</li> <li>→ Frequency</li> <li>→ Familiarity</li> <li>→ Purpose</li> <li>→ Indirect Organisations</li> <li>→ Alternative source</li> </ul>	
Response/comments:			

QUESTION	DRILL DOWN QUESTION	PROMPTS	SUB-PROMPTS
<p>3 What do you think needs to be done to improve the Steel Rail Supply Chain?</p>	<p>→ How are you allowed to improve the Steel Rail Supply Chain?</p>	<p>→ Social support</p> <p>→ Learning systems</p> <p>→ Technology</p> <p>→ Workplace layout</p> <p>→ Information</p> <p>→ Policies</p> <p>→ Other</p>	<p>→ Social confidence</p> <p>→ Comfort</p> <p>→ Approachability</p> <p>→ Credibility</p> <p>→ Trustworthy</p> <p>→ Knowledge Management</p> <p>→ IT, Hard production e.g. TLM</p> <p>→ Proximity, privacy, access, security, etc</p> <p>→ Measurement</p> <p>→ Job descriptions</p> <p>→ Governance</p> <p>→ Reward recognition</p> <p>→ Information Technology</p> <p>→ HR, IR</p> <p>→ Reward and recognition: pay, conditions</p>
Response/Comments:			

QUESTION	DRILL DOWN QUESTION	PROMPTS	SUB-PROMPTS
4			
From when you first got into the Supply Chain, has anything changed?	→ Are the initial factors the same compared with today's factors.	→ Same → Changed	
Response/Comments:			

QUESTION	DRILL DOWN QUESTION	PROMPTS	SUB-PROMPTS
<p>5</p> <p><i>We would like to discuss relationships.</i></p>	<p>→ When problems arise, are they mostly solved through</p> <ul style="list-style-type: none"> <li>• enforcement of legal agreements (including contracts),</li> <li>• through formal dispute mechanisms.</li> <li>• solutions usually worked out informally and cooperatively between the parties</li> </ul> <p>→ Does this formality scale vary with issue?</p> <p>→ How important are personal contacts in your dealings with other organizations in the Supply Chain?</p>	<p>→ Problem resolution</p> <p>→ Personal contracts</p>	<p>→ Formal mechanism</p> <p>→ Informal mechanism</p>
Response/comments:			

QUESTION	DRILL DOWN QUESTION	PROMPTS	SUB-PROMPTS
<p>6</p> <p>Other Aspects associated with relationships</p>	<ul style="list-style-type: none"> <li>→ Could you comment on any non-economic benefits you see associated with the supply chain?</li> <li>→ Were they always present or did they evolve over time?</li> <li>→ How would you describe your commitment to the Supply Chain</li> <li>→ What do you trust the most - people or systems in this Supply Chain</li> </ul>	<ul style="list-style-type: none"> <li>→ Non-economic benefits</li> <li>→ Commitment</li> <li>→ Termination</li> </ul>	<ul style="list-style-type: none"> <li>→ Short-term</li> <li>→ Long-term</li> <li>→ Income loss - would you suffer a significant loss of income (savings)?</li> </ul>
Response/comments:			



QUESTION	DRILL DOWN QUESTION	PROMPTS	SUB-PROMPTS
<p>7</p> <p>When it comes to making decisions, who has the most muscle (power)?</p>	<p>→ Are you able to plan and carry out your operations independently of others in the Supply Chain?</p> <p>→ What model of planning would you prefer to use in the Supply Chain?</p>	<p>→ Level of influence</p> <p>→ Level of dependence</p> <p>→ Who has the most control</p> <p>→ Leverage</p> <p>→ Level of independence</p> <p>→ Own Planning</p> <p>→ Joint planning</p>	<p>Autonomy vs Balance of power vs intermediaries</p>
Response/comments:			

QUESTION	DRILL DOWN QUESTION	PROMPTS	SUB-PROMPTS
8			
Overall, would you describe how you work together in the Supply Chain?	<ul style="list-style-type: none"> <li>→ How concerned are the parties for the interests and welfare of the others?</li> <li>→ In general, do you think that other organizations in the Supply Chain provide a reliable, actual and factual picture of their business?</li> <li>→ How good are the others at keeping their promises?</li> <li>→ How do you protect your own interests?</li> </ul>	<ul style="list-style-type: none"> <li>→ Your concern for other organisations</li> <li>→ Others concern for your organisation</li> <li>→ Reliable, actual and factual</li> <li>→ Keeping promises</li> <li>→ Protecting own interests</li> </ul>	
Response/comments:			

QUESTION	DRILL DOWN QUESTION	PROMPTS	SUB-PROMPTS
<p>9</p> <p>What Improvement Strategies do you use</p>	<p>→ Do you have a specific Supply Chain <b>strategy</b>?</p> <p>→ How does your organisational <b>structure</b> design impact upon supply chain management?</p> <p>→ Can you explain the role your <b>support mechanisms</b> play in Supply Chain Management?</p>	<p>→ Vision &amp; Mission (direct)</p> <p>→ Strategic Plan (direct)</p> <p>→ Purposefulness (indirect)</p> <p>→ Flexibility</p> <p>→ Freedom</p> <p>→ Autonomy</p> <p>→ Empowerment</p> <p>→ Decision Making</p> <p>→ Cooperative Teams and group interaction</p> <p>→ Reward &amp; Recognition</p> <p>→ Availability of Resources</p> <p>-Time</p> <p>- Information Technology</p> <p>- Creative People</p> <p>- Space Design</p> <p>→ R&amp;D Activities</p> <p>→ Records Management</p> <p>→ Measurement Systems</p>	<p>→ What Systems</p> <p>→ Technology Plans</p> <p>→ Information Literacy</p> <p>→ Philosophical Basis –TQM, MBO, financial, ABC.</p>

QUESTION	DRILL DOWN QUESTION	PROMPTS	SUB-PROMPTS
	<p>→ <b>Behaviours that encourage Innovation</b></p> <p>→ How would you describe the Communications approach used in the Supply Chain?</p>	<p>→ Risk Management</p> <p>→ Mistake Handling</p> <p>→ Idea Generating</p> <p>→ Continuous Learning culture</p> <p>→ Risk Taking</p> <p>→ Competitiveness</p> <p>→ Support for change</p> <p>→ Conflict Handling</p> <p>→ Open</p> <p>→ Formal</p>	<p>→ Policies and controls, etc.</p>
Response/comments:			

QUESTION	DRILL DOWN QUESTION	PROMPTS	SUB-PROMPTS
<p>10</p> <p><i>We'd like to explore some workplace design issues in relation to your supervisory or management role.</i></p>	<ul style="list-style-type: none"> <li>→ As far as you are aware, does the Organization have a formal policy in relation to workplace design (e.g. office layout/fit-out)?</li> <li>→ Would you comment on how you think geographical location of members across the chain impacts on their <b>interaction and communication</b>?</li> <li>→ Would you comment on whether you think the physical work environment enhances or inhibits interaction and communication?</li> <li>→ What changes would you like to see made?</li> <li>→ Are you in a position to initiate such a change and would you?</li> <li>→ Would you share your thoughts about the value of "user participation" in the workplace design process?</li> <li>→ Would it be practical to implement user participation across the Rail Supply Chain</li> </ul>	<ul style="list-style-type: none"> <li>→ Policy on space utilization / allocation</li> <li>→ People in different locations</li> <li>→ Impact of Bounded Physical Space</li> <li>→ Reasons to change (what would cause them to think about how changing where they are located and how they are accommodated.</li> <li>→ (willing and capable)</li> <li>→ "User participation" in workplace design</li> </ul>	<ul style="list-style-type: none"> <li>→ Existing layouts / relationships</li> </ul>

Do you have any other questions or comments?

If you don't know the answer, undertake to find out and to respond as soon as possible. (note: keep this promise)

Your responses will be kept confidential. Also we will combine the information that you and others have given us so that individuals cannot be identified.

Do you mind if we contacted you to again to clarify any issues that might come up in the course of the research program?

and likewise,

Feel free to contact us through the project manager (Anne Rego) at any time if you want any further information, if you have anything to add, or you have any concerns about this study.

Thanks very much for your time and your help.

Response/Comments:

## APPENDIX D

# Rail Supply Chain Optimisation Project

## INFORMATION SHEET

### Firm C would like to invite you to participate in a project that aims to:

- Develop a methodology that Firm C managers can use to manage and improve their inbound supply chains (i.e. the planning, sourcing, making and delivering of the products and services required to do business).
- Identify and understand both the technical and social factors impacting on cooperation within a supply chain.

### Firm C has undertaken this project because:

- Industry wide knowledge indicates that if a supply chain cannot continually improve, it will be unable to remain competitive.
- No suitable Supply Chain Management methodology exists which considers both the technical aspects and the people aspects that impact upon the performance of a supply chain.

### This project will:

- Initially look at the supply of rail from manufacture, through transportation, to assembly and installation of Steel Rail into track.
- Use a multidisciplinary team investigation approach comprising Firm C staff and academic researchers from four Australian Universities (i.e. QUT, Griffith, RMIT).
- Involve conducting either individual or focus group interviews with a range of stakeholders
- Be completed by June 2003
- Involve minimal risk to Firm C's business operations.
- Met all corporate and ethical requirements as endorsed by Firm C's Research & Development Committee.

### The benefits that this project intends to deliver are:

- Methodology for optimising the performance of Firm C's inbound supply chain.
- Introduction of a process reference model for Firm C to manage their business. This model will integrate with Firm C's Activity Based Costing & Records Management frameworks, and other relevant policies and guidelines, resulting in reduction of duplication, effort, and interface complexity.
- Reduction in Firm C's risk exposure e.g. safety, business continuity.
- Increase in corporate image.
- Operational efficiencies such as:
  - Reduced inventory holding costs.
  - Reduced track maintenance and track construction down-time.

- Improvements in processes, information capture and transfer, technology developments, workplace environment and relationship interfaces.

All stakeholders in the supply chain can expect to directly or indirectly benefit from this project.

### Firm C's proposed nature of your involvement is:

We would like to **interview** you (face to face) for about **1½ hours** in your official employment capacity.

Attached is a copy of the questions we will be asking you.

Your participation in this project is completely **voluntary** and you will be asked to sign a '**Consent to Participate**' form prior to any involvement. You will be able to withdraw from the study at any time without comment or penalty.

Also, with your permission and the permission of any relevant managers, we would like to do some general observations of your workplace.

The information that you share with us will be:

- kept strictly **confidential** and stored and reported in a way that does not identify individuals.
- kept for the period necessary to comply with the various University requirements, and then destroyed.

To assure the above, Firm and the project researchers have signed a **Confidentiality Agreement**.

For your information, we will also be interviewing:

- Senior management in their capacity of making strategic decisions regarding the supply of rail.
- Those who provide specialist advice on aspects of the supply of rail.

### Please feel free to contact the Researcher Anne X for:

- Further information or clarification regarding the project.
- Advising your concerns or complaints about the ethical conduct of the project.
- Obtaining feedback on the outcomes of the project.

Anne may refer you to one or more of the project researchers (see attached list)

Anne's contact details are:

Name:	Anne x	xxxxxx
Organization:	Firm C	-----
Location:	Floor x	GM Manager
Phone:	No Y	6 January 2003
Fax:	No Y +	
Email:	<a href="mailto:anne.x@Firm C. com">anne.x@Firm C. com</a>	



## INTERVIEW DETAILS

### Rail Supply Chain Optimisation Project

Interview	
Date:	
Time:	
Interviewers	
Name:	
Interviewee	
Name:	
Phone Number:	
Business Area:	
Location:	

The purpose of the interview is for the researchers to gain an understanding of your experiences of being involved in the Steel Rail Supply Chain.

The interviews will be conducted in a conversational format, whereby the interviewer will introduce the area of interest, and you will be invited to discuss your relevant knowledge, attitudes, and opinions.

The following is a list of the questions that we are proposing to ask you.

We would appreciate if you previewed the questions before the interview to ensure our best use of your time and assure yourself that you are comfortable discussing the proposed topic areas.

In general, the interview will be a two-way discussion encompassing:

- Your role
- Organisation to organisation relationships
- What could be improved
- Communication across the Steel Rail Supply Chain
- Improvement Strategies
- Workplace locations and environments
- Any other issues relative to the Steel Rail Supply Chain that you wish to raise

GENERAL QUESTION	RELATED SPECIFIC QUESTIONS
<p>1 Would you explain your role in the Steel Rail Supply Chain?</p>	<p>→ Do you feel your role is clearly defined?</p> <p>→ Do you work alone or with others in the Steel Rail Supply Chain?</p>
<p>2 Which organizations in the Steel Rail Supply Chain do you deal with?</p>	<p>→ How frequently do you have contact with these organizations?</p> <p>→ Do you know people in these organizations/groups very well?</p> <p>→ Is each of these linkages/connections for only one purpose or can some or all of them serve two or more purposes?</p> <p>→ Are there any organisations that you deal with indirectly and why?</p> <p>→ Do you have any alternative sources?</p>
<p>3 What do you think needs to be done to improve the Steel Rail Supply Chain?</p>	<p>→ How are you allowed to improve the Steel Rail Supply Chain?</p>
<p>4 From when you first entered the Steel Rail Supply Chain, has anything changed</p>	<p>→ Are the initial factors the same factors today or have they changed?</p>
<p>5 Regarding relationships in the Steel Rail Supply Chain?</p>	<p>→ When problems arise, are they mostly solved through</p> <ul style="list-style-type: none"> <li>▪ enforcement of legal agreements (including contracts),</li> <li>▪ through formal dispute mechanisms</li> <li>▪ solutions usually worked out informally and cooperatively between</li> </ul>

GENERAL QUESTION	RELATED SPECIFIC QUESTIONS
	<p>the parties</p> <ul style="list-style-type: none"> <li>→ Does this formality scale vary with the issue?</li> <li>→ How important are personal contacts in your dealings with other organizations in the Supply Chain?</li> <li>→ Do you find the people you deal with credible and reliable?</li> <li>→ What do you trust the most – the social or the technical system?</li> </ul>
<p>6 Regarding the benefits of the Steel Rail Supply Chain to your business.</p>	<ul style="list-style-type: none"> <li>→ Would you comment on any non-economic benefits you see associated with the supply chain?</li> <li>→ Were they always present or did they evolve over time?</li> <li>→ How would you describe your commitment to the Supply Chain?</li> </ul>
<p>7 When it comes to making decisions, who has the most muscle (power)?</p>	<ul style="list-style-type: none"> <li>→ Are you able plan and carry out your operations independently of others in the Supply Chain?</li> <li>→ What model of planning would you prefer to use in the Supply Chain?</li> </ul>
<p>8 Overall, would you describe how you work together in the Steel Rail Supply Chain?</p>	<ul style="list-style-type: none"> <li>→ How concerned are the parties for the interests and welfare of the others?</li> <li>→ In general, do you think that other organizations in the Supply Chain provide a reliable, actual and factual picture of their business?</li> <li>→ How good are the others at keeping promises?</li> <li>→ How do you protect your own interests?</li> </ul>
<p>9 What Improvement Strategies do you use?</p>	<ul style="list-style-type: none"> <li>→ Do you have a specific Supply Chain strategy?</li> </ul>

GENERAL QUESTION	RELATED SPECIFIC QUESTIONS
	<ul style="list-style-type: none"> <li>→ How does your organisational structure design impact upon supply chain management?</li> <li>→ Can you explain the role your support mechanisms play in Supply Chain Management?</li> <li>→ Behaviours that encourage Innovation</li> <li>→ How you describe the Communications approach used in the Supply Chain?</li> </ul>
<p>10 Regarding workplace design issues in relation to your supervisory or management role.</p>	<ul style="list-style-type: none"> <li>→ As far as you are aware, does the Organization have a formal policy in relation to workplace design (e.g. office layout/fit-out)?</li> <li>→ Would you comment on how you think geographical location of members across the chain impacts on their <b>interaction and communication</b>?</li> <li>→ Would you comment on whether you think the physical work environment enhances or inhibits interaction and communication?</li> <li>→ What changes would you like to see made?</li> <li>→ Are you in a position to initiate such a change and would you?</li> <li>→ Would you share your thoughts about the value of “user participation” in the workplace design process?</li> <li>→ Would it be practical to implement user participation across the Rail Supply Chain</li> </ul>
<p>11 Any other comments?</p>	

**We look forward to seeing you at the interview.**

**APPENDIX E**

**CONSENT TO PARTICIPATE**

A condition of the participating organisations and research institutions involved in this project is that the voluntary consent of all people participating in the study is obtained prior to the commencement of any data collection activities.

By signing below, you are indicating that you:

- have read and understood the information sheet about this project
- have had any questions answered to your satisfaction
- understand that you are free to withdraw at any time, without comment or penalty
- understand that at any time, you can contact the project manager if you have any questions about the project or any concerns about the ethical conduct of the study, and
- agree to participate in the project

Please indicate your choices to the options shown following by ticking the appropriate box:

I agree to the use of an audio recording device	YES	<input type="checkbox"/>	NO	<input type="checkbox"/>
I agree to the photographing of workplace area	YES	<input type="checkbox"/>	NO	<input type="checkbox"/>
I require feedback about the outcomes of the project	YES	<input type="checkbox"/>	NO	<input type="checkbox"/>

**Name** (printed in block letters): \_\_\_\_\_

**Date:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

## APPENDIX F

### Research Methodology - Description of Steps Taken with Data

#### Topics Covered:

1. Details how the overall research was conducted with respect to data sources.
2. Provides an overview and the framework used to carry out the preliminary analysis of the data.
3. Describes the processes used to analyse and refine the data in order to develop constructs. The various stages involved in reaching such constructs was first discussed and then how possible relationships between such constructs were developed.

**1. Data sources** - the primary source of data was the transcripts generated as a result of the semi-structured interviews generated by the questionnaires administered to 31 subjects spread across Firms A and C.

All interviews were tape recorded on the work site of each subject. Two research team members were present at every interview with one member attending all interviews to ensure consistency of process. The tapes were then transcribed in written documents. These documents were subsequently reviewed by the two relevant interviewers to ensure accuracy. The two reviewers made considerable effort to check that grammatical issues such as commas were done correctly. This was to minimise the possibility of distortions in the translation from tape to text. The transcripts were not sent back to the subjects as the majority were very busy people and most expressed the view, that while they were happy to help by giving up on average one and half hours for the interviews, they did not want to then spend several more hours going over a transcript. All were informed that if they wished to review the written transcript it would be made available to them.

As the research was designed to maximise *local groundedness* in order to reduce contextual variation, the interview data was collected in as close a proximity as possible to where events occurred in the lives of the subjects (Miles & Huberman, 1994). The transcripts were coded in NUD\*IST under the headings in Figure 1 but excluded SCOR as this dimension was used simply to define the boundaries of the supply chain.

The demographics of the subjects are shown in Table 1 below:

**Table 1**

Subject	Category	Firm	Length of Service	Education Level

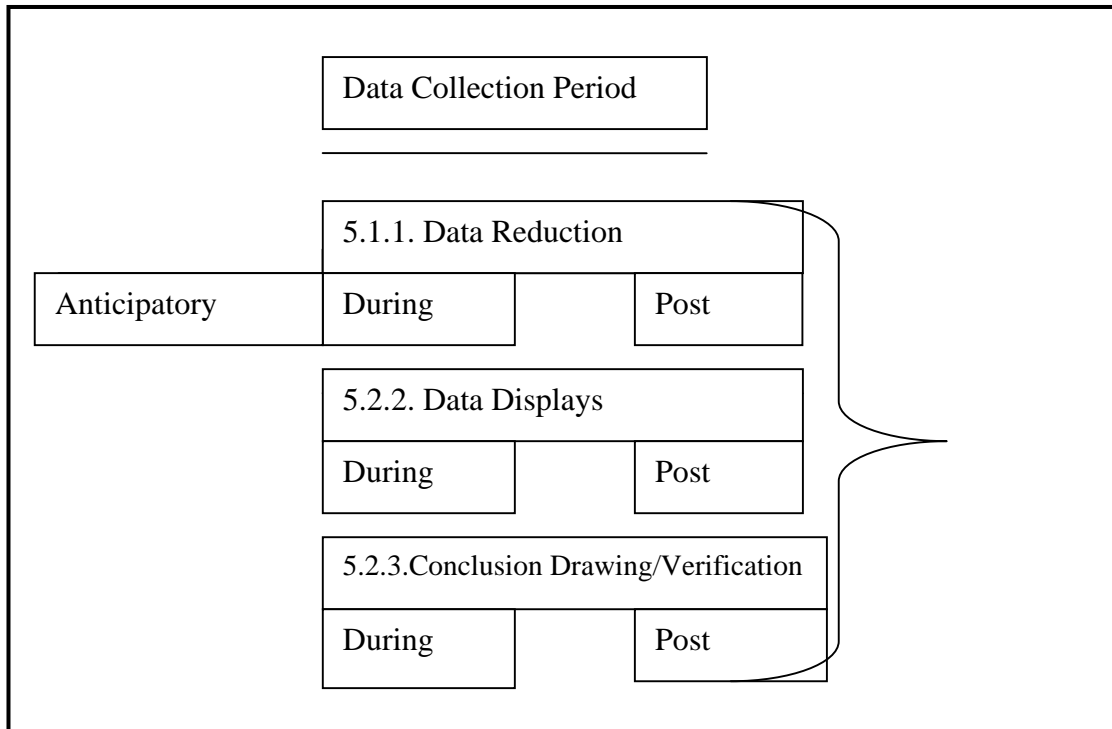
These demographics were seen as relevant to the research. Firstly, the code used to classify the subjects helps indicate their location in the chain and to give some indication of their power in their respective organisations. Educational level has been well

documented in social science to be a key variable linked to other variables such as attitude, self perception and income to name but a few. Length of service is often seen as relevant in such research as it often correlates with cultural variables and therefore has a direct link to issues such as learning capability.

A wide range of secondary sources of data were also used where appropriate. This involved desk top searches of key documents such as annual reports, internal policy documents, performance reports and other records which were considered to be related to activities associated with the running and improvement of this chain. Other subjects not in the 33 were occasionally contacted to clarify points on which they were seen to have expert knowledge. For example, Treasury staff in Firm C were contacted to clarify how a policy was applied after analysis of the interviews showed certain subjects had apparently conflicting interpretations. Some interviewees who were directly involved in the Supply Chain (Level 1 and 2) were contacted several times throughout the course of the research. Most of this contact occurred prior to the administration of the questionnaire and largely involved verification that the process maps developed by the researchers to represent their work and of the work was accurate. As these maps were used to identify the bounds of the research and who in the chain should be interviewed, verifying the accuracy of such work was critical to designing the wider research activities which followed. More details on the issues associated with the actual process mapping of the supply chain are discussed in Chapter 6 of the thesis. The bulk of the data were collected in 2003.

**2. Data Analysis Framework** – once the interviews were transcribed they were placed in NUD\*IST 6 where they were then coded initially under the five broad headings shown in Figure 1. As these categories were so large and they were then refined into elements. Elements were then drawn out and coded under each heading. Each element consisted of sub-elements which in turn were linked to a piece of specific text. Definitions of constructs were then developed this way and the method used is explored in more depth in 5.3.1.

The definitions were also run in NUD\*IST to explore possible patterns between definitions. An example of how this was done is shown in 5.2 below. The definitions derived from this process were then exposed to the team for further discussion, clarification and refinement. This process had numerous iterations. This was consistent with the Components of Data Analysis as defined by Miles and Huberman (1994) and shown below in Figure 1.



**Figure 1. Components of Data Analysis Flow Model.**

Consistent with the need to avoid bias the entire multidisciplinary team which consisted of six people and the author (three academics and four practitioners) were also involved. While they did not necessarily do the coding they were involved in discussions at key points in the process to see if the coding made sense. On each occasion the team met to discuss what they felt about the coding. Minutes were kept to record shifts in view.

A detailed example of how this technique was applied under the heading of governance is given to make the process more explicit. This process was applied to all categories. The following example also explains after a while why NUD\*IST 6 was found to be not very useful as the discussions which followed were seen as far more rich and insightful in understanding what lay embedded in the text. For the same reason, numerical counts and statistical techniques were not applied as the frequency was not found to be a good indicator of intensity and relevance.

**3. Data Analysis** – An example is given to show the processes used to develop the super construct of “Corporate Governance” and the four constructs which defined it. The same process was applied to all other super constructs which were developed with the exception of innovation which used a modified version of Chapman et al.’s (2002) work to define the construct.

The transcripts from 31 interviews were placed in NUD\*IST 6. Numerous iterations of coding were then followed by group dialogue which took several months. The following definition was developed.

As stated Corporate Governance was a super construct which was found to consist of four major elements: compliance, risk, policy and stakeholders.



These elements were further broken down. For example, how the element compliance was broken down further is demonstrated in Table 2.

**Table 2 Construct and elements.**

<b>Construct</b>	<b>Elements</b>	<b>Sub-elements</b>	<b>Examples</b>
Governance	Compliance		
		Specialist Skills	They cannot audit their admin people on what they do because they (managers) do not have a clue about SAP so they rely on their admin people totally. They could be plugging in the wrong numbers. Most of my supervisors need my help and it's mainly in the way they do their day-to-day job out there – it's a lot in their administration skills.
		Records Management	They don't sort of have a great consciousness of getting the records and keeping good records.  Documenting and reporting what they are actually doing out there – and particularly on the planning side. We're learning lessons the hard way with litigation.  It's not truly informal – there's a lot of documentation like emails.
		Standards	Legally there is only a certain amount of rail we can hold at Banyo for height.  The standards are more regimented standards than flexible standards.
		Hierarchy	Because of the hierarchy the approval systems in the chain can be a bit sluggish. There could be more trust to reduce the number of hands.

After numerous iterations and refinements more precise definitions in the form of texts containing key concepts were developed for each term. Because of the volume of data and potential to generate numerous elements to match variations in the data, the process was narrowed down even further to those elements that had sufficient data to suggest key relationships between two or more variables. Elements which could not easily demonstrate such relationships were discarded.

An example of such relationships between variables and constructs in a single piece of text is shown below in Table 3. The two examples below were classified under corporate governance as well as the other constructs shown below. It is precisely because so many

overlaps in concepts were discovered that lengthy team discussions followed to tease out the nature and strength of the relationships.

**Table 3 Examples of Corporate Governance Constructs Overlapping other Constructs**

Construct	Elements	Sub-elements	Examples
Information	Decision Support	Restrictions – non technical	Legally there is only a certain amount of rail we can hold at Banyo for height. So we have literally choked our business to a stop.
IONs	Trust	Verification	Because of the hierarchy the approval systems in the chain can be a bit sluggish. There could be more trust to reduce the number of hands.

To create even more focus and clarity between constructs, a series of additional refinements were made which restricted coding to those elements which were seen to have strong relationships (positive or negative) to the various forms of innovation. As will be shown in Chapter 6 this was further refined to those constructs and elements which were determined as having the strongest relationships.

The example developed so far may tend to imply that relationships were only found between elements of different constructs. This is misleading as no matter which taxonomies were used for coding many of the same pieces of texts were coded under different headings and indeed relationships were found even within the one construct. An example of the various governance elements within the focal firm is demonstrated by the following single piece of text.

*You need approval first of all from Investment Committee you need approval for Project element numbers, you need approval for EA which is Expenditure Authorisations from a number of senior executive people then like the rail through the SAP system it doesn't take very long to go out of people's delegations whereas you probably don't need that level of delegation because of common sense is going to question that much... it's not sort of like ya going out and buying \$50 000 worth of consumables which are attractive to everyday people out there so you're not going to rort the system by buying \$500,000 worth of rail.*

This piece of text was coded as capturing all four main constructs under corporate governance - compliance, risk, policy and stakeholders. It serves to illustrate several points including:

- a) Giving insight into what is meant by the term governance within the bounds of this study.
- b) Demonstrating both the process used and the enormous complexity involved in dealing with vast quantities of qualitative research. The transcripts were over 800 pages. The relationships explored were not just of these four constructs to each other but also included relationships to other constructs and of course to innovation outcomes.

- c) The importance of thick vs. thin descriptions when dealing with such data. Numerous other sources had to be checked to gain an understanding of what stood behind such statements including checking with the finance section on delegations, comparisons of delegations across the organisation to determine if there were inconsistencies between delegations to budgets to hierarchy, and so on. A shallow surface analysis of the text would not have revealed the meaning behind such words.

Given such complexity in the data, the role of a multidiscipline team became vital in exploring and analysing such data both to reduce bias and ensure a rich and deep understanding of it. Team members were selected on the basis of their discipline-specific practitioner expertise or their theoretical academic expertise. While the author did the bulk of the initial coding all team members were exposed to the outputs generated by NUD\*IST 6 and all were encouraged to explore and challenge these outputs. This approach had two immediate benefits. Firstly, from a methodological standpoint it provided some form of quality assurance by ensuring coding was not merely done on the whim of an individual or within the confines of a single discipline. Secondly, it generated a rich dialogue, albeit time intensive, over many review sessions. Much of the richness came from each team member sharing their interpretations of a piece of text as well as providing additional background insight on particular issues or topics. These interactions also helped provide insight into the overall interconnections between the various constructs and definitions. It soon became apparent to the team that this debate was far more meaningful than any of the outputs generated by NUD\*IST. As a result the team ceased to use NUD\*IST after the first few initial meetings. Definitions and terms were then generated using Microsoft Word as the written documents became more artefacts by which to progress the discussion and record conclusions.

The aforementioned text example is typical in that like most text examined in this study it was found to have multiple layers of possible interpretation. An enormous amount of discussion and challenge was generated by the multidiscipline team in order to determine what sat behind each piece of text. For example, the two pieces of text in Table 2 when exposed to such scrutiny revealed issues around the consequences of lack of trust in terms of reduced efficiency and longer cycle times. The second piece of text revealed the misunderstanding around the legal requirements of Occupational Health and Safety for a safe work environment as opposed to how the corporation interpreted such requirements – in this case a risk assessment on how to stack rail safely. Such analysis did not just rely on the perceptions of the multidisciplinary team. In the case of the first piece of text the Risk Unit in Firm C was contacted to determine what the official corporate line was on the interpretation of the Occupational Health and Safety Act. Therefore, a rich range of sources went into considering what sat behind the pieces of text as well as the context in which such views were formed.

All of the findings which are detailed in Chapter 5 have been arrived at by going through a similar process of numerous iterations until finally developing a construct. The following pages provide examples of NUD\*IST documents which were transferred into rough Microsoft Word documents and the definitions used for the constructs defined in Chapter 5.

The following example is a NUD\*IST output. It is for illustrative purposes only hence it is limited to one page. The highlighting shows how each text was coded under a specific

research stream – in this case corporate governance (CG). The same text was then coded under the other headings of information and social factors as well as innovation. All combinations were then run and several overlaps were detected. Numerous constructs were tried using this approach.

### Example 1 Transcript in NUD\*IST

QSR N6 Full version, revision 6.0.

Licensee: xxxx

PROJECT: Qualitative project 2, , 10:14 am, Nov 27, 2003.

REPORT ON NODE (F 14) '(CG) Compliance'

Restriction to document: NONE

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(F 14) //Free Nodes/(CG) Compliance

\*\*\* Description:

Stream: Corporate Governance

Coded by: Kevin

+++++

+++ ON-LINE DOCUMENT: C1 ZP22 Closed

+++ Retrieval for this document: 41 units out of 1389, = 3.0%

++ Text units 242-247:

their admin people. They cannot audit their admin people on what they 242  
are doing exactly because they just don't have a clue about SAP they rely 243  
on their admin people totally. Mmmm So their admin people can be plugging 244  
in the wrong numbers everywhere Yeah, (unclear comment in the 245  
background) Yep and it's internal, even though it is internal charging 246  
most of it, stuff like that, it can build in a lot of costs Did you learn 247

++ Text units 523-525:

Typical TLM attitude, hard to get away from that. That's the really 523  
(unclear)I suppose where and when pretty much Is there any information 524  
you um need for compliance purposes? NO nuh (unclear) Most of all that 525

++ Text units 600-605:

from purchase order, putting that into a batch and I know those processes 600  
 I do the inventory audits probably once every 3, 6 months sort of 601  
 thing. Probably 3 times a year I will sit down with the admin person and 602  
 go through, do a physical count and where we got it and also use SAP then 603  
 I'll rely upon, um ,um like checking how much we have charged out to the 604

For reasons already stated, NUD\*IST was soon abandoned as a useful way of progressing the research because while it show overlap it soon became apparent that the frequency at which constructs overlapped in the text was not necessarily a good indicator of the strength of such variables.

Example 2 provides a simplified version of how this data was refined into a construct, “compliance” - under the heading of corporate governance. Note that by now Microsoft Word is being used for the reasons already stated around requiring greater understanding of the meaning behind the text.

**Example 2 – Refining text**

**Governance- Compliance – definition derived from data.**

Construct	Elements	Examples
Compliance	Specialist Skills	<p>They cannot audit their admin people on what they do because they (managers) do not have a clue about SAP so they rely on their admin people totally. They could be plugging in the wrong numbers.</p> <p>Most of my supervisors need my help and its mainly in the way they do their day-to-day job out there – it’s a lot in there administration skills.</p>

	Records Management	<p>They don't sort of have a great consciousness of getting the records and keeping good records.</p> <p>Documenting and reporting what they are actually doing out there – and particularly on the planning side. We're learning lessons the hard way with litigation.</p> <p>It's not truly informal – there's a lot of documentation like emails.</p>
	Standards	<p>Legally there is only a certain amount of rail we can hold at Banyo for height.</p> <p>The standards are more regimented standards than flexible standards.</p>
	Hierarchy	<p>Because of the hierarchy the approval systems in the chain can be a bit sluggish. There could be more trust to reduce the number of hands.</p>
	Risk	<p>It's (governance and compliance) to ensure the organisation has at least some sort of reasonable expectation for people on accommodation standards.</p>

This process was repeated in order to develop all the constructs in the framework defined in Chapter 5. Clearly far more text was used to justify the construct and elements than suggested by this example which is given for illustrative purposes.

**APPENDIX G**

Number	Findings	Issues/Implications	Recommended Actions/ Strategies	Expected Outcomes (1st Order) preferably also stating which level/s of innovation it will be in <ul style="list-style-type: none"> <li>• Transformational</li> <li>• Radical</li> <li>• Architectural</li> <li>• Incremental</li> </ul>	2 <sup>nd</sup> Order Outcomes – these do not need to be stated now but this will form a large part of future research. Specifically it will cover off additional benefits which are expected such as increasing decision support systems (DSS) that will enhance planning or the reverse that trust is need to make DSS work.
1	Governance Macro				
1.1	Risk Management is stymied by GOC governance	Unable to enter into certain alliances where risk is shared	Proactively enquire into legislative changes to allow QR to act more as a Corporation	Transformational – Better management structure will better manage supply chains - CSO	Decision Support Systems Power Social Capital
1.2	Governance structure for a GOC limit ability to enter into innovative SC agreements	Limits opportunities for Transformational improvements as unable to enter into strategically advantageous agreements QR has started this with government relations position - CSO	Better manage social capital to influence bureaucrats at the macro level (that is linking) Use R & D research to shape the agenda i.e. Universities, etc – link to R & D	Radical – if QR can be freed up to pursue its reform agenda	Increased flexibility when entering into tendering phases of contracts, where opportunities for SC partners to take over some aspects of chain where they have the expertise.
1.3	Speed agility flexibility are affected by governance	Large contracts for standard items have to go through hoops and can cause delays for months where urgent action is required	At the operational level to enhance bonding only Lean Production techniques with Govt. Pilot Innovative Contracts which are low risk yet can be used to create new precedents. Actively influence State Purchasing by taking lead role on key commodities e.g. fuel	Architectural innovation linked to the influencing State Purchasing Policy and Bureaucrats	Greater Market Credibility Ability to alter present brand perception
1.4	Re-evaluate how we evaluate risk at the macro process as distinct to the atomistic process as we do presently	Lack of a process methodology which can combine an integrated risk management strategy	Realign risk around macro process	Chief Risk Officer	Enhanced ability to manage government.
1.5	Existing arrangements with long histories are fine	Supply chains function better in a high trust, low compliance regime.	Supply a) Extend our bridging capabilities with other organisations so we can rapidly form supply chains for example unincorporated joint ventures b) Use success stories to show case principles c) Link to Activity Based Costing Initiative with SAP to drive out costs	Architectural – especially if QR is willing to more clearly define it core competencies	Improvements to QR's processes i.e. SC literature states this is where 70% of opportunities are.
1.6	Role of Bureaucrats is extremely important	How to better comprehend their issues and proactively address such concerns	a) Role of CSO to be reviewed i.e. develop performance measures, etc to see just how CSO is improving this	Architectural/Radical – subject to how sophisticated QR can be at understanding the issues confronted	

			<p>function.</p> <p>b) Process map government approval processes and key players in such processes.</p> <p>c) CEO to adjust role to spend a major part of his time working with these bureaucrats.</p>	by government and ministerial minders.	
2	Governance QR Level				
2.1	Governance system which generates massive overheads and discourages innovation	Increased bureaucracy created to manage governance, more time spent on compliance rather than innovation	<p>a) Risk Management – needs to run on different lines and power of functional heads to run governance agendas removed.</p> <p>b) Standardisation – wherever possible. Centralise compliance to standards such as State Purchasing Policy, Public Records Act etc. to allow divisions to focus on core activities</p> <p>c) Work Flow – implement wherever possible and within the context of a process review methodology which ensures processes and activities are not only automated by reviewed on a regular basis for improvements.</p>	<p>Architectural –</p> <p>a) Reduced overheads. due to highly skilled specialists doing organisational planning/compliance issues, rather than more low skilled staff dealing with the same issues without the required skill-sets.</p> <p>b) Platform for process improvement – refer virtual SC literature</p>	Lowered staffing levels with key roles done by SS sections
2.2.	Centralised power with discipline heads who in turn drive their own self interests at the expensive of good business, this means we drive functional interests not process interests	Discipline heads role needs to be reviewed e.g.. to collaboratively make arrangements with other areas across QR to ensure their solutions are not detrimental to line of business and QR's global interests	<p>a) realign power structures to the new business models, which is line of business not functional (To be included into the review of the risk management system – CRO)</p> <p>b) Develop measures for macro process i.e. line of business which integrate the activities of support groups in a way which demonstrates their contribution.</p>	<p>a) Architectural – allow staff and service providers to work on improving processes as opposed to present situation of avoiding risks.</p> <p>b) Capacity Dynamics to play a major role in this respect – may involve changing their business direction i.e working on QR rather than market opportunities.</p>	
2.3.	Generating records to show compliance	Records are seen as a compliance activity, not as a knowledge resource	<p>a) Review knowledge management strategy re interface with KM and process management.</p> <p>b) Risk management and KM interface – does QR want so much information to be tacit and if so what strategy needs to be generated to reduce the risk of loss.</p> <p>c) Review metadata strategy (urgent) i.e. need to understand deeper reasons why QR is ignoring such an important plank for reform – link to six sigma examples and difficulty to improve due to data quality.</p> <p>d) Educate on the business benefits of good record-keeping not for</p>	Incremental - Reduction on time spent on compliance, as information required to make good decisions are on hand in a timely manner, therefore less rework and duplication required, leading to more time on core activities not administrative matters	Use the systems as a Decision <b>Support</b> tool



			compliance reasons, manage previously tacit information in a structured way so it can be used as an informational resource		
2.4	Ring-fencing causes complex transactions to meet competitive neutrality requirements, creating more interfaces at operational level	Administrative Costs.	<p>a).Process owner to explore ways of simplifying the processes and understanding the cost drivers involved.</p> <p>b) Determine what parts of Network Access genuinely require Ringfencing and which do not tin order to reduce complexity in dealings.</p>	Incremental (b) and potentially architectural ( a) subject to how advanced the process owner is allowed to be.	
2.5	Lack of free flowing information inhibits information sharing	Managers have their own budgets and are not mandated to use a corporate system, therefore access can not be provided, where and if required if they are not part of the same Group/Division	<p><b>a) Decision Support Systems (DSS)</b>  – need to a review to shift emphasis from SAP and systems to real DSS with emphasis on support. Such an analysis to include examination of the</p> <p>i) process approach used – if at all  ii) the measures used and how relevant they are  iii) Data integrity – and link to meta data.  iv) Information literacy  v) Ways to make people want to engage with information systems –e.g. SAP has no play facility which is doubtless linked to poor uptake.  vi) Analysis of what cultural factors and reward systems drive “feral systems” with a view to understanding how such needs can be incorporated into the system e.g. why so much “bloat-ware”?</p> <p>b) Process Management - Organise Management around a process so that everyone in a process has access to the information required to efficiently perform their duties without duplication, or if justified allow access to that information via a corporate system with appropriate access controls</p>	<p>Architectural - SAP provides a platform to move from functional silos to corporate wide processes. However this will not happen under present practices.</p> <p>Incremental - Reduction on time spent on compliance, as information required to make good decisions are on hand in a timely manner, therefore less rework and duplication required, leading to more time on core activities not administrative matters</p>	
2.6	Capital Works	Decision Rules seem to work against local process and business interests	<p>a) Review rules to gain understanding of how costly wasteful processes can never be improved under present arrangements i.e. stuck with wrong technology.</p> <p>b) Review asset management strateav</p>	Radical – technology if done well is still one of the best options open to get the large step improvements it so desperately needs.	

			and its relevance. c) Advise present Investment Strategy Review team of findings with view to altering guidelines.		
3	Information Systems				
3.1	People				
3.1.1	Not trusting systems “no one trusts SAP”	No trust may be a prime cause of the creation of ‘feral’ systems	Develop local champions to champion the cause and understand the system from operational points of view (This may require some KPI capability)	Architectural - Wider acceptance of system, leading to fewer ‘feral systems’ meaning more standardisation of reports and lower administration costs	
3.1.2	Business Units develop ‘feral’ systems to optimise their function despite corporate best interests	Can corporate systems do the job of feral systems? Why are feral systems being developed?	a) Work with operational areas to find a corporate solution that meets their needs or if one isn’t available and it is in-house developed make it the corporate standard and support it. b) Instigate a forum to find out the ‘why’ we are developing systems	Incremental - Lower rework of similar software, less testing for example there is over 50 picture editing software packages, which all do a majority of the same tasks. Even the cheaper ones cost more as they need to be tested. Reduced amount of software packages in QR and lower administration costs Radical – Standardisation will allow platform for corporate wide process improvement.	
3.1.3.	Technology is complex therefore intermediaries are used to interpret information from systems	Managers have trouble being heard by IT, they know what information they require but do not necessarily know how to express it to the IT profession	DSS people to ask management what Functionality, reports they need to run the business effectively. Business management conduit, between managers and IT solutions	Incremental/Radical - Managers get the reports/information they require to perform their work efficiently – may then have a better understanding of their processes and can then generate improvements.	
3.1.4.	Heavy reliance on tacit knowledge and individuals ‘hero’s’	If a hero wins lotto and leaves QR the knowledge that they store is lost.	a) Knowledge management strategy to turn the tacit knowledge into explicit knowledge to manage the risk of loss of key individuals across the chain b) Review HR practices which drive such a hero culture i.e. work long hours, know everything at an individual level, make yourself indispensable etc – this is at odds with a lean manufacturing philosophy	Architectural – Just making the process explicit allows other minds to engage in improvement activities. Risk is also reduced as reliance on key members across the chain is diminished.	
3.1.5.	Lack of motivation to make compatible systems across supply chains	Some divisions invest heavily on getting systems to meet their needs but then don’t share the information/systems	Reward and recognition systems to reward information sharing and decision support	Architectural – if managers increase awareness of possible systems that can aid business and decision support they will also be in a position to get a better line of sight for the entire process which drives costs into their business.	
3.1.6	Individuals have to take	Individuals have to train themselves	Develop systems/ or motivators that	Incremental – in times of reduced	

	initiative to make communication effective as the system does not have the formal mechanisms to assist in this area	to use certain systems as they don't have the access/training provided even though it is required	reduce the need for individuals to go to such lengths and/or happen easily. All appropriate training is identified and appropriate means for course attendance are taken	waste and rework	
i.2.	Processes				
3.2.1.	No one has knowledge of the entire process	Silo mentality, I only need to know where I fit in not the bigger picture.	a) Develop standard methodology from the focal business's point of view b) Supply Division engages with key stakeholders in supply chains using the standard methodology to have a common mapped supply chain c) Process Owner role – define who does what i.e. function, vs. Process. Vs systems and different accountabilities. Of each party and how they interface with each other and other issues such as metadata.	Architectural – corporate wide focus which will allow configuration of components in more efficient ways.	
3.2.2.	No standard process management technology (i.e. Process mapping)	Each business group uses different applications to map. i.e. Visio, IDEF0, Flowchart etc.	Demonstrate the benefits of a standard process management methodology. Engage the business groups in ways that they find useful. A standard methodology can then making discussions with key stakeholders easier as explanation of the maps would not be required beforehand	Architectural – permits better configuration of corporate wide assets and processes.	
3.2.3.	Lack of compatibility across systems and methodologies within the supply chain	This includes external SC members, which makes collaboration hard if they do not have access to our systems and vice versa	Enable access to key components in supply chains such as stock usage to enable modern SCM techniques such as automatic stock replenishment/ordering. Stock is replaced when used not ordered, which often happens after required.	Architectural – allows release of assets such as warehouses	
3.2.4.	Lack of Macro Process measures e.g. capacity of the chain	Key members of the supply chain know what there is in the chain, the costs, but do not know the capacity which affects flexibility, causing stockpiling just in case (JIC)	Capacity Dynamics integrated into DSS with emphasis on support. Devise ways for Integration of technical and operational expertise to develop and implement measurement systems that are user friendly and relevant.	Architectural - reduced inventory levels as trust in the capacity to replenish stock piles is known	
3.2.5.	Collaborative Planning	Presently plan around functional requirements	Develop methodology to be used QR wide which addresses a) Skills and Competencies b) Social facilitation methods c) Technical Processes d) Measurement systems. e) DSS tolls, etc	Architectural – the strategic planning cycle is the best point to set strategies and targets around process improvements which can then be monitored and reported upon.	

3.3.	1. Hardware/software				
3.3.1.	One shoe fits all – people modify the process to fit the system, this results in the creation of feral systems	SAP doesn't give the reports managers need so they develop their own systems to get them	Find out why feral systems are created and why corporate systems cannot meet those needs	Incremental - Reduced development of in-house reporting tools	
3.3.2.	Synchronisation of information exchange is required for all members in the chain	Other than email and fax information exchange is limited as current firewalls prevent other sharing of information. Only major suppliers can offer EDI links to their own system, but even this does not give them access to ours.	Innovative technology such as Portal technology, which would allow even remote locations, which previously could not even be connected to the wide area networks (WAN) or local area networks (LAN). This for the price of an Internet connection will allow remote locations access to a secure site outside internal firewalls, which will permit information sharing and yet be secure to deny access to external users without appropriate access. This is also another way of sharing information to other members of the supply chain such as OneSteel without the need to set up EDI links.	Architectural - Vendor self service would be possible via a portal type of link, or in the future the Supplier Relationship Management module in SAPR3 may make it possible. This would enable online invoicing, vendors to check out blocked invoices and fix errors themselves, check out stock levels and start their own production accordingly etc.	
3.3.3.	Even with R3 the system is backward focussed, Operational areas require Decision Support Systems To be forward focussed which can generate multiple scenarios	Key members across the chain don't know the answer to the 'what if' scenarios, therefore they stockpile JIC	Develop Decision support system for forward focussed planning and resource management across supply chains	Architectural - Scenarios are run which shows how Supply Chains cope with extraordinary events such as black mountain. Which then leads to more trust and lower reliance on JIC stockpiles	
3.3.4.	Records Management is fragmented causing lack of information sharing or duplication of records	Each member of the chain has a separate system for managing records, no one has ownership of them	QR could utilise leading edge technology to communicate across the chain: First at the intra-organisational level; Then through the use of portal technology we could allow access to our records on an "as required basis" to collaborate and share information with inter-organisational members such as OneSteel so we can share vital information such as unloading problems, stockpiles, even order information and forecasts.	Incremental - No duplication required as all members have access to the records as needed, problems and solutions are worked on collaboratively.	
3.4.	Data				
3.4.1.	Metadata and accountability is missing	Records are generally managed on an ad-hoc basis without appropriate metadata to enable faster retrieval and accountability	Metadata strategy which at a bare minimum seeks to build upon and integrate the following initiatives. <ul style="list-style-type: none"> <li>• Corporate thesaurus</li> <li>• Activity based costing</li> <li>• Process mapping methodology</li> </ul>	Incremental/Radical - Common search tools/metadata (structured data about data, for example file title, date created etc.) available for all members internally regarding the supply chain. One system with full accountability,	

			<ul style="list-style-type: none"> <li>Records Management / Knowledge Foundation steering committee findings re Functions, etc.</li> </ul>	therefore separate audits not required.	
3.4.2.	Data integrity and reliability issues. E.g. feral systems are not as robust as off the shelf models	Feral systems such as Access databases are not saved to the same standard as corporately supported systems, they also don't have the richness as off the shelf systems	Interim strategy required to find reasons why feral systems are created in the first place. Maybe emerging technologies/motivators should be looked at to systematically improve practices	Incremental/Architectural Reduction in systems and reliability increase of the remaining ones	
3.4.3.	low trust in systems therefore 'feral' systems are used to compensate for outcomes based business groups	"No one trusts SAP"	As per Knowledge Management strategy	Incremental/Architectural - Higher trust in SAP	
3.4.4.	Dependence / reliance on social sources rather than technical source	A lot of respondents said they sent a fax then rang up to confirm, if it was okay.	Investigate the needs of the social systems and how the technical system can interact with the social system	Incremental - Using workflow would automatically trigger when a task is complete and also trigger if it wasn't completed on time and escalate to the responsible manager, therefore lowering the need to check up on work.	
4	Communication				
4.1.	Chain is generally dependant on fax/phone/email not computer systems	<p>a) Most members of the chain trust people not systems</p> <p>b) The social capital built up between OneSteel and QR is worth a lot but we are unable to value it.</p>	<p>a) Generate a social capital strategy i.e. identify what and where it is how it can exploited, etc , with emphasis on bridging capital and the role it can play with innovation via "weak ties"</p> <p>b) See if possible to generate a financial figure on social capital involved with suppliers and use in tendering evaluation process.</p>	Architectural – via enhanced decision support which goes across the chain.	
4.2.	Hierarchical in terms of decision making	SC members at the lower level say that speed and efficiency is lost when they are unable to make the decisions required to get the work done	Review the authority and delegation and PD.s to determine if the Decision making powers match the requirements of the workers in the process	Incremental/Architectural - Speed and decision making improved by being done at the correct level	
4.3.	Planning is not communicated to all SC members	Key areas in the chain are aware that there are plans but have never seen them	In line with the requirements of the business model develop a methodology and capability for collaborative planning	Architectural/Radical - All potential problems have the opportunity to be identified if everyone involved has access to the planning of supply chains Also if linked with the strategic planning cycle it is logical to link to large step improvements	
4.4.	Key knowledge bridge's in chain	A few individuals have high bridging capital but do not necessarily build upon it in constructive ways e.g. Present system has lots of padding with grass stocks, etc.	<p>a) KM Strategy – to determine how much tacit can be made explicit and where tacit knowledge needs to be kept in that state determine what to do</p> <p>b) Social Capital Strategy</p>	Architectural – resulting in improved decision support across the chain.	

		Stock is replaced when used and then not ordered; as a result this often happens well after the lead time needed. .	c) Decision Support		
4.5.	Strongly expressed view that Face to Face meetings were valued	SC members communicate via Phone, fax, email, but value the face to face meetings more	Develop virtual team capabilities in line with new research which identifies the need to meet face to face as required.	Incremental - Lowered travel costs as more meetings are done by teleconferencing or virtual chat rooms, some face to face will still be required.	
4.6.	Lack of resources to facilitate Face to face communications	SC members would like to meet with other SC members on a more regular basis to share insights, findings but don't get the opportunity	Improvement in organisational development. strategies as well as the resources to do this. Also enable more virtual teams HR ?	Architectural – will enhance ability to work on entire SC.	
5.	Architecture				
5.1.	Technology is not currently proving to be the panacea required to solve all of the communication, data transmission, and information transfer requirements of the network enterprise. Feral systems are being created and introduced in isolation with no apparent integration across the network.	<p>Investing enormous money, effort and time as well as assuming much of our productivity improvement can come from this strategy. This assumption needs to be challenged and a more critical assessment of the benefits we are gaining needs to be in place.</p> <ul style="list-style-type: none"> <li>□ There appears to be a challenge for existing architects and designers to find ways and opportunities to engage with a wider audience consisting of client stakeholders and other disciplinary professionals, to find common grounds, and to establish both a basis for and a means of discourse.</li> <li>□ The inter-disciplinary approach appears to present a vehicle for richer and deeper understandings of interactions across the network and organisational impacts on the design process in a network context, not usually considered or revealed by current design approaches.</li> <li>□ Workplace design (i.e. the creation of 'place') appears to have potential to lessen the tension between the competing power dynamics contained within organisational hierarchies and which are inherently part of the social system within the 'space of flows'.?</li> </ul>	<p>a) Develop review methodology for technology investments. b) R &amp; D committee to develop strategy position around converging technologies and need for associated organisational innovations so that the issues around failure to get expected returns can be understood more fully. This strategy should be wide ranging and include investigation of the issues associated with inter-disciplinary activities. c) Examine links to asset management strategy to determine if there are gaps in the process at this level. d) Investigate the role of workplace design in more depth to determine if this asset can be better used to facilitate better use of technology.</p>	Radical – due to transformation of business processes as a result of technology	

		<ul style="list-style-type: none"> <li>❑ Workplace design cannot provide any all encompassing revelations in isolation, there must be a corresponding realignment of management practices and a reconsideration of the policies which provide the authority for members to use 'place' in intended ways.</li> <li>❑ What appears to provide the best 'fit' between theory and practice could be to allow and encourage 'places' in the network (the hubs and nodes) to be self-organising in terms of work processes and thus the workplace design solutions to support those processes. A variety of generic 'place' typologies (built on those already developed by others) may provide the tool kit which could deliver both appropriate workplaces and a means to monitor and control space distribution and utilisation in practical terms.</li> </ul> <p>From a management and efficient system perspective, together with a means to satisfy social needs, it appears from the data collected that a possible approach may be to specify outcomes to be delivered by each individual 'place', and then for network interfaces to be managed in a cooperative manner.</p>			
5.2.	Members appear to have a much greater reliance on social connections rather than technological or management systems to get their jobs done.	Social capital appears to be a vital element in SC productivity. However there does not appear to be anything in place which to identify , manage or improve such intangible assets.	Develop a social capital strategy for SC aimed at improving innovation in terms of diffusion and rate of uptake. .	Architectural – is members could meet for improvement rather than scheduling purposes then better use of existing components should follow.	
5.3.	Sense of place seems to be strongly influenced by the level of autonomy delegated to workers, or to the physical distance away from the hierarchical centres of power, rather than on any particular design features or considerations? Design features	Clearly a blind spot in terms of QR's OD strategy and governance structures. Links in well with STS literature and need for elbow room.	Determine implication if QR chooses to go down lean production road as opposed to STS road.	Incremental if kept at STS level Architectural – if kept at the lean production level	
5.4.	Sense of connection appears to be related closely to the level or degree of personal	Refer comments 5.1.	Refer 5.1	Unknown – assume incremental	

	relationships rather than any contribution by technological tools				
5.5.	A majority of participants appear to require, or at least prefer access to a variety of workplace locations and configurations	Our workplace design policy needs to be reviewed	Hand on findings to Property Division.	Unknown – assume at least incremental due to providing facilities which match the different needs of the individuals concerned	
5.6.	Bureaucracy (hierarchical power) is prevalent and closely protected within organisational silos	Refer comments 2.2.	Refer 2.2	Incremental at the very least and possibly more.	
5.7.	Physical symbols of power and control appear to be important, particularly to upper management levels	Raises several questions about QR's culture development strategy and if such a document exists gaps which may exist in it i.e. the need to align physical artefacts with the rest of the strategy	Take up with HR.	Incremental – attitudinal change takes a long time and the type discussed here centres on hygiene factors.	
5.8.	Operational levels rely heavily on local and tacit knowledge to compensate for the restrictions of rules and policies which are rigid, highly structured, and often ignored	Refer comments in 3.1.4.	3.1.4	Incremental/Architectural – subject to going from work flow through to useful SC wide DSS	
5.9.	Collocation is desirable but in most cases impractical. This could be compensated for by spending time in the office of others in the supply chain to exchange information and to learn up and downstream processes.	Need to get a lot clearer about how if at all, virtual supply chains can be made to work in such a context.	Refer to HR for development.	Incremental – at the bare minimum and assuming the virtual team concept can be harnessed.	
5.10.	Most members were unaware of whether a workplace design policy existed within their own organisation or not. Those who were aware of a policy, did not know anything of its content or intent	Determine if it this matters and if so what to do	Determine who needs to be made aware, why and what it is they should do with such knowledge in relation to innovation.	Incremental – assumption only at this stage.	
5.11.	The organisation which had no formal workplace design policy found it easy to self-organise and be flexible to quickly adjust to changing needs or challenges	One Steel Issue	Advise OneSteel of findings,	Unknown	
5.12.	The entire management category participants indicated that they considered the physical workplace had a large impact on the functional operations of the network and the ability	Refer 5.7 and 5.9..	5.7 & 5.9.	5.7 & 5.9.	



	for people to interact. They also considered that participation in the design process was very important but very difficult to manage across a dispersed geographical area, and very few had any ability or authority to influence the process.				
5.13.	Distribution and use of physical space appears to be a management control mechanism rather than an enabler of processes and interaction	Still no idea what this means for innovation – based on STS literature it would appear a negative	Generate recommendations on how staff could be more empowered to take greater control of their workplace.	Incremental – mainly hygiene	
5.14.	Observation sessions indicated a strong desire for privacy and some need for territorial ownership or control, but equally, a willingness to utilise and share common space for group interactions	Refer 5.12	5.12	Incremental	
5.15.	Much of the documentary evidence is couched in terms of management rhetoric, jargon, and generalisation, intent on promoting a public image quite contrary to the operational reality. Policies and contracts appear to be influenced by a desire to minimise risk and maintain control, while at the same time avoiding responsibility. Floor plans, where they do exist, indicate a one-size-fits-all approach to workplace configurations and an obsession with security. The organisation with a flexible approach to workplace layouts, whilst having no recorded plans, appears to be able to negotiate space distribution, usage, and flexible arrangements in a much more autonomous manner	Refer 1.1. 2.2.	1.2. & 2.2	Incremental – link to comments on culture change.	
6.	Learning				
6.1.	Lack of structured learning around supply chains, it is around compliance.	Functional silo's still retain a lot of kudos with operational staff. Will need to address this issue.	Develop learning systems that focus on supply chains not functions,	Architectural – learning across the chain is key to reconfiguration of components in novel way.	

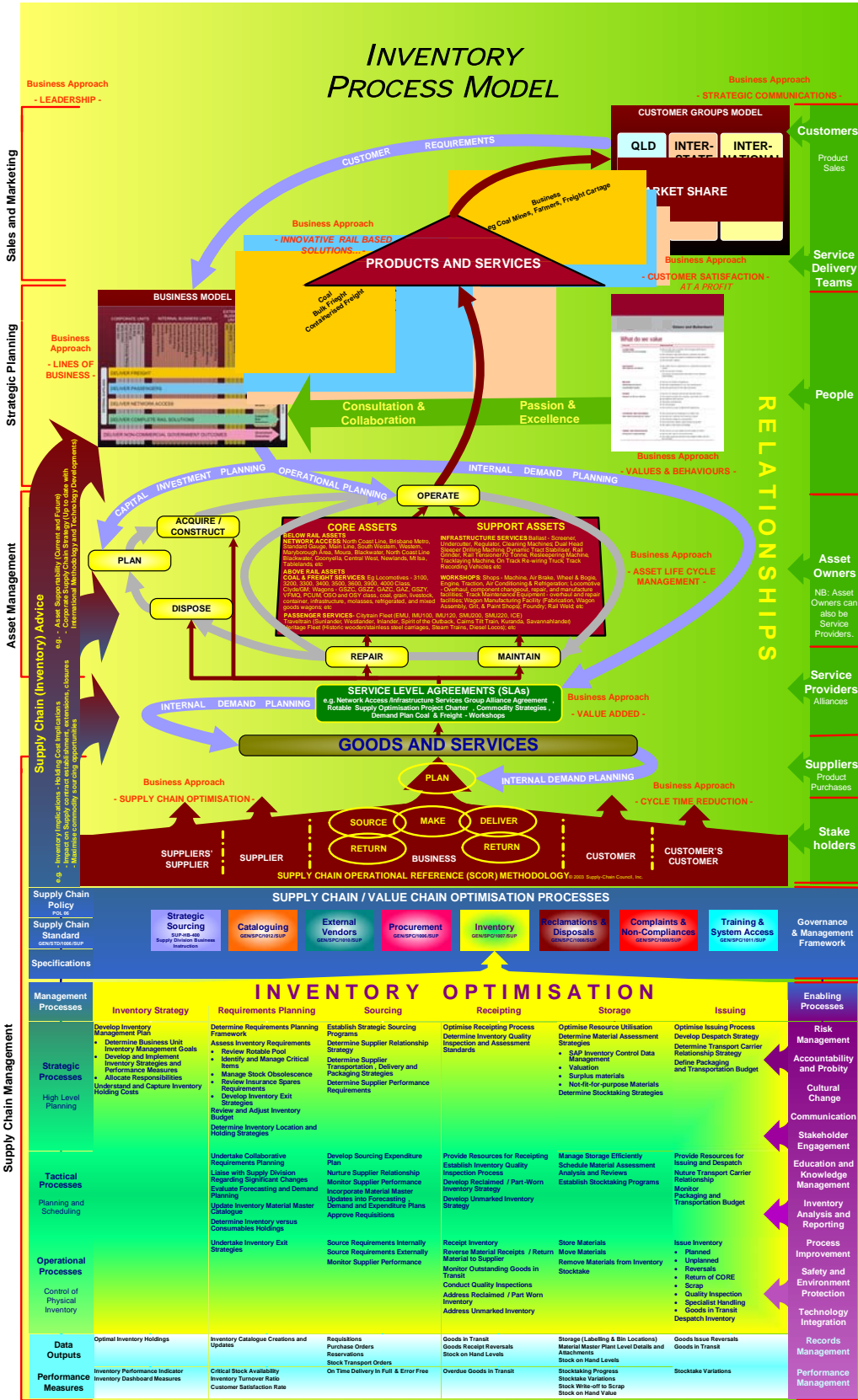
	scheduling operations	Lack of structured learning focussing on SCM			
6.2.	Barriers are time and geographical distance, technology isn't being used in a helpful way.	There isn't LAN access at Acacia Ridge therefore only fax/phone used to communicate, whereas all modern SC literature points towards ERP communication channels  Need teams with the skill sets and capabilities to take advantage of modern Supply Chain practices.	Virtual teams to ensure collaboration Making the technology more accessible given the reality of literacy both IT and information Test the emotional profiles of people to engage with technology	Architectural – moving from functional silos to process focus.	
6.3.	Documents aren't being used appropriately	Each silo uses different forms, standards etc. This leads to more training required for operational staff and more administration than if done at a corporate level.  Standard set of documentation to follow internal supply chain processes which uses common metadata and document design.	Link to metadata and standardise document design, either screen based or paper based e.g. standardise protocols	Architectural – a major issue for QR if it wants to go to a process based organisation.	
6.4.	Formal structures are around individual structures not supply chains.	Each different group/division has a different set of standards, work instructions etc. Sometimes causing miscommunication or even competition or demarcation issues arise  More visibility of the chain, allowing for effective communication and sharing of knowledge	Align structures around SC processes not functions Develop job competencies around SCM, logistics and collaboration.	Architectural	
6.5.	Language, eg. SAP updates, unreadable to the masses	A lot of corporate communication is unintelligible to the masses, therefore the messages are lost  All messages are clear to everyone not just the specialists in that area of expertise	Metadata, editorial design of corporately published material, Visual factory, look at interfaces with international icons eg McDonalds	.Architectural	
6.6.	World view and mental models, are based around safety and operations	QR values keeping the trains running which is sometimes overly risk adverse to the point of not being competitive Learning which promotes innovation methods for running a corporate entity in a competitive environment.	Learning organisational principles around mental models, which inhibit learning i.e  a) Teach staff action learning principles b) How to use benchmarking to improve. c) Systems thinking d) Reward and recognition for sharing information and knowledge e) Mechanism for experimentation.	Architectural	

6.7.	Training & Education is not useful, transfer training model is not effective when done outside their work environment	<p>Respondents to interviews expressed that training courses done at corporate levels were not tailored to meet operational needs. They had to learn ways to meet their own needs and then pass that information to their team members. (leads to feral systems being created.)</p> <p>A learning environment that promotes operational excellence and corporate systems that are accepted and valued as tools for providing information to aid in Decision Support</p> <p>Issues around consistency and variation of training under a localised approach need to be explored. To avoid creating too much variation.</p>	<p>Train them in the field or re-jig supervisors to do training themselves, Set up mechanisms to spread knowledge across QR on operations management</p> <p>Train and educate on innovation techniques and practices.</p>	Incremental	
6.8.	Culture around companies is different. Social relationships between actors is suboptimal	<p>Different companies across the supply chains have different cultures which causes relationships to be formed in different ways, i.e. hierarchical, functional or process based</p> <p>Staff with better people skills, able to communicate better across supply chains</p>	<p>Develop soft skills competency methodologies needed to enhance social capital, complete with multiple solutions on how to develop and refine such skills. i.e. beyond sheep dip training. training re dimensions identified in social capital.</p>	Incremental and perhaps architectural	
6.9.	Leadership styles are still rewarding bureaucratic/compliance activities rather than innovation.	Not helpful for innovation	<p>Leadership – develop more around transformational leadership. (e.g. PLP confused around this issue)</p>	Incremental - Architectural	
6.10.	Org strategy not around supply chains Alignment around personal goals.	<p>Rewards are based on group/divisional performance, managers are therefore looking into their own best interests not the corporations sometimes</p> <p>Need to move away from self serving goals supported by the functional silos to those set at the higher level of the business process - this will ensure QR's interests are always foremost.</p>	<p>Org Strategy – needs to determine core competency, if SCM then align strategy accordingly.</p> <p>Develop methods to better determine intrinsic motivators which individuals possess and are best suited to SCM.</p>	Architectural	

6.11.	Trial-ability of innovations are important factors associated with adoption of technology	Operational areas are concerned that they do not get enough chance to test new technology as it comes available. They are sometimes left without the functionality they require  Need to generate Innovations that are robust and do not require the need to develop feral systems so that they can serve a wider supply chain reality	Set up learning environments that can ensure "trialability".	Architectural	
7	Planning				
7.1.	Don't have a plan that looks at the entire supply chain.	Key respondents do not have enough knowledge of the entire process which could aid in innovation Common process for mapping supply chains, which is both easy to interpret but contains enough information to be useful	Develop Supply chain process, with a view to reduce complexity	Architectural - Radical	
7.2.	Lack of good information cause people to pad/stockpile	Key respondents don't trust information about availability of stock etc. so they hide stock JIC	As above	Architectural - Better information = better decisions and lowered dependency on inventory stockpiles	
7.3.	Disconnects between Strategic, Tactical and operational planning across the chain	Long term planning doesn't include scenario planning, the what if's	Develop comprehensive model around collaborative planning, which includes the social and tech requirements DSS tools to provide multiple scenarios	Architectural - Better planning will lead to fire prevention not fire fighters	
7.4.	Orders to execute are a long process that seems to have a lot of complex steps, funding capital works etc. At the micro level money spent on operations and no evidence of money spent on the improvement cycles	The sign off process for necessary work is long and done manually. This causes the need to find ways around the formal structure to 'get the job done'.	a) Develop strategy for better Systems integration, b) Culture development strategy to address cultural practices which drives behaviours to hide inventory	Architectural - Automate the approval process to fast track necessary expenditure, freeing up time to spend on improvement cycles	
7.5.	Detailed planning is not done at the correct time	Job costing is done after a job begins, no detailed planning such as when we went to tender for the Bauhinia spur.	Do as per the Bauhinia model	Architectural - True costs are known before projects begin, leading to correct resource allocation	
7.6.	Collaborative planning does not appear to be achieved because the lack of performance measures are unavailable to members across the chain	Performance measures are based on group/divisional targets and are not disseminated to other members and are not standard	a) Develop performance measures across entire chain (Capacity Dynamics to assist) In line with building upon new business model. b) Develop measures which are corporate, supply chained based which are able to be shared to provide common goals and aid in collaborative planning	Architectural and possibly radical if used to direct capital works investment.	

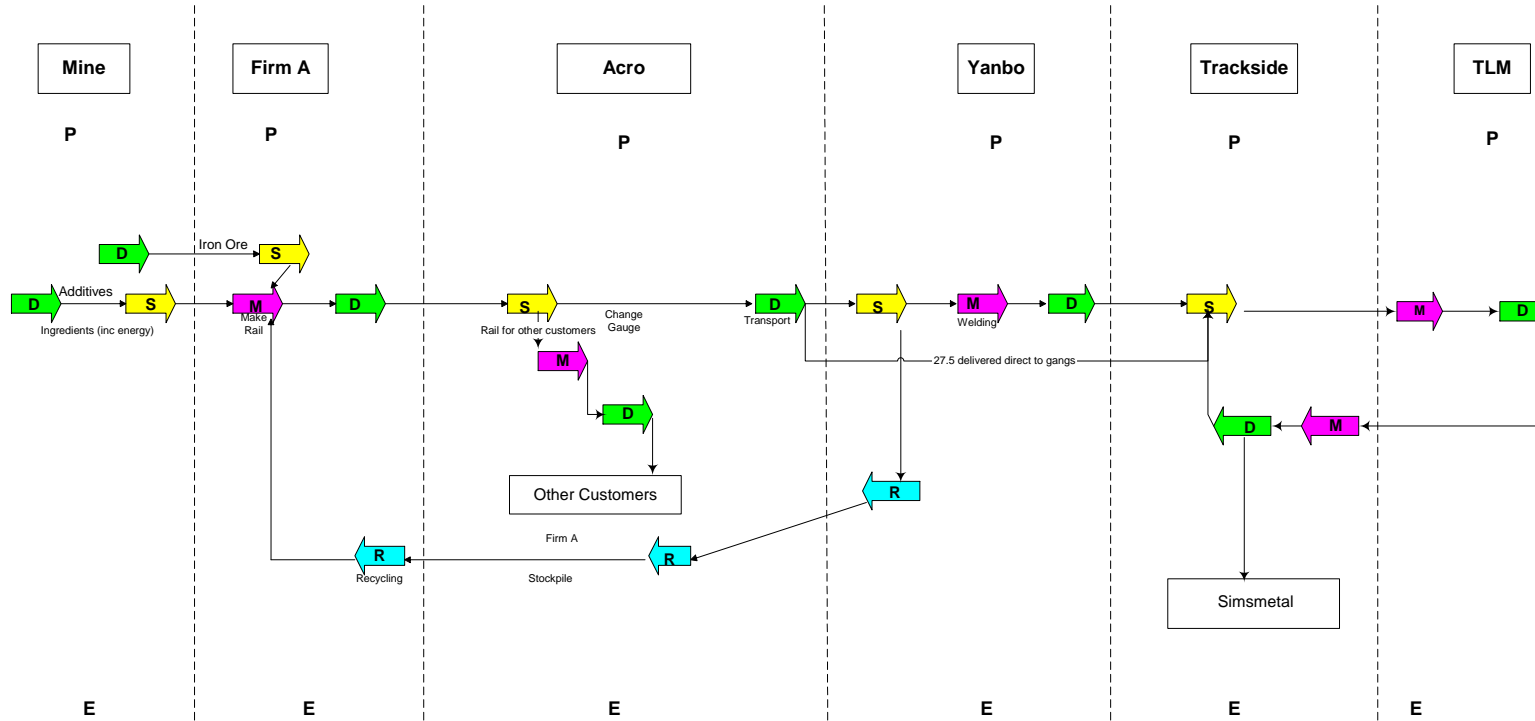
7.7.	Don't have a framework which allows smooth planning activities across org. boundaries and indeed across QR.	Issues of Ringfencing often affect willingness to share information both internally and externally.	a) Getting forecasting and scheduling activities improved to enable innovation in planning b) Planning activities to include innovation and R & D considerations in order to which cater for external and internal supply chain customers/suppliers improvements.	Architectural to Radical	
7.8.	Innovation is stymied by the governance structures, that is the tendering process offers the best opportunities for improvement but we are unable to implement those opportunities	Suppliers would like to offer better solutions than the tender allows but are unable to put forward their ideas. To win tenders they must follow it verbatim	a) Investigate legal options to gather such information. QR needs to think through strategic issues pre tender b) Expressions of interest could be placed before tender which invites suppliers to offer how best a service/commodity can best be offered, which may include them providing some of the service that QR does currently, but uncompetitive due to lack of specialisation.	Radical – Transformational.	
7.9.	Distribution and engagement of plans needs to be better	Key stakeholders felt left out of the planning process yet their ideas if included would ensure planning is more robust	Involve more stakeholders in the planning process as key stakeholders have	Architectural	
8	Social capital				
8.1.	Longevity of the commitment with OneSteel, reasonable trust at the operational level, (Banyo exception) fair willingness to collaborate, strong relationships at the bonding and bridging level, but not at the linking level.	OneSteel would like to operate more as a collaborative partner rather than tied down by legalities caused by such a strict agreement as is currently in place	a) Develop methodology which will deliver throughout analysis of social capital, using the framework and indicators document 1378.0 published 2004 to measure it b) Implement a strategy to improve social capital in key areas	Architectural and even radical if the focus is on weak ties and bridging capital.	
8.2.	Not a great deal of empowerment due to the governance structure and the lack of training in an empowered way.	Stifling local innovation initiatives.	Develop methodology for virtual teams which looks at identifying and developing social capital, with either existing or new suppliers	Architectural and perhaps radical if governance structures change.	
8.3.	Change of suppliers would lose a lot of social capital built up over many years, it may take many more years to build this with a new supplier	Operational areas trust members across the chain, thus less reliance on the contract. A new supplier would cause more reliance on the contract which is less advantageous than on trust	Determine how to place an economic value on such activities as well as operational measures so that such factors can be considered more fully in terms of tender evaluation and proposed improvement initiatives.	Architectural	

# APPENDIX H



# APPENDIX I

Firm C Steel Rail Supply Chain Using Level 1 SCOR Thread Diagram



**Firm C Steel Rail Supply Chain Using Level 2 SCOR Thread Diagram**

