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Leading innovation and entrepreneurship: an action research study in the Australian red meat industry

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Leading Innovation and Entrepreneurship

An Action Research Study in the Australian Red Meat Industry

Christine Anne Pitt

A thesis submitted in fulfillment of the requirements of the degree of Doctor of Business Administration

Southern Cross University
Australia

March 2007

DECLARATION

I Christine Anne Pitt (formerly Christine Anne Raward) hereby declare that this submission is my own work and that the intellectual content of the thesis is the product of my own work. To the best of my knowledge it contains no material previously published or written by another person, nor material which has been accepted for the award of any other degree or diploma at any educational institution, except where due acknowledgement is made.

I also declare that any contribution made to the research by others is explicitly acknowledged.

Christine Anne Pitt

Date: 13 March 2007

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While this thesis represents the culmination of my own academic efforts, it would not have been achieved without the encouragement and support of many friends, family and colleagues. Unfortunately, it is not possible to name all who have helped shape my thoughts or who have contributed their own energy and time to the 'action' of this research study. However, I particularly acknowledge the following.

Firstly, my employer Meat & Livestock Australia Limited for their financial assistance and access to resource materials that provided the context and depth to the study.

Secondly, I acknowledge the many talented and passionate people working in the red meat industry who were willing to take a risk and try out the new approaches in their own businesses. Without their support I would have been severely restricted in the scope and impact of the study. Without their wisdom my ability to develop meaningful learning and insights would have been significantly impoverished.

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Fundamentally however, this thesis is a testimony to the value of teamwork. Thanks to John Elias (previously from MLA) who made an invaluable contribution by tracking down many elusive references. To the members of my own work team I owe an enormous debt. Without your amazing energy and commitment, your considerable intellectual contribution, and your unwavering trust and loyalty, I could not have achieved this outcome. I can only hope that you have gained as much from the experience as I have and that you are equally proud of our achievements.

Finally, and most importantly, my thanks go to my family: to my parents David and Mary-Jane for your unconditional support and your pride in my successes; and to my children Lachlan and Skye for your understanding when I could only give you half my attention. But it is to my husband, Colin, to whom I owe the greatest debt. It was your vision and creative genius 15 years ago that set this journey in motion and it was your sacrifice that enabled me to be the one to take it this far.

ABSTRACT

The dynamic and often hostile competitive landscape of the twenty-first century has created significant threats to existing patterns of successful competition. A review of the extant literature and research about innovation and entrepreneurship identifies their importance to ensuring corporate vitality and wealth generation in today's global economy. For over one hundred and fifty years the foundation of Australia's prosperity has been from resource-based industries such as agriculture and mining. Changes in the world economy clearly require a much broader range of globally competitive industries to sustain Australia's strong economic position. It is proposed that the older more traditional industries must also undergo rapid transformation if they are to maintain their competitive advantage.

This thesis describes an action research study conducted over four years (2002-2006) in the Australian red meat industry. The study aimed to extend the body of knowledge on innovation and entrepreneurship in the industry. It also sought to explore options for improving practice through interventions which would accelerate the development of firm innovation capabilities and a culture of innovation more broadly across the industry.

The thesis articulates a comprehensive contextual framework of the sector's innovation and entrepreneurship system and an associated model of firm innovation and entrepreneurial capability. In addition, a new methodology for mapping the effectiveness of an innovation system is developed based on the emerging concept of system failures. By applying this methodology, a new *SI-Intervention Framework* is developed and a suite of intervention projects is tested for acceptance and potential impact with industry participants.

It is proposed that the thesis offers a contribution to knowledge through convergence of the related fields of innovation and entrepreneurship into a

single conceptual framework. In addition, the development of new theoretical and analytical models and methodologies build on and extend the work of previous researchers. Evidence of improved practice is demonstrated in relation to incorporation of the new framework and methodologies into the industry's future innovation strategy, building internal capability in the innovation intervention agency, and acceptance by industry participants of the new approach.

It is acknowledged that the models and concepts articulated in this thesis are at an early stage of development and that there is a significant amount of further research required. Similarly, as the study is focused on a single case, no attempt is made to offer broad generalisations. The value of the study will ultimately be determined by the specifics of future research contexts and can only be evaluated to the extent that it seems accurate, appropriate and authentic from the reader's own perspective.

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PEER-REVIEWED PUBLICATIONS ARISING FROM THIS RESEARCH

Raward, C. (2004) “Leading innovation and entrepreneurship: An action research study in the Australian red meat industry” in Gillin, L., Yencken, J. & La Pira (eds.) “Regional Frontiers of Entrepreneurship Research: Refereed Proceedings of the First AGSE-Babson Entrepreneurship Research Conference” *Australian Graduate School of Entrepreneurship Research Report Series* Vol. 1 (2) Swinburne University of Technology, Melbourne

Raward, C. (2004) “Leading innovation and entrepreneurship in the Australian red meat industry” *Innovation: management, policy & practice Vol. 6(3): 430-443*

GLOSSARY

Australian Graduate School of Entrepreneurship	AGSE
Australian Institute of Food Science and Technology	AIFST
Australian Meat and Livestock Corporation	AMLC
Australian Meat Industry Council	AMIC
Australian Meat Industry Employees Union	AMIEU
Australian Meat Processor Corporation	AMPC
Australian Quality Council	AQC
Australian Quarantine Inspection Service	AQIS
Australian Research Management Society	ARMS
Centre for International Economics	CIE
Chief Executive Officer	CEO
Competitive Intelligence	CI
Department of Agriculture, Fisheries and Forestry	DAFF
Department of Industry, Tourism and Resources	DITR
European Foundation for Quality Management	EFQM
Information and Communication Technology	ICT
Information Technology	IT
Innovation and Entrepreneurship	IE
Meat and Livestock Australia	MLA
Meat Industry National Training Advisory Council	MINTRAC
Meat Research Corporation	MRC
National Food Industry Strategy	NFIS
Occupational Health and Safety	OHS
Organisation for Economic Co-operation and Development	OECD
Prime Ministers Science, Engineering & Innovation Council	PMSEIC
Return on Investment	ROI
Research and Development	R&D
Researching Accelerated Processing Innovation & Development	RAPID
Rural Research and Development Corporations	RRDC
Science and Technology	S&T
Sectoral System of Innovation	SSI
Small to Medium-sized Enterprise	SME
System of Innovation	SI
Venture Capitalist	VC
Work Related Issues Program	WRIP
World Trade Organisation	WTO

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CHAPTER 1
INTRODUCTION AND THESIS OUTLINE

1.1 Introduction

In today's dynamic and often hostile competitive landscape, firms are faced with the challenge of capturing competitive advantage through revolutionary business strategy innovation that creates whole new industries and markets (Hamel 2002). In order to survive and prosper firms must: dramatically shorten product life cycles; learn new forms of competition based on global competitiveness; develop new business models which require supply chain partners to engage in sophisticated relationships and strategic alliances; scan for the emergence of disruptive and frame-breaking innovations fuelled by rapid advances in new areas of science and technology; and cope with the criticality of speed in making strategic decisions without falling prey to the dangers of indiscriminate bandwagon behaviours (Fiol & O'Connor 2003).

There is a growing body of literature about the nature and importance of innovation (Chandler, Keller & Lyon 2000) and the link between the effectiveness of innovation management and sustainable competitive advantage. According to Lin (2001, p.1), "Success in the twenty-first century can only come from competing through continuous corporate innovation." Similarly, Smith and West (2005, p.3) note that "All major theories and all empirical analyses of economic development treat innovation as the key explanatory factor in growth." References to the role of innovation in social and economic development can be traced back more than 60 years to a time when Schumpeter (1942) emphasised the importance of innovation for the business firm and society as a whole.

The emerging field of entrepreneurship has also generated considerable attention in the research literature due to its importance to corporate vitality and wealth generation in today's global economy. Zahra, Kuratko and Jennings (1999) argue that entrepreneurship increases national prosperity and competitiveness by virtue of its impact on employment creation and the development of new goods and services. Guth and Ginsberg (1990), Lumpkin and Dess (1996), Miller (1983) and Naman and Slevin (1993) have also proposed that corporate entrepreneurship can be used to improve competitive positioning and transform corporations, their markets and industries as opportunities for value-creating innovations are developed and exploited. There is now a firmly established empirical base for claiming the effectiveness of corporate entrepreneurship in increasing competitiveness (Lumpkin & Dess 1996; Zahra & Covin 1995).

There is considerable evidence in the literature to suggest that both scholars and practitioners alike have found the understanding of innovation and entrepreneurship to be problematic. In addition, there remain significant levels of concern among researchers regarding the efficacy and value of much of the work to date. In fact, innovation has been identified as an extremely complex, chaotic and highly unpredictable area of research (Van de Ven et al 1999).

This thesis describes an action research study in the Australian red meat industry conducted over four years (2002-2006). The study aimed to extend the body of knowledge on innovation and entrepreneurship and to explore options for improving practice through interventions which accelerate the development of firm innovation capabilities and a culture of innovation across the entire industry. The central research question addressed by the study was:

How should MLA design and deliver interventions that will significantly enhance the innovation capabilities of the Australian red meat industry in order to sustain competitive advantage in a rapidly changing environment?

At commencement of the study a narrower perspective on designing interventions aimed specifically at improving innovation capability within firms was the target. However this perspective was significantly expanded as the research unfolded and was informed by: insights derived from the emerging data; progressive engagement with the innovation systems literature; and the evolution of my own understanding as I undertook the iterative action research processes of: *plan; act; observe; reflect.*

1.2 Overview of Research Context

For over one hundred and fifty years the foundation of Australia's prosperity has been from resource-based industries such as agriculture and mining. However, the changes in the world economy clearly require a much broader range of globally competitive industries to sustain Australia's strong economic position. In addition, the older more traditional industries such as agriculture and food production must also undergo rapid transformation if Australia is to maintain the current dominant status.

The red meat industry is one of Australia's most significant exporters, earning approximately $8 billion each year and employing more than 300,000 people. The industry makes a very important contribution to many regional communities through the creation of employment, business and service opportunities. Australia is the world's largest exporter of red meat and livestock, exporting to more than 100 countries and with exports representing 60% of the industry's trade. In addition, the meat industry is a key component of the broader processed food industry which is Australia's largest manufacturing sector with a turnover in excess of $55 billion and $16.9 billion in export earnings in 2001-2002. The food industry is one of the fastest growing manufacturing sectors in Australia due to growth in exports, increased value-adding and the development of more sophisticated food products.

Meat & Livestock Australia Limited (MLA) is the industry body charged with the responsibility to provide marketing and R&D services for the whole of the red meat industry from 'paddock to plate'. MLA is a not-for-profit company governed by: corporations' law; the *Australian Meat and Livestock Industry Act 1997;* a Deed of Agreement with the Commonwealth of Australia; and a Memorandum of Understanding with other industry bodies and peak councils. Funding for MLA's activities are derived from: Commonwealth government R&D funds; compulsory levies imposed on livestock transactions; collective contributions from the meat processing sector; and investments by external partners in MLA innovation projects. MLA's mission is to create opportunities for growth and increased profitability and sustainability in the industry. As a sub-set of this, MLA seeks to ensure that the innovation culture and capabilities within the industry equip it to maintain competitiveness.

Based on this structure, MLA occupies a relatively unique position as an intervention agency that straddles both the public and private spheres. As a recipient of government funding, MLA is identified as a key policy instrument in the government's innovation agenda. However, as an industry-funded body, MLA is also perceived as an important integrator of public-private interests and a key mechanism for industry engagement. Finally, as a co-investor with commercial partners in delivering innovations directly to the marketplace, MLA also has a mandate to operate in the entrepreneurship domain. It is in this area that the benefits of effective innovation strategy ultimately achieve traction in terms of accelerating industry competitive advantage and ensuring long term sustainability.

Throughout this study, I have occupied the position of General Manager Innovation Services, with overall strategic and implementation responsibility for a division within MLA which accounts for approximately 20% of the company's activities (in monetary terms). The core function of the role is the development and implementation of MLA's innovation strategy post-farm gate which includes: investment in a wide range of R&D programs; facilitation of R&D adoption; management of intellectual property and commercialisation of R&D outcomes; and building industry knowledge and innovation capability. At the commencement of this study, the division's annual budget was $12 million, and it grew to $34 million by 2005-2006.

The Innovation Services division employs a team of professional innovation program managers and project coordinators (12 in 2002 expanding to 26 in 2006) from a diversity of science and technology backgrounds. Most staff members have combined research and commercial experience and many have higher degrees at masters and doctoral levels. The position I held thus provided a unique opportunity to investigate the area of innovation capability within an important Australian industry sector, and to influence policy and practice in this area.

1.3 Justification for the Research

While it is one of Australia's oldest and most successful industries, in recent years the red meat industry has begun to experience a number of major challenges. These include: declining market share due to escalating competition from more entrepreneurial and aggressive competitors; devastating consequences from food safety scares and animal health problems such as 'mad cow disease'; and emerging difficulties in attracting and retaining appropriately skilled labour.

On the other hand, there are also many opportunities for the industry to improve its competitive position including:

- The ‘clean and green’ image of Australian food products
- Substantial government R&D funding provided to the industry
- High quality infrastructure support such as that provided by MLA
- The promise presented by emerging technologies such as genomics, biotechnology, ICT and robotics

Several studies in the 1990’s identified that the Australian red meat industry was under-performing in terms of global competitiveness and declining productivity performance (Booz, Allen & Hamilton 1993; Industry Commission 1994). A number of early research programs were aimed at introducing specific change management initiatives to assist the industry to improve its overall performance. However, the level of effectiveness in implementing these approaches was varied (Cordery et al 1996). In recent years there is anecdotal evidence of an increasing awareness by the industry of the importance of innovation and the role that new technologies and business strategies can have in improving overall competitiveness.

To respond to the challenges and to capture the opportunities outlined, the industry must be able to develop and implement effective innovation strategies. Justification for this research is based on the proposition that there is an opportunity to improve the industry’s competitive position through building innovation capability within individual firms and facilitating the emergence of a stronger innovation culture across the industry sector.

1.4 Thematic Concerns

In undertaking field-based research, it is critical to both understand and attempt to address the core concerns of key stakeholders. In action research terminology these are referred to as the ‘thematic concerns’ and, as Kemmis and McTaggart (2003, p.9) note, "The thematic concern defines the substantive area in which the (action research) group decides to focus its improvement strategies". In broad terms, the key stakeholders for this research study included government, industry and Meat & Livestock Australia. The overall concern of these stakeholders was to ensure that their substantial investment in R&D delivers real benefits to the industry and to the broader community.

As indicated, MLA has responsibility for leadership in developing and implementing the red meat industry's innovation programs. Despite some initial difficulties when MLA commenced operations in 1998, by 2002 significant growth and consolidation in the post-farm gate innovation programs had occurred. However, there was a concern that MLA's approach was still predominantly *ad hoc* and fragmented due to the difficulties associated with rebuilding relationships and responding to industry's needs.

While there was a suite of R&D programs in place, there was very little evidence of a cohesive approach across programs and there was virtually no evidence of integration more broadly across the company's R&D and marketing activities. It was apparent that the paternalistic approaches employed in the past did not work as they encouraged passivity and even hostility within an industry culture that predominantly perceived R&D as a cost and not an investment in business growth. MLA was struggling to work with industry R&D committees that seemed to be focused on short-term reactive projects aimed at fixing immediate crises and who had very little tolerance for longer term strategic research. As there were no clear and relevant measures of innovation impact it was difficult to convince key industry stakeholders to take the risk of investing industry funds in longer term programs. What was lacking was an integrated innovation strategy that was based on a clear understanding of threats and opportunities in the external environment and that took a holistic whole-of-industry perspective.

Despite this, MLA had achieved some impressive growth by implementing a new approach based on co-investment in R&D projects in partnership with individual firms. However, it was apparent that there was considerable variation in the quality of many of these projects and there were serious concerns that the focus on rebuilding relationships may have resulted in projects being approved that were doomed to fail.

Although it was still early days, it was becoming clear that an enormous amount of effort would be required to assist firms to develop proposals and then manage projects that were underway. One of the major frustrations for MLA program managers was that there did not appear to be anyone at a firm level that had the skills or expertise to identify strategic innovation targets or to manage the innovation process. It was also evident that many firms were not equipped with the change management skills that would be required to successfully adopt the new technologies and systems that were being developed by MLA.

There were similar frustrations associated with the lack of alignment between industry needs and the projects being submitted by R&D providers. This was imposing significant strains on MLA's internal resources with program managers spending a lot of time 'translating' between the two groups. Perhaps of even greater concern was the lack of effective commercialisation skills available to the industry. This meant that MLA was often required to either go offshore to find a company to commercialise innovations, or to support inexperienced start-ups while they built completely new businesses.

Finally, because the portfolio had grown quite rapidly, MLA had recently employed a significant number of new program managers. It quickly became clear that MLA did not have sufficient resources and tools to assist managers to cope with the complexity of their work as they attempted to support an industry that didn't seem to understand what they were talking about.

It was clear that MLA had to start doing things very differently if current and proposed growth activities were to be sustained. MLA needed to experiment with ways to create industry ‘innovativeness’. Preliminary investigations indicated that this was something new and had not been attempted in a comprehensive and integrated way within the existing agricultural innovation framework. It was even possible that there would be resistance from firms and industry bodies who would not necessarily see this as MLA’s role. The new approach was likely to be very resource intensive and no immediate funding mechanisms for conducting this type of research were in place. In addition, the MLA Board might have seen a change in role as high risk with the potential to detract from what was perceived as the core purpose of funding and managing R&D. It was even possible that too much success could threaten the long-term position of MLA if industry built capability and became less dependent on MLA as a result.

Despite these risks, I developed a summary of the core concerns and possible responses and submitted a proposal to MLA’s Managing Director to undertake a research study in this area (see Table 1.1).

Table 1.1: Core research concerns

Concerns	Potential MLA Responses
• Industry culture not supportive of innovation • No measures of impact of innovation programs • Fragmented innovation strategy • Lack of innovation skills in industry • Poor alignment of R&D providers • Absence of commercialisation skills in the industry provider network • Lack of suitable framework and skills within MLA	• Better understand the environment in which the red meat industry operates • Develop a model of firm innovation capability • Identify support services that MLA could provide • Develop and communicate measures of impact • Develop a whole-of-industry innovation strategy • Transform ourselves

The proposal was approved and it was agreed that a formal approach for undertaking the study within an academic framework was appropriate (Doctor of Business Administration at Southern Cross University). It was anticipated that in addition to the doctoral thesis, the results of the study would also be presented as an *Innovation Strategy Framework* for the MLA Board and industry and government stakeholders.

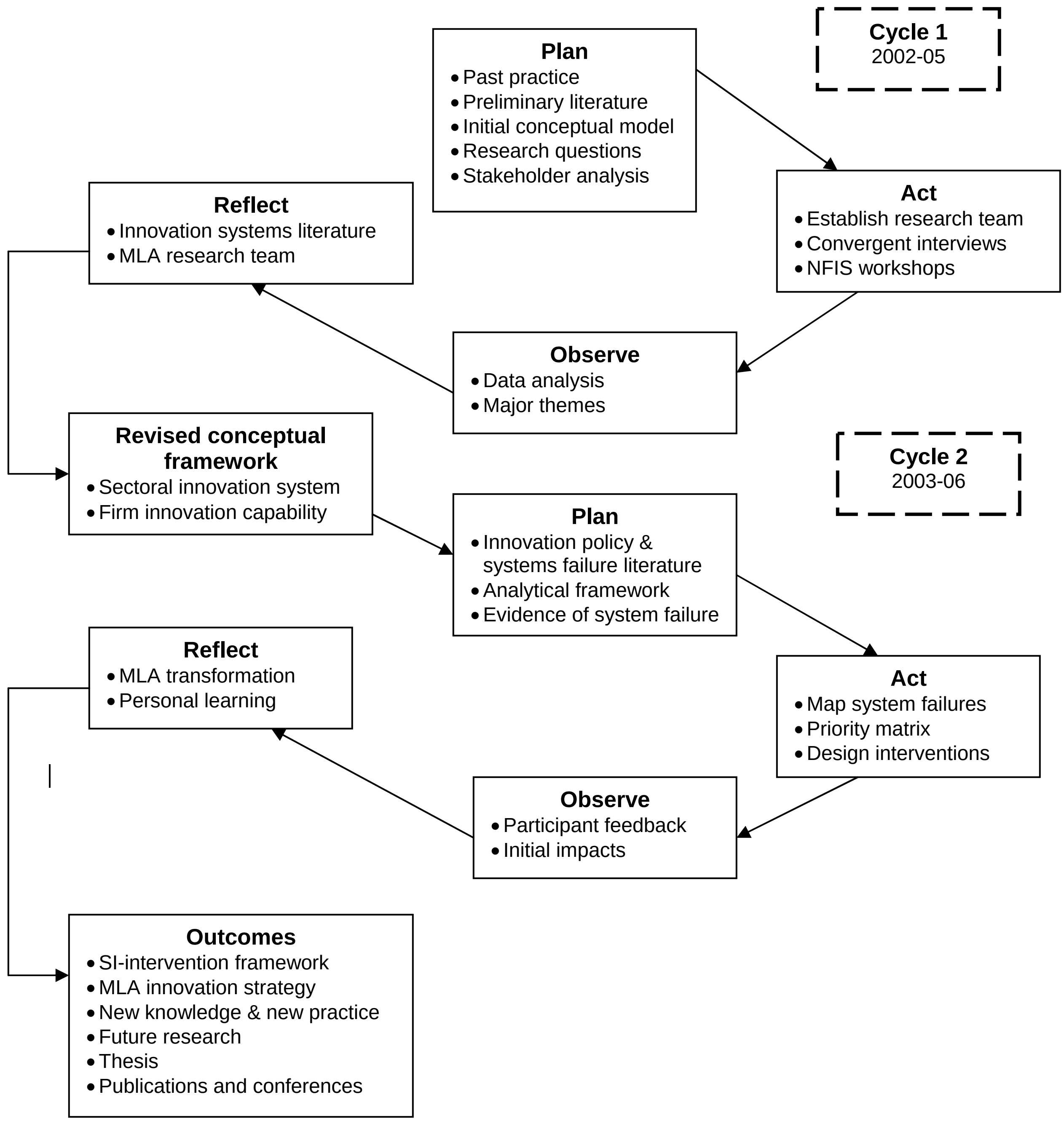
This thesis represents the outcomes of my focus on these concerns over the ensuing four years culminating in the development of a new *SI-Intervention Framework* for the design and delivery of innovation intervention services which has now been adopted by MLA.

1.5 Overview of Research Process

In any research study it is important for the researcher to explicitly articulate his/her paradigm or theoretical framework so that the reader can evaluate the process, methods and outcomes from within the researcher's particular perspective or value-base. The methodology selected for this research study was action research. This methodology belongs to the critical interpretative paradigm of social science research in which researchers are seen to be a critical part of the research process and the perceptions and interpretations of the participants are central to understanding (Ticehurst & Veal 1999). Action research has been found to be particularly useful when a study is seeking innovation, change, growth and transformation of firms and their leaders/managers (Wilson-Evered & Hartel 2001). It has been suggested that in-depth inductive studies should be conducted in the innovation field to safeguard against the premature adoption of a rigid framework which may limit the scope of inquiry (Dyer & Page 1988; Van de Ven, Angle & Poole 1989). Specifically, the collaborative and participatory approach embodied in action research methodologies was deemed to be most appropriate to MLA's proposed intervention framework as it would be likely to require a high degree of stakeholder engagement.

The research study was conducted over the period 2002-2006 and consisted of two major research cycles (at the macro level) with multiple 'cycles within cycles' (at the micro level of individual activities and interventions) embedded within the overall research design. While subsequent chapters include detail of the specific methodologies and iterations that occurred within the major cycles, Figure 1.1 provides a summary of the action research process.

Figure 1.1: Research cycles



It is noted that while two distinct cycles are evident, they did not conform to a rigid linear sequence and there was a degree of overlap in the middle of the study. As the conceptual framework was being refined in the reflective phase of Cycle 1, the planning and action phases of Cycle 2 commenced. This reflects the often complex nature of action research which must remain flexible and adaptive to the realities of the research context.

A key outcome of this research was to improve practice within MLA. This included the application of new methodologies and conceptual frameworks to the design of innovation intervention strategies, and also the building of internal capability within MLA. I therefore considered it important to engage members of my own team extensively in the study and this was achieved by the formation of a seven-member MLA research team.

1.6 Limitations of the Research

Given the complex and multi-faceted nature of the subject matter being researched, it is important to minimise ambiguity by explicitly identifying the specific limitations of the study. As noted by Wolfe (1994), many of the problems associated with innovation research may be due to the failure of researchers to clearly articulate the nature of their research. In this study there were a number of limitations, some of which were beyond my control but which were considered to have the potential to influence the outcomes. Other limitations were explicitly imposed as a means of controlling the scope for practical or other methodological reasons.

The most obvious limitation of the study is the limited generalisability associated with a single case, the Australian red meat industry. This limitation was inherent in the overall purpose and context of the study in that the outcomes of the research were specifically to improve practice in the intervention strategies of the service provider (MLA) to this industry sector.

Criticisms regarding the lack of generalisability of action research are not uncommon. Clearly no observations or interpretations that have been derived from a single context are ever perfectly repeatable of transferable to different contexts. As noted by Kemmis and McTaggart (2003, p.357), “It is an illusion to believe that research methods and techniques provide secure paths to truth and certainty”. Fundamentally, ‘truth’ is shaped by particular views and contexts and can only be evaluated to the extent that it seems accurate, appropriate and authentic from the reader’s own perspective. Nonetheless, the cyclical, data-driven nature of action research inherently provides opportunities for constant evaluation of method, findings and meaning that other research methods may not provide.

Opportunities arose during the study to ‘test’ the applicability of concepts and models more broadly in the food sector. This resulted in many of the ideas and frameworks being accepted and adopted by food companies and other service providers such as NFIS Limited. However, this is not presented as evidence of broad generalisability, merely an indicator of the potential to explore the application of the approaches developed in this study to these other sectors.

Another limitation imposed by the constraints of the research context relates to the four year timeframe within which the study was undertaken. The ultimate goal of MLA’s innovation intervention strategies are to improve the long term competitiveness of the red meat industry by significantly enhancing the innovation culture and capabilities of the firms and value chains that comprise the industry. As the study evolved, the target of these intervention strategies was enlarged to encompass the overall innovation system and the elements and functions that make up the system. Given the long time frame generally required to realise the benefits of innovation, it would not have been realistic to expect that significant outcomes from a new intervention approach would be achieved within a four-year research effort. The findings of this research study are limited to the measurable levels of acceptance of the proposed new approach by the industry participants involved in the second research cycle.

As a core purpose of this study was to improve practice and build capability within the MLA innovation team, the research methodology focused on a participatory and collaborative action research design in which co-researchers were engaged in a process of transformation. In this process they attempted to improve and change their own practice through their own efforts (Kemmis & McTaggart 2003). Engaging MLA staff directly in the research imposed a number of limitations as the study had to be conducted (to a degree) within existing priorities, existing skill sets, existing budget allocations, and with existing expectations from stakeholders regarding what the team should be focusing on. However, any compromises were considered to be justified as this participative approach:

- Enabled considerably more research to be undertaken with the additional resources
- Provided different perspectives on interpreting the data (triangulation)
- Ensured the team who would subsequently be responsible for implementing the outcomes of the research were provided with opportunities to learn during the research phase
- Allowed me to better understand the competencies required of intervention agencies implementing the new innovation systems approach

1.7 Thesis Structure and Presentation

In documenting an action research study, it is sometimes difficult to decide how much of the ‘journey’ will be of interest to the reader as compared to simply providing an elegant description of the ‘destination’ (with an overview of the research methodologies employed to arrive at the destination at each stage of the research). In this thesis, I have attempted to provide sufficient detail so that the reader will have some insight into the evolution in my thinking, the change in the conceptual models and methodologies that have emerged during the study and the multiple iterations and convolutions that have had to be navigated. In action research this is particularly important as the value of the research in terms of its generalisability will depend more on the subsequent applications by those who participate or read about the study than would be derived in a more conventional sense from the findings of the study itself (Phelps & Hase 2002; Watkins & Brooks 1994). As noted by Stake (1994, pp.240-241), researchers can only “assist readers in the construction of knowledge” by providing them with opportunities to “add and subtract, invent and shape – reconstructing the knowledge in ways that leave it differently connected and more likely to be personally useful.”

As was noted earlier in this chapter, this study was undertaken in two distinct research cycles with multiple ‘cycles within cycles’ embedded within the overall research design. In documenting this research I considered it appropriate to apply a chronological approach in which the chapters of the thesis proceed basically as the research unfolded. As such, there is no single chapter in which literature, methodology, or data analysis may be found. Instead, ‘findings’ and ‘theoretical connections’ are presented as emergent knowledge within each cycle and are subsequently incorporated as input into the next stage.

In action research, ongoing and iterative engagement with theory via the literature is an important part of the research process itself as the researcher seeks to identify support for emerging ideas or challenges to assumptions. As the literature was progressively reviewed throughout this study (and not undertaken ‘up front’ in its entirety), it is also presented temporally in each of the major research cycles. While this approach to documenting the research may appear unconventional, it is considered to be both epistemologically and methodologically justified in an action research thesis such as this (Phelps 2002). The overall structure of the thesis is summarised as follows:

Chapter 2 documents background information in relation to the Australian red meat industry so as to provide a detailed context to the research. In providing this overview, the intent is to demonstrate the importance of the industry to Australia's economic position, particularly in relation to the contribution it makes to export earnings, employment, and the sustainability of rural communities. A summary of the key challenges and opportunities facing the industry is provided to illustrate the major imperatives driving the need for innovation and change. A brief overview is included of the context in which innovation occurs within Australia and in particular the findings from a number of recent studies undertaken to develop an understanding of the Australian innovation system (Balaguer et al 2003) and to map Australia's science and innovation capabilities (Commonwealth of Australia 2003). The evolution of the specific model for government support for R&D in the agricultural sector is discussed as it is within this framework that MLA operates and the research undertaken for this study took place. The chapter concludes with an analysis of previous attempts at change within the red meat industry and a distillation of insights based on a reflective appraisal of the earlier work.

Chapter 3 serves to document the early starting points for the study and to detail the specific activities undertaken in the planning phase of Cycle 1. The overall action research methodology is described and the outcomes of the preliminary literature review are presented in the form of an initial conceptual framework. In keeping with the fundamentals of collaborative action research methodologies, the planning phase for the first major research cycle focused on understanding key stakeholder concerns and on determining opportunities for active participation by those most likely to be affected by the outcomes of the research. The chapter includes an outline of a structured stakeholder analysis undertaken to ensure relevant industry knowledge was captured and discusses formation of the MLA research team.

Chapter 4 details the acting and observing phases of the first major research cycle. The action stage of the cycle included a series of convergent interviews which involved multiple iterations of data collection, data analysis, engaging the literature and reflection by the MLA research team. Observations from the cycle are presented in the form of major themes articulated by industry stakeholders.

Chapter 5 represents a slight deviation from the chronological order in which the processes of data collection and engagement of the literature were undertaken in Cycle 1. The processes employed during this cycle were inextricably linked in relation to their input to the refined conceptual framework which represents the output of Cycle 1. However, the outcomes are presented in two separate chapters to assist the reader to distinguish those elements of the final framework which were principally data-driven (and reported in Chapter 4) from those based on the data and literature combined (and presented in Chapter 5). The chapter includes an overview of the findings from an extensive search of the literature in the areas of innovation systems theory and strategic entrepreneurship. The review of this literature assisted in broadening the study and provided important insights that significantly increased the scope and depth of the intervention strategies developed in subsequent stages. At the core of this chapter is a description of the revised conceptual framework of the sector's innovation and entrepreneurship system. To complement the overall conceptual framework, an integrated model of firm innovation and entrepreneurial capability was also developed.

Chapter 6 presents the planning phase for Cycle 2 in which two new and emerging areas in the literature were identified. These two areas relate to the concept of ‘mapping’ the effectiveness of an innovation system, and the concept of system failures and its application to the design of innovation policy and interventions. The chapter begins by outlining the implications for policy and intervention strategies when the new systems approach is employed. It is argued that the traditional neoclassical economic theories that have dominated innovation policy are based on the concept of ‘market failure’ which many researchers now consider to be too abstract and blunt an instrument to be useful. The systems approach to understanding innovation presents a new economic paradigm which acknowledges that innovation occurs as a result of complex interactions at many different levels. It is noted that while there have been significant advances in the development of the new systems approach to innovation there is very little theoretical or practical information to inform policy development in this area. Building on the work of previous researchers, an analytical framework is proposed which incorporates six areas of potential system failure as the basis for designing an integrated intervention strategy at the sectoral level. The chapter concludes with a plan for the second major action research cycle which involved applying this new analytical framework to the red meat sector’s innovation system and designing an integrated intervention methodology as the basis for a new approach by MLA.

Chapter 7 represents the culmination of the research study. It begins by describing the outcomes of applying the new analytical framework to the construction of a ‘map’ of system failures which revealed evidence of failure present in the red meat industry. Based on a process of rating importance against likelihood of impact, an intervention priority matrix is constructed. The chapter describes how a new SI-Intervention Framework was progressively developed during the second major cycle, and how potential intervention projects were identified and tested for acceptance through engagement with industry participants. The chapter concludes with a brief description of internal developments undertaken by MLA to build its own capability to deliver the new approach.

Chapter 8 begins with a brief summary which includes specific reference to the original purpose of the study and commentary on how the research questions were addressed. Reference is made to the implications of the study regarding contributions to knowledge as a result of the insights and learning achieved, and to opportunities for improved practice both for MLA and more broadly within the food and agricultural innovation systems policy arena. The chapter concludes with recommendations for future research and reference to how the new approaches could be implemented in practice.

CHAPTER 2
SETTING THE SCENE: THE RESEARCH CONTEXT

The purpose of this chapter is to provide background information and context for this research in relation to the Australian red meat industry. It seeks to demonstrate the importance of the industry to Australia's economic position, particularly in relation to the contribution it makes to export earnings, employment, and the sustainability of rural communities. A summary of the key challenges and opportunities facing the industry is provided. The major imperatives driving the need for industry change and innovation that form the basis for this study are described.

The chapter includes a discussion of the evolution of the rural research and development framework in which MLA currently operates and a reflection on past attempts at change in the industry. This review of historical data was considered essential in terms of identifying the overall focus for this study and in ensuring the research was informed by lessons learned from previous efforts.

2.1 The Australian Red Meat Industry

For over one hundred and fifty years the foundation of Australia's prosperity has been from resource-based industries such as agriculture and mining. While the changes in the world economy clearly require a much broader range of globally competitive industries to sustain Australia's strong economic position, the older more traditional industries must also undergo rapid transformation if they are to maintain global competitiveness.

The red meat industry is one of Australia's most significant exporters earning approximately $8 billion each year and employing more than 300,000 people.

The industry makes a very important contribution to regional economies through employment, business and service opportunities. Australia is the world's largest exporter of red meat and livestock, exporting to more than 100 countries and with exports representing 60% of the industry's trade. In addition, the meat industry is a key component of the broader processed food industry which is Australia's largest manufacturing sector with a turnover in excess of $55 billion and $16.9 billion in export earnings in 2001-2002. The food industry is one of the fastest growing manufacturing sectors in Australia due to growth in exports, increased value-adding and the development of more sophisticated food products.

On the domestic market, intense competition between the two major retailers results in industry profit margins of only 2-3% which are significantly lower than international comparisons. It is predicted that rationalisation and consolidation of global retailers will play a major role in defining the food industry over the next decade and Australian companies and supply chains will be forced to rapidly become more sophisticated and competitive.

2.2 Industry Challenges and Opportunities

Two major studies in the 1990's identified that the Australian red meat industry was under-performing in terms of global competitiveness and declining productivity performance (Booz, Allen & Hamilton 1993; Industry Commission 1994). When compared to major competitors such as the USA and Argentina, Australia was found to have very high cattle to meat conversion costs (see Table 2.1). In addition, productivity growth rate was found to be significantly lower in meat processing when compared with other food competition within Australia. A study by AACM International (1996) showed that while the productivity growth rate of the Australian poultry meat industry had averaged 8% per annum for the previous thirty years, in beef processing the average was only 1.2% over the same period.

Table 2.1: Raw product conversion efficiency

Efficiency Indicator	USA	Argentina	Australia
Total cost of beef slaughter & fabrication (¢ per kg dwt)	41.2	73.3	115.0
Labour cost of beef slaughter & fabrication (¢ per kg dwt)	16.5	26.1	49.4

Source: Booz, Allen & Hamilton 1993

In more recent times it has become apparent that the industry is continuing to face enormous challenges which include:

- Globalisation, rationalisation and multi-national ownership
- Changing consumer demands and declining market share
- Reduced margins and declining competitiveness
- Significant difficulties in attracting and retaining skilled labour
- Regulatory intervention in a range of areas such as food safety, environment and occupational health and safety
- Intense competition and the emergence of major new competitors such as Brazil
- Multiple crises such as: animal disease outbreaks; high mortality in live exports; attention from animal activists; and food safety incidents

As discussed in subsequent sections of this chapter, while a number of early research programs were aimed at introducing specific change management initiatives to assist the industry to improve its overall performance, the level of effectiveness in implementing these approaches was varied (Cordery et al 1996). However, in the future the industry could be seen to be well-placed to capture benefit from a range of emerging opportunities including:

- The unique ‘clean and green’ image of Australian food products
- Industry resilience and willingness to embrace change
- Infrastructure support such as that provided by Meat & Livestock Australia (MLA)
- Government priority positioning for the industry as evidenced by the substantial funding that is made available to the industry for R&D

- The promise presented by emerging technologies and new knowledge in areas such as genomics, biotechnology, ICT, and robotics

In recent years there is some evidence of an increasing awareness by the industry of the importance of innovation and the role that new technologies and business strategies can have in improving overall competitiveness. A number of innovation strategies have started to emerge in areas such as:

- Research to support repositioning the product with consumers in terms of its importance in a healthy diet
- Development of new product categories and new export markets
- Application of new enabling technologies such as robotics to gain greater processing efficiencies
- Emergence of new business models such as lean thinking and new strategic alliances along the supply chain
- Development of whole new industries in the biotechnology area including gene markers and high value bioactives.

Clearly to respond to these challenges and capture the opportunities outlined, firms within the industry must be able to develop and implement effective innovation strategies.

As will be discussed in more detail in the next section, traditionally innovation and the funding of R&D have been seen as the responsibility of industry bodies such as MLA. This was based on the premise that collaborative effort in R&D would be more likely to accelerate the development of new knowledge and technologies. In addition, very few companies in the red meat industry have the level of resources and capabilities required to undertake large-scale and high risk R&D projects. Furthermore, Commonwealth government R&D funding arrangements for the agricultural sector require that an independent, specialist industry body, such as MLA, co-ordinate the industry's R&D efforts.

The underlying proposition of this research study was that there exist significant opportunities to improve the industry's competitive position through the building of innovation capability within individual firms and the facilitation of a stronger innovation culture across the industry.

2.3 R&D and Innovation Framework

This section provides a brief overview of the context in which innovation has occurred within Australia. In particular, a number of recent studies undertaken to develop an understanding of the Australian innovation system (Balaguer et al 2003) and to map Australia's science and innovation capabilities (Commonwealth of Australia 2003) are discussed. Following this, detail is provided on the evolution of the specific model for R&D support in the agricultural sector as it is within this framework that this study took place. In addition, information is provided in relation to a more recent Commonwealth Government initiative, the National Food Industry Strategy (NFIS). This program provided important opportunities to test acceptance of the concepts developed for this study within a broader industry context. A more detailed review of the innovation systems literature follows in subsequent chapters.

2.3.1 Innovation in the Australian context

In a study of Australian innovation systems, Balaguer et al (2003) identified that the structure, functioning and level of integration found in a national innovation system may have a significant impact on the innovation competence achieved by individual companies. That study found that the innovation system within Australia exhibits a number of distinguishing characteristics around: attitudes to entrepreneurship; strength of the public education and research infrastructure; industry-research linkages; and impact of deregulation and foreign ownership. Overall, despite many positive indicators, the study characterised Australia as having a conservative innovation system that is only slowly evolving new pathways and models to overcome the limitations created by a highly dispersed environment (geographically, sectorally and organisationally). The study concluded that it will be critical for Australia to develop a robust innovation system that contributes, in a sustainable way, to ongoing economic growth rather than continuing to simply respond to short term ‘market pull’ opportunities.

Similarly, in the forward to the government’s science and innovation mapping study (Commonwealth of Australia 2003) Dr Brendan Nelson (then the Minister for Education, Science and Training) noted that innovation capability will be crucial for Australia’s long-term success:

> *But the future we aspire to – a healthier, sustainable and prosperous community – will depend increasingly on our capacity to develop ideas, to build new high growth industries, to apply knowledge in new ways to old industries, and to fashion intelligent solutions for the social and environmental problems we face (Commonwealth of Australia 2003, p.i)*

The Commonwealth Government has had a long history of supporting the R&D and innovation efforts of Australian industry with a new $3 billion strategy, *Backing Australia’s Ability* (Commonwealth of Australia 2001), announced in the 2001-2002 Budget. It is noted, however, that government support for business R&D in Australia is low by international standards, being less than half that of the leading OECD countries. In the new strategy’s policy, the Government acknowledged a need to focus support in three broad areas:

- Ensuring Australia is well placed to generate new ideas and to undertake leading edge research by investing in education and training initiatives and supporting the development of world class research infrastructure.
- Accelerating the commercialisation of new ideas by ensuring a supportive legal and regulatory framework and facilitating the emergence of an entrepreneurial culture.

- Retaining Australia's competitive advantage through implementation of a range of knowledge management initiatives in the area of intellectual property protection and providing competitive remuneration for specialist skill sets.

As noted in the mapping study and other reports (Hindle & Rushworth 2002; PMSEIC 2002), Australian managers are ranked poorly in terms of managerial skills. In addition, Australian businesses are characterised by a low level of expenditure on R&D. They also generally demonstrate poor performance in commercialising new ideas, products and technologies. This exists despite other research (DITR 2002) finding a widespread public acceptance of the importance of innovation to Australia's long-term prosperity and a perception that Australia is an innovative nation in terms of the production of new ideas. It is considered that the generally poor performance of Australian businesses in realising the full potential contribution of innovation may be attributed to: lack of access to early stage capital; shortage of management and entrepreneurial skills; and ineffective linkages between researchers and industry when compared with competing nations (Hindle & Rushworth 2002; PMSEIC 2002).

A key finding of the mapping study was the recognition that there are no short cuts to developing an innovation and entrepreneurial culture. The report recommended that innovation policy and intervention requires an integrated approach which takes into consideration the complexity of the landscape in which innovation occurs and which includes the building of both theoretical concepts and practical skills and experience.

2.3.2 Rural Research & Development Corporation (RRDC) model

Since the early part of the twentieth century, Australian governments (at both national and state levels) have directly supported rural R&D efforts. They have done this through a range of initiatives including: the collection of compulsory R&D levies imposed on transactions in primary production; the provision of government funds as matching R&D dollars; and infrastructure development covering both research and extension activities. This support has been based on an acknowledgement of the substantial contribution to the Australian economy of the wealth generated by agricultural commodity-based exports combined with recognition of:

- Important social benefits to rural communities delivered by agricultural industries
- The need to underpin the evolving food manufacturing sector
- Emerging problems due to unsustainable exploitation of natural resources
- The fact that farmers are generally small and isolated with insufficient funds or the ability to develop an effective R&D structure

It has been the need to ensure that there is a balance of profitable agricultural production with sustainable resource management that has guaranteed an ongoing focus on agricultural R&D in the national innovation agenda.

In the early part of the twentieth century, government support for rural R&D was administered through a wide variety of commodity-based initiatives and committees made up of a mixture of government, university, and producer representation. This approach was characterised by: scattered, disparate and isolated research effort; a narrow research focus on short-term issues; regional biases; researcher-based parochialism; and *ad hoc* managerial arrangements. A major criticism at the time was that research priorities for rural R&D were being set by scientists and measured according to scientific professional priorities such as the number of publications (Lovett 1997). During this buoyant economic period, there was an apparent unlimited supply of land to be exploited and sustainability concerns had not yet reached the national and political consciousness. It is not surprising, therefore, that rural industries were concentrating their efforts on achieving quick financial returns and they did not have a tolerance for less certain, long-term R&D.

Following the election of the Hawke Labour Government in 1983, the Australian economy underwent a period of significant reform aimed at reducing reliance on industry protection and creating a more globally competitive and resilient economy. At the same time as the Australian dollar was floated and financial markets were substantially deregulated, government investment in rural R&D also became a focus for reform. While among politicians there remained general support for ongoing government involvement in rural industries, some serious concerns were expressed concerning the effectiveness of the mechanisms that were in place.

During the period 1984-89, a series of reviews were undertaken and a new model, known as the Rural Research and Development Corporation (RRDC) model, finally emerged and was embedded in the national innovation system with the enactment of the 1989 *Primary Industry and Energy Research and Development Act* (PIERD). The principal champions for this major reform believed that Australia could no longer afford to invest in R&D that was not delivering tangible, commercially relevant results.

The outcome of the reform was the creation of 14 new R&D corporations. While the corporations remained directly aligned and accountable to government as statutory authorities, they were organised on private sector lines and were encouraged to act more autonomously and commercially. For the first time, government became a client rather than a director of rural R&D. More specifically, the various agricultural sectors were provided with a much greater direct control over the research agenda affecting their industries. The balance of power moved from the previous *science-push* approach predominantly driven by research institutions to an *industry-driven* philosophy.

When it was introduced, the RRDC model was seen as a unique industry-government partnership that would provide the rural sector with the best possible chance to develop a profitable R&D system delivering the highest ultimate returns. The RRDC model was expected to produce significant impacts that would be evidenced by:

- More money attracted to research in the sector
- Research would be more contestable and accountable and government's research investment would be managed more professionally and effectively
- Research priorities would be broadened to include: both short and long term strategies; R&D adoption; an understanding of key sustainability issues; and recognition of the contribution of post-farm issues to overall industry competitiveness
- Increased industry commitment to and participation in R&D

Despite these optimistic assurances when the new arrangements were introduced, the RRDC model became the subject of ongoing and close government scrutiny with a significant number of reviews being undertaken. This led to criticism by some that the effectiveness of the model may have been undermined by 'analysis paralysis' (Lovett 1997, p.27-51). Lovett's analysis of the extensive reviews of the RRDC model from 1991-95 suggests that rather than clarifying the issues regarding the role and effectiveness of the RRDC's, they added to the confusion and ambiguity.

More recently there appeared to be growing confidence that the RRDC model was working. Senator Judith Troeth (then Parliamentary Secretary to the Minister for Agriculture, Fisheries and Forestry) noted in the 2003 RRDC Outcomes Report (DAFF 2003) that Australia's agricultural research model is unique and attracts considerable international interest. It would also appear that the model has been successful in achieving at least one of its objectives in relation to attracting more money into agricultural research, with a record $454 million combined industry-government investment in 2002-2003.

In recent years, the model itself has continued to evolve with a movement towards even greater industry ownership through the privatisation of a number of the statutory authorities to become industry-owned companies. There are now six of these companies (of which Meat & Livestock Australia became the first in 1998), which are an amalgamation of both R&D and marketing functions. In addition, government has continued to actively encourage a broadening of the scope of rural R&D strategies with the publication in 2003 of the Rural Research Priorities as follows:

- Sustainable natural resource management
- Improving competitiveness through a whole-of-industry approach that emphasises efficient and effective supply chain management
- Maintaining confidence in the integrity of Australia's agricultural products and to uphold our reputation as a supplier of high quality produce
- Improving trade and market access
- Making use of frontier technologies, especially biotechnology, that offer potential benefits across the rural sector
- Protecting Australia from invasive diseases and pests
- Creating a culture of innovation, largely by investing in the sector's most important asset, its people

The most recent review of the RRDC model was undertaken in 2003 by the Centre for International Economics (CIE) as part of the broader study to map Australia's science and innovation system (Commonwealth of Australia 2003). In their report, CIE documented the maturing role of the RRDC model as incorporating the distinguishing characteristics highlighted in Box 2.1. The CIE RRDC case study also noted that the key features of the evolution of the model have been: the increasing focus on adoption; building industry capability; an increasing exploration of issues from a systems perspective; and the emerging use of action research.

Box 2.1: Distinguishing characteristics of RRDC's in 2003

1. RRDC's play a key leadership role in the planning and managing of R&D for specific industries.
2. It is not a 'grants' model as RRDC's treat funding as an investment in economic, social and environmental benefits.
3. The model delivers a high rate of return on R&D via facilitation of interaction along the innovation chain.
4. To achieve this rate of return there must be a focus on translating research outputs into practical outcomes.
5. A strategic approach is applied to implementing R&D portfolios rather than an *ad hoc* approach to project approval.
6. There is a dominant (but not exclusive) focus on applied research.
7. High levels of accountability to key stakeholders and the broader community are apparent.
8. The need to take a broad supply chain approach (farm-to-consumer) has been recognised and is being progressively implemented.

Source: CIE study (Commonwealth of Australia 2003)

While a driving motivation behind the establishment of the RRDC model was to change the agricultural paradigm from one driven by researchers to one driven by end-users, the CIE study identified that demand-driven R&D is not enough in itself to drive adoption. It would appear that simply delivering R&D outputs in response to industry-identified priorities does not guarantee uptake. While specific adoption strategies need to be developed for specific R&D projects, more fundamentally there is a need to build innovation capability at an individual, firm and sector level. The study found that the RRDC's are just starting to address an emerging role in relation to adoption and capability-building. The CIE noted that few models exist to guide the RRDC's in implementing this new approach. At the time of this review in 2003 there were only preliminary results in terms of identifying what might constitute effective strategies.

This overview of the evolution of the RRDC model has been provided to illustrate the volatile, complex and political environment in which rural R&D occurs. Effective innovation policy and interventions must remain flexible, adaptable and innovative in approach. There is a need for a holistic, global perspective in which RRDC's must act more strategically and with an entrepreneurial flair, but at the same time maintaining close alignment with the industries they serve. This is a critical leadership role if the past successes of Australia's agricultural sector are to continue into the future. The research undertaken for this study focused specifically on developing a new innovation intervention services paradigm to support the continuing evolution of the RRDC model.

2.3.3 National Food Industry Strategy

The National Food Industry Strategy (NFIS) was established in 2002 in response to a number of government reports (Howard Partners 2001; PriceWaterhouseCoopers 2001) which identified key challenges and opportunities facing the Australian food industry as a result of globalisation. The strategy was conceived as an industry-government partnership with the vision that:

> *By 2007, the Australian food industry will be a significant global player with a sustainable and profitable role in the global food product system.* (NFIS 2002 p.18)

The initiative represented a $102 million investment by government over five years (2002-2007) and focuses on innovation, supply chain management and firm level competitiveness. The four key strategic areas addressed by NFIS program initiatives were:

(i) **Leverage Australian science & technology, education & training** by ensuring Australia is a recognised centre for innovation in food product, process and systems development that anticipates and meets consumer needs and attracts follow through investment.

(ii) **International food market entry strategy** that grows exports of food products to enable companies to optimise profitability, investment and employment.

(iii) **Ensure a better business environment** that enables food businesses to grow in a globally competitive business environment that enhances competitiveness and improved investment.

(iv) **Environmental sustainability** that ensures long term resource availability and responsible management of environment, energy and water.

The strategy acknowledged that achievement of the vision would depend on dynamic and innovative businesses actively pursuing growth and development along the entire food supply chain.

While the red meat industry's R&D and innovation strategies were not directly linked with the NFIS, the obvious overlap and synergies meant that a strategic alliance between MLA and NFIS was warranted. This was driven in part by the fact that many of the food processing companies that are the key target of the NFIS are also important players in the meat industry's value-adding supply chain. It was also considered that linkages with NFIS participating companies would provide opportunities to compare concepts being developed for the red meat industry and to explore their application beyond a single sector.

2.3.4 MLA's role in R&D and innovation

Meat & Livestock Australia Limited (MLA) is a not-for-profit producer-owned company providing marketing and R&D services to the entire red meat industry. MLA became the first privately owned RRDC when it was formed in 1998 following a major industry restructuring which involved the merging of the statutory corporations Australian Meat & Livestock Corporation (AMLC) and Meat Research Corporation (MRC). As reported in the annual report

(MLA 2005), in 2004-2005 MLA's revenue was in excess of $150 million with the main sources including:

- A compulsory transaction levy paid on livestock sales
- Federal government dollar-for-dollar funds for investment in R&D
- Contributions by processor and live export bodies
- Co-operative contributions and partnership investments from individual companies

MLA's mission is world leadership for the Australian red meat industry achieved through a range of programs in the three key strategic areas described below:

Building demand

Both domestically and internationally, MLA promotes the high quality of Australian red meat, its versatility and enjoyment, and value for money, with a particular focus on the important role red meat has in a healthy diet. Promotional activities are undertaken via the media and directly with retailers and foodservice outlets such as hotels and restaurant chains. Marketing effort is supported by extensive consumer research and innovation in new products and packaging. More recently, there has been the addition of a range of co-products, including high value bioactives, to the industry's product range. This has been underpinned by an R&D program focused on identifying new bioactive compounds aimed at addressing the emerging health issues of the aging populations of developed countries such as Australia, Japan and the US.

Ensuring market access

As noted in Section 2.1, Australia is the world's largest exporter of red meat and livestock, exporting to more than 100 countries. Exports represent 60% of the industry's trade, making it critical to protect and expand markets. MLA works closely with industry and government to provide the background information that supports Australia's positioning in WTO access negotiations. As the industry relies heavily on a 'clean, green and natural' image, R&D in a range of areas such as food safety, traceability, environmental management and animal welfare are of critical importance.

Developing competitive advantage

MLA has an extensive portfolio of R&D programs which are aimed at improving efficiency and profitability throughout the whole supply chain. Specific R&D programs are aimed at developing innovations in areas such as: feedlot management; meat quality; animal genetics; automation technology; occupational health & safety; supply chain management and e-business. There is an underlying philosophy in MLA's approach that sustainable competitive advantage requires the industry to evolve to a more integrated value-chain based mode of operation.

In addition to corporations' law and its Memorandum and Articles of Association, MLA is governed by the:

- *Australian Meat and Livestock Industry Act 1997*
- Deed of Agreement with the Commonwealth of Australia
- Memorandum of Understanding 1998

In particular, MLA is deemed to be the industry research body pursuant to section 60 (2) of the Act and therefore has exclusive rights (on behalf of the whole industry) to claim matching R&D funds from the Commonwealth subject to meeting the requirements for eligibility of expenditure. This is basically the role of an industry Rural Research and Development Corporation as discussed in Section 2.3.2. Among the specific objects for which MLA was established (Section 2: Memorandum of Association) are:

- To improve the production and quality of meat and livestock in Australia

- To improve the methods of production, handling, storage, transport and marketing of Australian meat and livestock and to encourage production of livestock and marketing of meat and livestock to be more efficient
- To investigate and evaluate the needs of the industry for meat and livestock research and development and to encourage and facilitate the exploitation and commercialisation of the results of meat and livestock research and development
- To undertake, co-ordinate and fund meat and livestock research and development activities

Being charged with these responsibilities means that MLA is clearly expected to take a dominant leadership role in the area of R&D and innovation strategy. Based on this structure, MLA occupies a relatively unique position as an intervention agency that straddles both the public and private spheres. As a recipient of Commonwealth Government funding, MLA is identified as a key policy instrument in the national innovation agenda. As an industry-funded body, MLA is also perceived as an important integrator of public-private interests and a key mechanism for industry engagement. Finally, as a co-investor with commercial partners in actually delivering innovations to the marketplace, MLA has a mandate to operate in the entrepreneurship domain. This is ultimately where the benefits of effective innovation strategy achieve traction in terms of accelerating industry competitive advantage and ensuring long term sustainability.

One of the key changes that took place with the industry restructuring in 1998 was the removal of a compulsory levy on the slaughter of livestock. This levy on the processing sector was replaced with much reduced voluntary contributions from this sector. Not only did this change substantially reduce the quantum of funds available for industry marketing and research effort, it also heralded a period of significant dissatisfaction and industry political unrest between the production (farm) and processing sectors. Producers were disgruntled by what they saw as an abdication of responsibility by the processing sector to contribute sufficient funds to important industry initiatives. Processors were similarly unhappy with the new structures which essentially disenfranchised them from direct involvement in decisions concerning the expenditure of industry and government funds.

The full impact on MLA's activities from the disconnect which occurred in 1998 between the key sectors is discussed in more detail in Section 2.4.4 together with the strategies MLA has since implemented to overcome the many problems that initially occurred.

2.4 Previous Attempts at Change

As was noted in the introduction to this chapter, documenting the R&D and innovation efforts that have been underway in the red meat industry since the 1980's was seen as critical if future research effort was to be informed by lessons learned from previous attempts. This review also provided an opportunity to reflect on past practice and the historical context that underpinned the overall rationale for this study. The following sections detail the key phases of R&D and innovation interventions that have been undertaken over the past two decades. The information included in these sections was derived from internal documents sourced from MLA archives, combined with my own knowledge arising from my work with MRC and MLA since 1992.

2.4.1 Pre-1992: the legacy of Fututech

When the Meat Research Corporation (MRC) was formed in 1989, its overall strategy and capability was dominated by a focus on scientific-based R&D. This was aimed primarily at improving the performance of the production (farm) sector in a range of areas including animal genetics, animal disease, pastures, grazing systems and natural resource management. However, MRC did inherit a major processing technology R&D initiative that had been underway since the early 1980's. The project, which subsequently became known as Fututech, was aimed at fully automating the beef slaughtering process in order to improve processing sector competitiveness through reduction in labour costs and increased product yield and quality. Fututech was seen as a radical, disruptive technology which would signal a complete departure from the conventional methods of meat processing.

Despite the fact that MRC continued to invest heavily in the technology, by the early 1990's it became apparent that the technical challenges presented by the overall Fututech concept were too numerous and too complex to be overcome. The engineering company commissioned to complete the work (a large and very experienced multi-national) withdrew from the project amid considerable acrimony. Faced with heightened attention from government and industry investors, serious negative perceptions from the processing sector, lack of suitable technical and commercialisation expertise, and uncertainty regarding the project's likely completion timeframe and final cost, the MRC was finally forced to abandon the $70 million project.

To determine what finally went wrong with this project it is important to understand how it was conducted. Due to the disruptive nature of the new technology and the major impact it would have on the industrial relations agreements that had dominated the industry up until that time, the Fututech initiative was developed under conditions of extreme secrecy. Access to the research locations was strictly controlled. Even at the participating site there were no opportunities for the workforce or their representatives to be involved in planning for the introduction of the new technology. MRC's extraordinary efforts to maintain high levels of secrecy clearly exacerbated key stakeholder perceptions and concerns. This resulted in a lack of ownership and commitment to support the project when it began to experience difficulties.

Fututech would have represented the first major technological innovation for the industry in many years. It had the potential to significantly improve productivity and profitability by serving as a catalyst for change and fundamentally altering the work organisation, remuneration system and restrictive operating environment of the meat processing sector. However, serious flaws were apparent in the implementation plan and a number of key lessons were identified from the experience as follows (MRC 1992a):

- Importance of building trust and confidence with key stakeholders through ensuring high levels of ownership, participation and commitment. Clearly the decision to conduct the project under conditions of extreme secrecy did not ultimately work in favour of achieving a successful outcome.
- Ensuring a broad perspective is applied when attempting to introduce major technological change. It was clear that the major sociological impacts associated with the new technology were not adequately addressed and resistance to technological innovation was not managed strategically.
- Execution of major technological change initiatives clearly requires a level of capability within the industry (and its broader science and technology provider network) which was not available at the time. Strategies to address innovation capabilities which take into consideration all aspects of the innovation system must be a key component of any overall plan.
- The industry’s culture (at the time) was such that there was not a capacity to embrace large scale disruptive change or to sustain investment in long term, high risk initiatives. Opportunities to create incremental and sustainable improvement for the industry, rather than ‘big bang’ approaches, must therefore be identified and implemented in a proactive and strategic manner.

The legacy of this ambitious but failed attempt severely undermined the processing sector's confidence in the MRC's ability to successfully undertake research of this type. This had a major impact during a period of industry restructuring that occurred in the late 1990's and was an important consideration in the design of this research study.

2.4.2 1992-96: Work-Related Issues Program (WRIP)

Following extensive research during 1992 into other industry R&D programs both in Australia and overseas, the MRC launched an innovative new program strategy in 1993 known as the Work-Related Issues Program (MRC 1992b). The overall objective of the program was to assist in improving industry performance by stimulating innovation specifically in the meat processing sector. The design of the new program was in response to the lessons learned from the previous failures and the recognition that the development of new technology in itself would not improve the competitiveness of the sector.

Perhaps for the first time, the contribution of human beings was explicitly acknowledged as being vital in ensuring improved competitiveness, especially in such a labour intensive industry dealing with a highly variable product. At the time, the approach proposed in the WRIP strategy was considered to be very high risk as nothing like it had previously been attempted by any RRDC and many of the key stakeholders (including government, unions, employer groups and the MRC Board itself) expressed considerable anxiety. In addition, the type of expertise of the Program Managers employed to develop and implement the program (two experienced change management practitioners including myself) and the application of qualitative research methodologies such as action research was very different to the strictly science-based quantitative approaches familiar to the MRC. While this posed significant threats to the previously unchallenged research paradigms, the failure of previous efforts indicated that a fundamentally different approach was required.

Based on an analysis of the meat processing sector's strengths and weaknesses, the two MRC Program Managers developed a comprehensive intervention strategy based on the following core principles (MRC 1992b):

(i) **Ensure ownership** – this represented a significant shift in the paradigm of a top down change model and ensured all stakeholders worked together to implement the strategy. Those who owned the problem played an active role in developing and implementing solutions which were targeted at a multi-level of ownership by individuals, enterprise and industry.

(ii) **Create leadership pull** – industry needed to drive the program through utilisation of existing leadership structures including industry associations and trade unions.

(iii) **Build credibility** – industry pragmatism had resulted in a lack of tolerance for the vague, long-term initiatives typical of previous research efforts. There was a need for quick wins and obvious results to be achieved. Pilot studies and industry demonstrations were a key feature together with extensive industry consultation when approving projects.

(iv) **Apply action research** – a significant paradigm shift from positivist scientific research methodologies. Approaches were based on: addressing key stakeholder concerns; involving subjects in finding the solution; cyclical processes with feedback loops; and participative methods.

(v) **Revolution by evolution** – it was identified that previous efforts based on large-scale revolutionary, disruptive change had failed. Slower, more culturally sensitive methodologies were applied to capture existing industry energy and to create momentum.

(vi) **Minimise obstructions** – the WRIP invested heavily in engaging key political exponents in a variety of focus groups, committees and workshops. Main detractors were placed in positions of control over program directions where appropriate.

(vii) **Sow idea seeds** – analysis indicated that the industry had been isolated from new thinking in the area of people and organisational culture and did not believe that ideas from other industries would work. There was a need to generate new thinking in key industry leaders by exposing them to completely new environments. An example was the funding of an industry delegation to the Australian Workplace Reform Conference in Melbourne in 1994.

(viii) **Ensure holistic design** – the WRIP was based on integration between technology, work organisation, skills development and industrial relations.

(ix) **Create critical mass** – innovative new methods to encourage uptake by key adopters were developed based on formation of networks, information sharing initiatives and creating opportunities for industry participants to learn together.

While these principles may not appear particularly new or innovative in today's environment, in 1993 the red meat industry would never have considered that such an approach would even get off the ground let alone succeed. This was the first time that an RRDC had attempted to leverage R&D as a vehicle for initiating major industry change.

During its three year implementation period there were many significant benefits arising from the WRIP (MRC 1996a). Much of the program's success was deemed to have been related to the creation of an enabling platform of cultural change which included the following achievements:

- Elevated the importance of people within the industry
- Encouraged company investment in R&D
- Enhanced in-plant research skills
- Encouraged collaboration between key stakeholders, particularly employers and union

- Introduced academia onto plants
- Exposed industry people to outside ideas
- Generated a high level of participation
- Introduced qualitative research methodologies as a valid alternative to rigid scientific approaches
- Ensured researchers and consultants transferred their skills to industry

Many of the successes of the WRIP reinforced the core principles that were incorporated into the program's conceptual design. However, at its conclusion in early 1996, it was clear that the WRIP had suffered from problems due to a lack of integration of technology/people/organisation issues. Activities and interventions that did not fully optimise social and technical systems alignment appear to have limited success in sustaining the changes necessary to achieve long-term improvements in efficiency and competitiveness. This fundamental principle was incorporated into the design of the next research phase, the new RAPID program, which is described in the next section.

2.4.3 1996-98: RAPID Key Program

The RAPID key program (MRC 1996b) represented an ongoing evolution in the MRC's approach to facilitating change and innovation in the meat processing sector. Building on the approaches that appeared to be working from the WRIP, and addressing the gaps that had been identified, the new program concentrated in the following areas:

- Integrating, for the first time, both new technology and people related issues into one key program thereby creating the opportunity to undertake projects that embraced a broader socio-technical perspective
- Creating a sector wide strategy in which a full range of the processing sector's R&D requirements could be addressed
- Impacting on the industry's innovation culture with a specific focus on improving the industrial relations environment

- Increasing participation in the program by industry associations, trade unions and individual enterprises
- Enhancing a broad base of participation at the level of the individual and supporting this involvement with a range of skills development programs
- Developing new methodologies to accelerate the adoption and uptake of innovative ideas and practices based on the concept of critical mass

The design process that was employed in the development of the RAPID key program was the most comprehensive that had ever been attempted by an industry R&D body. A number of planning groups were formed in each of the program's key areas with representation from company personnel, trade unions, industry associations and technical advisors. Drafts of the program strategy and project proposals were circulated extensively to the industry and comments were sought from a number of international academic experts.

The result was that the program plan was strongly endorsed by industry and a $19.5 million investment over three years was approved. This was considered to be a major achievement given that the program was outside the traditional scientific R&D areas and it relied on a range of qualitative research methodologies that were considered quite novel in the science-dominated RRDC culture.

Unfortunately, despite the widespread support for the program combined with some early successes, the program's implementation was disrupted in mid 1997 when a major industry restructuring program brought to a halt all activities being undertaken in the sector. The outcomes of this restructuring and the implications for the role of the industry R&D body in facilitating industry innovation are discussed in the next section.

2.4.4 1998-2002: MLA - a period of transition

As was noted in Section 2.3.4, when MLA commenced operations in 1998 the relationship with the processing sector was extremely fragmented. Despite the high levels of support that had been generated for the MRC R&D programs during the previous five years, in 1998 the processing sector withdrew almost all financial support for MLA R&D programs. It became clear that the program framework was not yet robust enough to withstand the level of political turbulence that had been created by the restructuring process. Many processors reverted to the old reactive ways of thinking in which they perceived R&D as a cost rather than an investment. Their focus became one of achieving short-term immediate gains rather than searching for longer term strategic positioning.

Under the new structure, all responsibility for developing processor focused R&D initiatives was vested in new external R&D committees and MLA was seen as being responsible for project management only. Program strategies were abandoned in favour of a more *ad hoc* approach of supporting technically based projects. As a result, most of the efforts to incorporate an integrated socio-technical perspective were lost.

While this new approach was seen as a significant regression by the MLA Program Managers, it did provide an opportunity to reflect on past practices and to develop a deeper understanding of what might be required to work with this very challenging industry sector. The R&D model that had been developed at MRC was based on a genuine desire to engage the processing sector. However, it was still a fundamentally paternalistic approach in which the industry R&D body ultimately had the power to invest R&D funds where it believed most benefit could be achieved. Under the new regime, industry had to be totally engaged in the process and programs and projects could only proceed if true collaboration existed. It soon became clear that for this collaboration to be effective, the processing sector would have to develop a level of expertise in innovation management that was far greater than any that had been achieved up until that time.

For the next two years (1998-2000), the MLA team responsible for processor R&D was therefore forced to develop a completely new approach based on:

- Rebuilding relationships and trust with key influencers within the sector
- Consolidating outcomes from previous research projects and concentrating on ensuring these outcomes were made available to industry
- Developing a much deeper understanding of the specific issues impacting on processor efficiency and productivity
- Identifying future trends likely to impact on the industry
- Facilitating the development of a more viable provider base in terms of R&D and commercialisation

During this period, MLA had to be content with undertaking a range of projects that did not have a strong strategic basis and were often driven by narrow perspectives on where solutions might be found.

By 2000, much of the tension of the restructuring had been dissipated and MLA was in a position to test some new models for collaborating with the processors. At this time a new program known as the *Partners in Innovation Program* (MLA 2000) was launched which provided an opportunity for MLA to co-fund R&D projects with individual companies. Over the next two years this program became increasingly popular with the processing sector and from a zero base, a portfolio of $8 million in collaborative projects was established. As the perceived value of the program grew, it was possible for MLA to begin to develop a more strategic approach to innovation strategy. By 2002 a more comprehensive portfolio of innovation initiatives was once again underway, incorporating many of the positive attributes of the earlier MRC programs.

With the privatisation of MLA, the RRDC model underwent further evolution to incorporate a much greater level of industry control over their investment in R&D. However, it became clear that this involvement was not sufficient in itself to guarantee success in terms of R&D adoption or the realisation of the full benefits from innovation. Hence the stimulus for this study emerged.

2.5 Reflection on Past Practice

At commencement of this study in 2002, I had been working in the red meat industry for almost 10 years as a change agent. I believed it was important for me to take some time to reflect on what I had learned about facilitating change and innovation. It was clear to me that MLA had reached a critical point in its life cycle which required a rethink in terms of how a producer-owned company was to maintain a long-term and productive relationship with a predominantly adversarial sector partner. The review of past attempts at change had highlighted a number of key lessons which are summarised in Table 2.2.

Table 2.2: Previous attempts at change: 1989-2002

Phase	Characteristics	Lessons
R&D Funder (early RRDC model) Pre 1992	Science push Focus on-farm Limited through chain R&D Legacy of Fututech	R&D of little industry relevance. No sense of urgency from researchers to have outputs adopted. Little industry input leading to lack of interest or adoption. Limited impact on industry competitiveness due to narrow on-farm focus. Major negative fall-out from failure of automation strategy.
Work-Related Issues Program 1992-1996	Importance of processing sector in industry competitiveness recognised. Focus on people issues in driving technological change. Used R&D to develop new models of management-employee interface. Conceived as an enabling program – until	Importance of interventions at three levels of the individual, enterprises and the industry. High industry involvement strategy required. R&D focus must be perceived as relevant – tactical areas targeted. Structured industry participation utilising action research methodology was

	people issues addressed, large scale change and innovation unlikely to succeed. Early attempt at action research methodology.	promising. Lack of integration with technology program resulted in limited impact.
RAPID Key Program 1996-1998	First real attempt to integrate people and technology/process innovation. More sophisticated industry change model developed. Building provider capability seen as important.	Some individuals/segments of industry starting to see big picture systems approach (although still very much in minority). Recognised need to impact on whole system.
MLA Transition & Rebuilding Phase 1998-2002	Program totally disrupted due to restructuring and industry politics. Loss of trust between parties. Gradual rebuilding of R&D program in processing sector. Focus on smaller, “quick-win” projects with only limited program strategy.	Previous efforts at change not robust enough to withstand intense political pressure. Need to learn new models of collaboration. Return to more tactical areas of intervention as a strategy to rebuild industry trust and confidence.

Based on a review of the innovation and change management literature and discussions with other practitioners and industry personnel involved in the previous change programs, the following insights were distilled and subsequently incorporated into the design of intervention strategies developed in Cycle 2 of the research (discussed in Chapter 7).

Insight One: Through Chain Focus

A continuing focus on improving competitiveness and sustainability in the meat processing sector is fundamental to the long term success of the red meat industry and should therefore be a priority for MLA. This view was reinforced by:

- Results of MLA economic forecasting studies which demonstrate a flow through benefit to producers from gains made in the processing sector
- A stated requirement by government for MLA to focus on building innovation capability through the whole of the value chain
- The emergence of similar approaches in other initiatives such as the National Food Industry Strategy (NFIS 2002)
- Strong endorsement for this approach by the MLA Board

Insight Two: Ownership and Participation

This sector exhibits very specific characteristics in terms of its culture which requires MLA to develop fundamentally different approaches to facilitating change. It is apparent that in a very practically-focused industry, overly theoretical approaches to innovation are unlikely to be successful and gaining stakeholder ownership of and commitment to change is of critical importance (Ackoff 1974). The industry has demonstrated an ability to embrace change and there is early evidence of a number of initiatives becoming embedded in the sector. Some examples are: improved industrial relations climate; major investment in employee skills development; emergence of team-based approaches to problem solving; and participation in knowledge-sharing networks. These early successes should be built on using a range of participative action research methodologies in which those most affected by change are directly involved in designing and implementing the change strategies (Miller 1995; Reijs 1994; Rogers 1996).

Insight Three: Socio-technical Perspective

Wherever possible, R&D projects should encompass a holistic socio-technical perspective which incorporates people, technology and organisation in the overall design (Axtell et al 2001; Nadin, Waterson & Parker 2001). Industry capability to implement change based on this holistic perspective should be facilitated through skills development and other support initiatives.

Insight Four: Whole Systems Approach

Innovation strategy and interventions should be based on a whole systems approach and be implemented on a multi-level basis (Beer & Nohria 2000). Examples of this approach include:

- Support for developing skills and participation at the level of the individual
- Working at the firm level to build their capability and confidence to develop and adopt innovative solutions

- Intervening at the industry system level to gain ownership and engagement from a wide range of stakeholders including industry associations, R&D and technology providers, investors, regulators, the education system, and the local community.

Insight Five: Align MLA Capabilities

MLA must develop more robust conceptual frameworks for undertaking this work which are flexible and adaptive to changing industry requirements (Hofer & Polt 1998; Smith, K. 1998). Significant changes to MLA's own structures and capabilities will be required.

2.6 Summary

This chapter documents background information in relation to the Australian red meat industry to provide a detailed context to the research. The importance of the industry to Australia's economic position is demonstrated, particularly regarding its contribution to export earnings, employment, and the sustainability of rural communities. A review of the key challenges and opportunities facing the industry indicates that there are a number of major imperatives driving the need for innovation and change.

A brief summary is provided of the context in which innovation has occurred within Australia. Detail is provided on the evolution of the specific model of government support for R&D in the agricultural sector as it is within this framework that MLA operates and this study took place. MLA's unique position as an innovation intervention agency that straddles both the public and private spheres is discussed.

The chapter concludes with a detailed analysis of previous attempts at change within the red meat industry and a critical reflection on past change management practices. From this reflection, a number of key insights regarding the implementation of innovation and change management strategies in the red meat industry were developed. The incorporation of these insights into the design of this study is discussed in subsequent chapters.

CHAPTER 3

PLANNING CYCLE ONE: A ‘FUZZY’ BEGINNING

This chapter documents the early starting points for the study and also details specific activities undertaken in the planning phase of Cycle 1 of the research. Firstly, the outcomes of a preliminary literature review are presented in the form of an initial conceptual framework which assisted in determining key research questions and became the basis for embarking on the first cycle of the research. The planning for this first major research cycle included activities that identified opportunities for active participation and input by those stakeholders most likely to be affected by the outcomes of the research. A structured stakeholder analysis was undertaken to facilitate industry input and ensure capture of relevant knowledge. The chapter concludes with the outline of the plan for Cycle 1 and the key research questions.

3.1 Preliminary Literature Review

As will be discussed in Section 3.3 and in Chapter 4, an iterative triangulation process (Lewis 1998) was adopted for this study. This involved progressively integrating outcomes from an ongoing engagement with the literature as distinct from the more traditional approach of completing a detailed review at the beginning. This approach is consistent with action research methodologies which, due to their emergent nature, can legitimately begin with ‘fuzzy’ questions and ‘fuzzy’ methods (Dick 1993). It was therefore determined that, at the commencement of the research, only a preliminary literature review would be undertaken. The aim was to provide a sufficient basis upon which to begin, but not to constrain the research by a narrow theoretical perspective (Bourgeois 1979; Lewis 1998).

As the specific focus of this research was *innovation* this became the *immediate discipline* for the purpose of the preliminary literature review. Four preliminary concepts were developed from the review and were subsequently incorporated into an initial conceptual framework. It was anticipated that a significant evolution of the conceptual framework would occur and that further literature review (in areas not yet identified) would be undertaken as the research progressed.

In the following sections each of the preliminary concepts is discussed and a preliminary proposition regarding relevance to the conceptual framework is articulated. The discussion concludes with a conceptual framework proposed as the starting point for the research. As will be seen in subsequent chapters, this conceptual framework was continuously refined throughout the research study.

3.1.1 Concept One: Innovation and performance

Preliminary proposition: there is a relationship between the degree of innovation within an individual firm (or an entire industry sector) and the overall performance, profitability and competitiveness of that firm or sector.

While innovation alone will not guarantee business success (Tidd, Bessant & Pavitt 2001), there is a growing body of literature on the nature and importance of innovation and the linkage between the effectiveness of innovation management and sustainable competitive advantage (Butlin & Carnegie 2001; Chandler, Keller & Lyon 2000). According to Lin (2001, p.1), "Success in the twenty-first century can only come from competing through continuous corporate innovation". As identified by Smith (1997), the traditional sources of competitive advantage such as efficiency, productivity, technological leadership and low cost per unit may no longer be appropriate in an environment which demands competitive advantage through innovation. References to the role of innovation in social and economic development can be traced back more than 60 years when Schumpter (1942) emphasised the importance of innovation for the business firm and society as a whole.

The link between innovation and business success has also been described in many case studies and benchmarking reports. In these reports 'best practice' and 'high-performance' companies have been analysed in terms of their innovation management capabilities (AQC 2000; EFQM 1999; Marsh & Shaw 2000). The connection between innovation and competitiveness has been discussed in terms of how firms make money and achieve competitive advantage (Tidd, Bessant & Pavitt 2001). For example, research suggests that there is a close relationship between product innovation and market performance. Companies that exhibit a high percentage of revenue from new products and product attributes achieve significant growth in terms of market capitalisation (Luchs 1990).

Based on the literature, it was considered acceptable to propose a relationship between innovation capability (at both firm and sector-level) and performance in terms of competitiveness, profitability and sustainability. A number of more specific innovation measures (such as: percentage of revenue from new products; improvements in efficiencies as a result of new technologies and processes; tallies of intellectual property assets) were identified as providing more specific evidence of success in relation to innovation (Ambler 2000; Collins & Smith 1999; von Stamm 2003).

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3.1.2 Concept Two: Innovation capability

Preliminary proposition: the characteristics of an innovative organisation can be identified and articulated as specific innovation capabilities.

A significant stream of innovation-related research has been concerned with identifying the specific characteristics of organisational innovativeness. The core elements deemed most important for the successful management of innovation were defined in a number of studies (Amabile 1998; EFQM 1999; Higgins 1995; McGinnis & Verney 1987) and are summarised in Table 3.1.

Table 3.1: Characteristics of organisational innovativeness

Amabile 1998	EFQM study 1999	Higgins 1995	McGinnis & Verney 1987
• Challenge • Freedom • Resources • Work-group features • Supervisory encouragement • Organisational support	• Anticipation • Risk acceptance • Funnel concept • People 'boost' • Business results and innovation linked • External co-operation • Technology • Sharing information • Databases	• Strategy • Structure • Systems • Style • Staff • Shared values • Skills	• Open to ideas • Create a performance gap • Develop organisational competence • Focus efforts on external challenges • Foster open communications

Kanter (1988) takes a somewhat different approach to defining organisational innovation capability. She describes the micro-processes through which individual innovations must pass in order to identify the macro-context of ideal organisational properties which will stimulate, facilitate, and enhance or inhibit innovation. Based on this analysis, Kanter (1988) proposes a flexible and dynamic model of organisational innovativeness which incorporates both structural and social conditions and is characterised by:

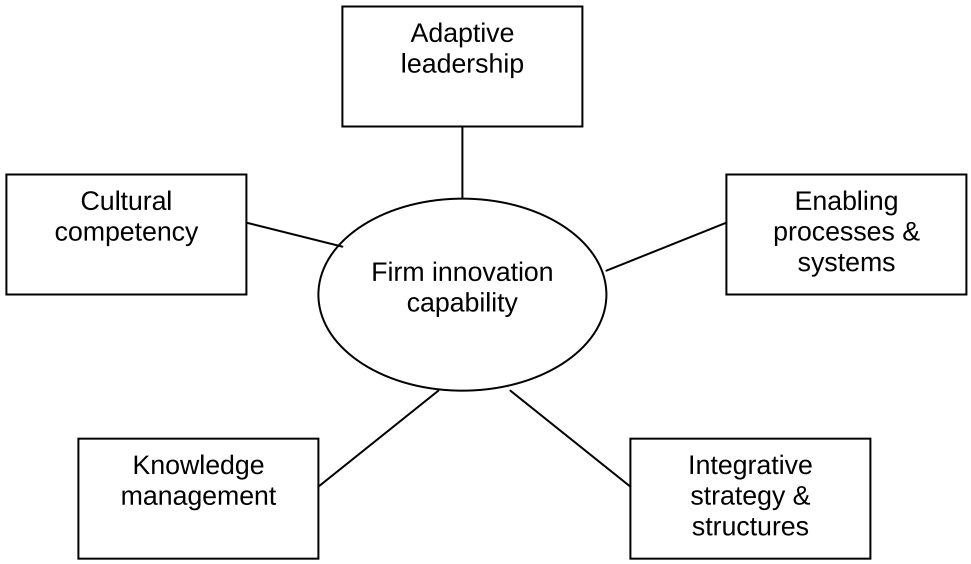
- Conditions which allow flexibility, quick action and intensive care, coalition formation, and connectedness
- Integrative structures with multiple linkages both inside and outside the organisation
- Cultures which emphasise diversity
- Intersecting territories and coalition building
- Collective pride and faith in people's talent
- Collaboration and teamwork with multiple opportunities for interactive learning

There are a number of concepts found in the broader leadership and organisational change literature that also have relevance in understanding the notion of innovation capability. One such concept is that of adaptive leadership (Glover, Friedman & Jones 2002; Haeckel 1999) which cautions leaders to recognise and understand the context-sensitivity of any change or innovation strategy. Glover, Friedman and Jones (2002) argue that the adaptive potential of any change process (or innovation) becomes a crucial consideration if desired organisational outcomes and performance improvements are to be achieved.

The idea of organisational capability is also related to innovation. Unlike more narrow competency-based skills development initiatives, a focus on building innovation capability is considered more likely to equip organisations to address a wide range of problems and opportunities in both familiar and unfamiliar settings (Hase, Cairns & Malloch 1998). Organisational capability bears a close relationship to the concept of the learning organisation which was developed by Argyris and Schon (1974) and then popularised by Senge (1993). Developing capability is of particular relevance as organisations seek to compete in the current turbulent environment.

For the purpose of developing the preliminary conceptual framework for this study, the defining characteristics of firm innovation capability were distilled from the literature into the following five core concepts as shown in Figure 3.1.

Figure 3.1: Preliminary model of firm innovation capability



A concept to be further explored in this study relates to identifying an effective measurement or diagnostic instrument in relation to a firm's innovation capability. This area of research is relatively immature and at this preliminary stage only one instrument appears to address the core competencies proposed in the preliminary conceptual framework (Bubner 2001). This instrument is based on an open systems approach with the theory used to identify and extract a subset of innovation capabilities from a broader set of the firm's foundation capabilities as shown in Table 3.2.

Table 3.2: Organisational and innovation capabilities

Foundation Capabilities	Innovation Capabilities
General management	Leadership
Strategy	Strategy for innovation
Environmental scanning	Fostering innovation via external environment
Marketing and sales	Internal environment for innovation
Production/operation systems	Innovation 'production process'
Administration	Maintenance & measurement of innovation

Source: Bubner 2001

The specific research question for this aspect of the conceptual framework was identified as:

How can the concept of 'firm innovation capability' be expressed in the context of the red meat processing sector?

3.1.3 Concept Three: Contextual environment

Preliminary proposition: the degree of innovation within an individual firm will be influenced by the contextual environment in which it operates.

As identified by Wolfe (1994), one of the key challenges in innovation research is to understand the complex, context-sensitive nature of the phenomenon itself and to acknowledge that different theories of innovation will be more or less useful depending on the environmental context within which innovation takes place. A number of researchers have suggested that research effort should be directed at determining the contingencies that govern when various innovation theories hold (Abrahamson 1991; Poole & Van de Ven 1989; Tornatzky & Fleischer 1990; Van de Ven & Rogers 1988).

The contextual issues which have been identified as having a significant impact on innovation fall into two broad categories: external (outside the organisation); and internal (contained within the organisation but not directly related to the organisation's innovation strategy). In relation to the external environment, environmental uncertainty has been identified as having a generally positive effect on innovation (Russell & Russell 1992). This effect is thought to be due to the fact that uncertain environments are likely to generate more innovation through opportunity-seeking and adaptation to change. Sources of environmental uncertainty which are likely to produce this result include: changes in customer demand; new industry-related technologies; and changes in strategic relationships between competitors. Kanter (1988) identified external factors as playing an important role in determining the degree of innovation occurring at the firm level, with her work focusing primarily on the institutional environment including: government policy; regulation; industry institutional arrangements such as trade unions; supporting infrastructure; and societal expectations.

Similarly, internal factors have also been discussed as playing a moderating role on the expression of innovation. In particular, different organisational business strategies will require different responses in relation to innovation (Covin 1991; Miles & Snow 1978; Porter 1980). More recently, Smith (Smith, M. 1998) has proposed two distinct types of business strategy which require very different approaches to innovation, namely:

- Prospector-Differentiator-Entrepreneur
- Defender-Cost Leader-Conservative

While intuitively, the former category would appear to be the most conducive to innovation, clearly there are many market leaders that better fit the latter category. As identified by Smith (1997), the traditional sources of competitive advantage such as efficiency, productivity, and low cost per unit may no longer be appropriate in an environment which demands competitive advantage through innovation. It is clearly appropriate for researchers to look beyond the specific concept of innovation capability and the narrow borders of one organisation for the determinants of innovation performance.

The specific research question for this aspect of the conceptual framework was identified as:

What are the key contextual issues impacting on the level and success of innovation initiatives in the red meat industry?

3.1.4 Concept Four: Intervention strategies

Preliminary proposition: a firm’s (and ultimately an industry sector’s) innovation capability may be improved through implementation of integrated, externally-driven intervention strategies.

The organisational change literature is rich with intervention models that aim to impact on innovation capability through accelerated change, innovation diffusion and specific models to improve the success rate of individual projects. Mezias and Glynn (1993) have suggested that while there is overwhelming consensus on the need to manage innovation and corporate renewal, there is very little agreement on the most appropriate strategy for achieving effective change and improvement in this area. Similarly, Wolfe (1994, p. 405) believes that “The current state of the literature thus offers little guidance to those who want to influence organisational innovation.”

Reference to a major OECD study (Little 2001) provides a degree of confidence that externally driven interventions (combining policy modification, strategy and ‘hands-on’ support) if well defined and applied can have a significant impact on a firm’s innovative capabilities and performance. Importantly, the study also showed that interventions can have impacts at all levels, from the individual firm to the national level. One of the key findings of the OECD research was that to be successful, intervention strategies must incorporate a holistic, integrated approach and that increased attention must be given to the broad innovation concept as a whole, rather than focus on individual aspects in isolation. The study also identified that interventions that involved networks and supply chains are likely to be more effective than those focused on individual firms, and that a high degree of flexibility is required in delivery mechanisms.

As discussed in Chapter 2, this is the central research question to be addressed by this study and is articulated as follows:

How should MLA design and deliver interventions that will significantly enhance the innovation capabilities of the Australian red meat industry in order to sustain competitive advantage in a rapidly changing environment?

At this early stage of the research, it was not considered appropriate to predefine a rigid set of intervention strategy options. Instead, the concept was integrated into the conceptual framework as a 'fuzzy' concept with a number of possible areas for attention including:

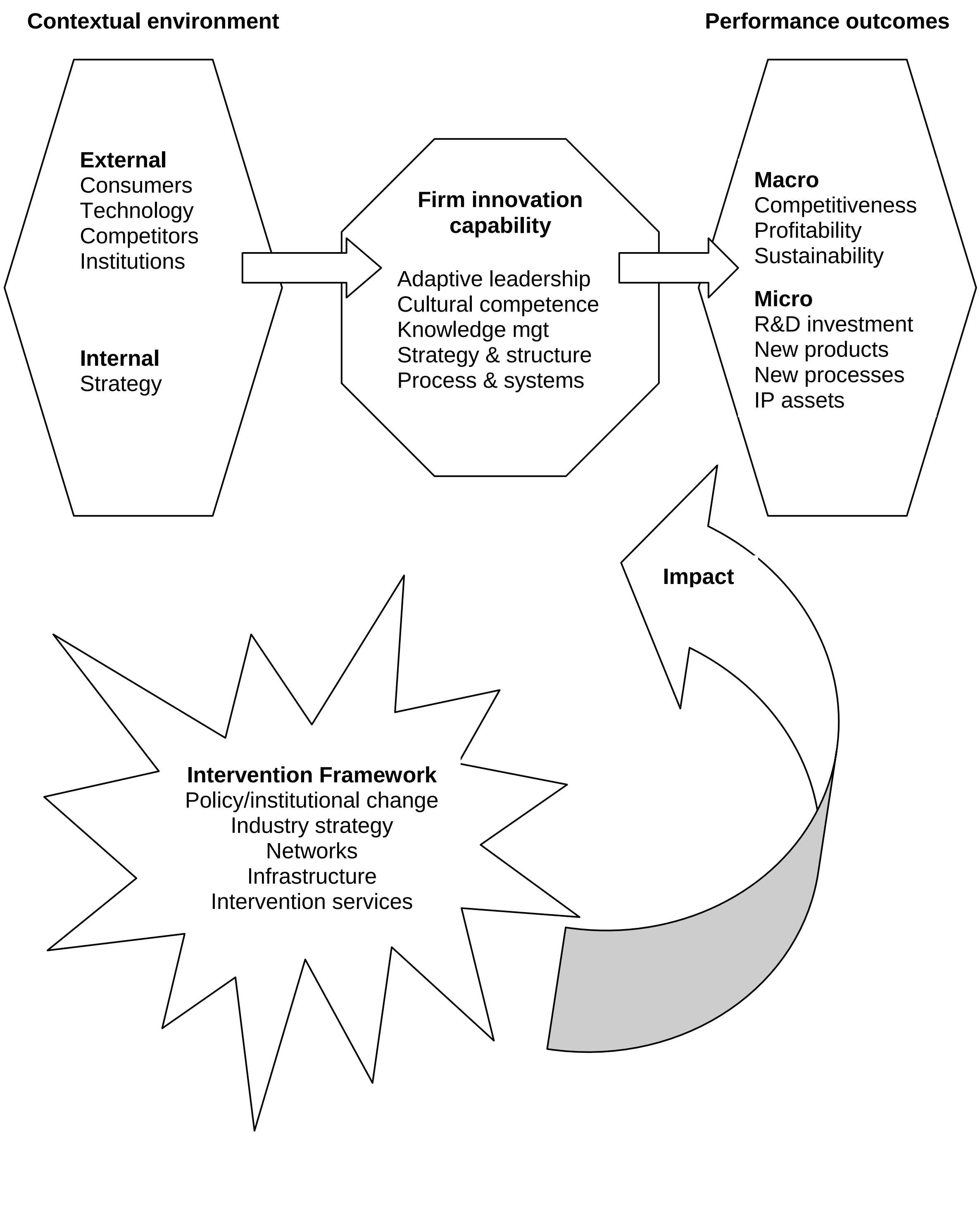
- Policy/institutional changes
- Industry innovation strategies
- Creation of networks
- Building infrastructure
- Intervention 'services' to build capability

3.2 Preliminary Conceptual Framework

Based on the preliminary literature review, the following conceptual framework was developed as the starting point for this research (see Figure 3.2). The framework integrates the four key concepts identified from the literature as follows:

1. Organisational performance is related to the degree and success of innovation
2. Firm innovation capability, as a precursor to successful innovation, can be defined and identified
3. Innovation is context sensitive
4. Integrated, externally-driven intervention strategies can be instrumental in creating sustainable improvements in both innovation capability and the success of innovation initiatives.

Figure 3.2: Preliminary conceptual framework



The framework was intended to provide initial insight into the key issues impacting on innovation in the red meat industry and to inform the design of the first research cycle in relation to:

- Understanding the contextual factors which impact on innovation at both the firm and industry level
- Describing and defining the characteristics and competencies of an innovative firm
- Suggesting a model for developing intervention strategies

As will be evident from the discussion in subsequent chapters, the conceptual framework was substantially modified as data emerged, new literature was engaged, and reflective insights evolved.

3.3 Overview of Methodology

While subsequent sections and chapters provide further detail, a broad overview and justification of the methodology is provided here.

3.3.1 Research paradigm

In any research study it is important for the researcher to explicitly articulate his/her paradigm or theoretical framework so that the reader can evaluate the process, methods and outcomes from within the researcher’s particular perspective or value-base. The methodology selected for this research study was action research which belongs to the critical interpretative paradigm of social science research in which researchers are seen to be a critical part of the research process and the perceptions and interpretations of the participants are central to understanding (Ticehurst & Veal 1999).

Zuber-Skeritt (2001) has developed a theoretical framework for action research methodologies which draws on four areas of theory:

- Grounded theory

- Personal construct theory
- Critical theory
- Systems theory

Table 3.3 shows how her framework was applied in this study.

Table 3.3: Application of Zuber-Skeritt theoretical framework

Theoretical framework	Application in this study
Grounded theory: enabling researchers to develop an inductive approach to knowledge creation through reliance on emerging understanding as data emerge from the cyclical process.	An iterative inductive approach based on a methodology developed by Lewis (1998) was used in Cycle 1 of this research (see Chapter 4). This approach incorporated, but was not limited to, a grounded theory methodology (Eisenhardt 1989; Glaser & Strauss 1967; McCutcheon & Meredith 1993).
Personal construct theory: according credibility and equality to researcher and participant perspectives by viewing them as 'personal scientists' who are actively engaged in the change process.	The researcher and members of the MLA research team were actively engaged in the research process with data including their personal reflections and input from industry participants.
Critical theory: referring particularly to the confirmatory and disconfirmatory dialectical processes intrinsic to action research methodologies.	Multiple opportunities were created throughout this study for data and emerging concepts to be confirmed or disconfirmed. In Cycle 1 this occurred through the iterative design of the convergent interviews combined with the progressive engagement with the literature (see Section 4.1.1). In Cycle 2 the SI-Intervention Framework was progressively developed on the basis of iterative testing of the concepts with industry participants (see Section 7.1).
Systems theory: is considered fundamental to the choice and application of action research which seeks to develop systems-oriented, holistic resolutions to complex problems.	The research relies fundamentally on a systems approach to understanding innovation at both a firm and sectoral level (see Chapters 5 & 6). The outcome of the research, the SI-Intervention Framework, is based on the concepts of system failures and system mapping (see Chapters 6 & 7).

Action research has been found to be particularly useful when a study is seeking innovation, change, growth and transformation of organisations and their leaders/managers (Wilson-Evered & Hartel 2001). It has been suggested that in-depth inductive innovation studies should be conducted to safeguard against the premature adoption of a rigid framework which may limit the scope of inquiry (Dyer & Page 1988; Van de Ven, Angle & Poole, 1989).

The collaborative and participatory approach embodied in action research was therefore deemed to be most appropriate to this research study. It was achieved with the formation of an MLA research team (with members participating directly in the study as co-researchers) and the creation of multiple opportunities for input and engagement of industry participants to determine acceptance of proposed changes arising from the research.

3.3.2 Research design

The defining characteristics of the action research approach as applied in this study were as follows:

- Application of cyclical processes in which the researcher alternated *planning, action* and *observation* with *critical reflection*
- Design of the study to achieve the dual outcomes of improving practice in the workplace and a contribution to theoretical knowledge through the development of new insights
- Predominantly data-driven research that, as noted by Dick (2000a), provides an approach that suits managers and practitioners who wish to understand and intervene in a complex and interconnected system
- Inclusion of an iterative triangulation process (Lewis 1998) in which data were interpreted in concert with an ongoing engagement with the literature and input from the reflective phases during multiple cycles

3.3.3 Justification

Justification for the application of an action research methodology in this research study is as follows:

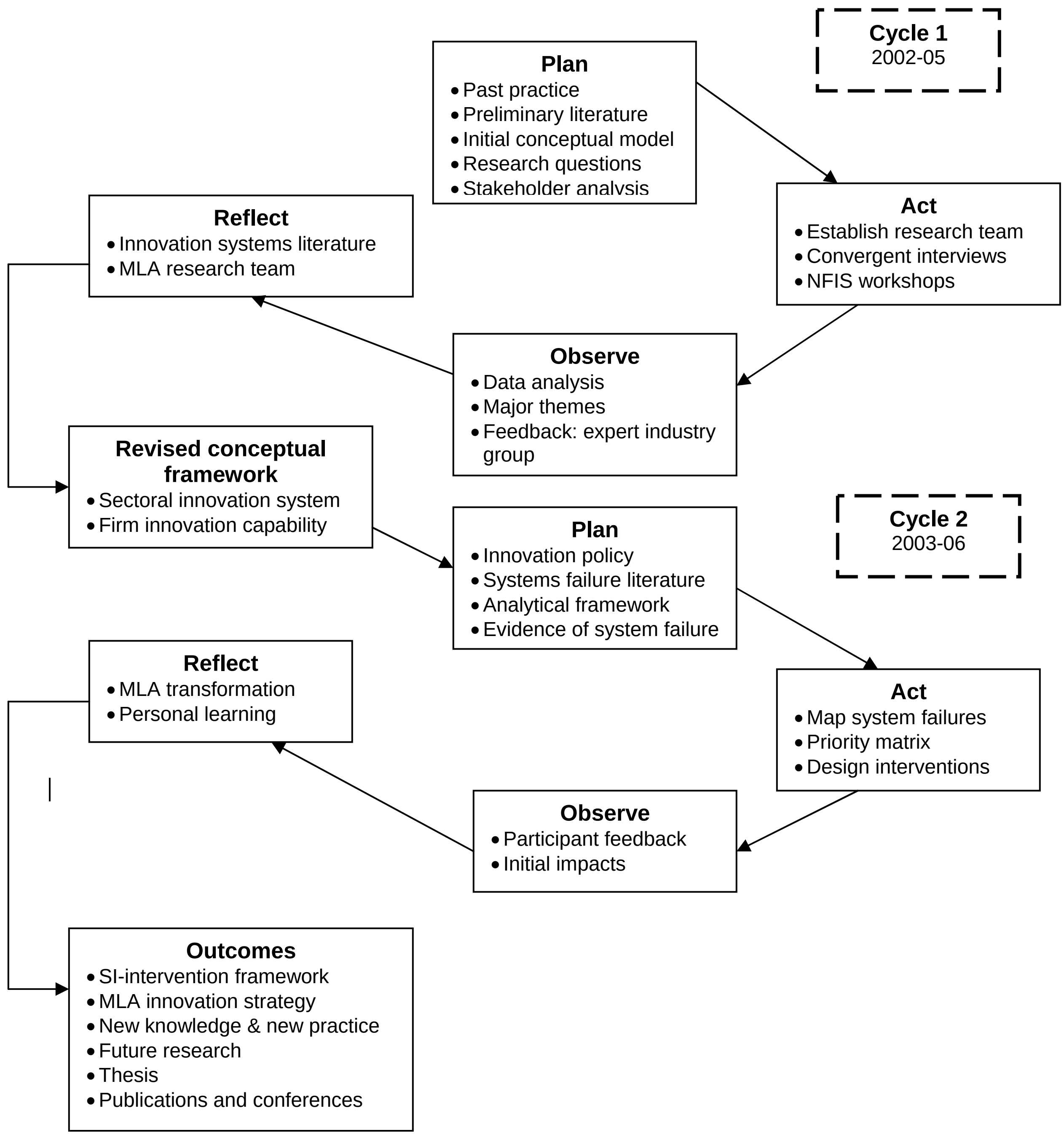
- The iterative approach embodied in action research is particularly useful when there are many variables which are not known at commencement of the research and there is unlikely to be any way of controlling them
- Flexibility and responsiveness to emerging data and understanding facilitate the refinement of a robust conceptual framework
- Rigour and validity are enhanced through multiple approaches to data collection (triangulation) and the creation of opportunities for confirmation and disconfirmation (dialectical processes)
- The participative approach applied within MLA and more broadly in the industry enhanced sustainability of the desired changes and improved practices

3.3.4 Research cycles

The research was undertaken within two major action research cycles from 2002 to 2006 (see Figure 3.3) which incorporated many 'cycles within cycles'. The iterative approach is considered to be particularly useful when there are many variables which are not known at commencement of the research and there is unlikely to be any way of controlling them. This research design, which represents a blend of inductive and deductive processes along a continuum, is well reported in the literature and has been proposed as the preferred approach to studies of this type (Parkhe 1993).

It is noted that while two distinct cycles are evident, they did not conform to a rigid linear sequence and there was a degree of overlap in the middle of the study. As the conceptual framework was being refined in Cycle 1, planning and action phases were underway in Cycle 2. This reflects the often complex nature of action research which must remain flexible and adaptive to the realities of the research context.

Figure 3.3: Research cycles



3.3.5 Data collection and analysis

A detailed account of data collection and analysis techniques for each cycle of the research is included in subsequent chapters with a brief overview provided here.

Interviews

In Cycle 1 a series of 28 in-depth interviews were undertaken from a cross-sectional sample of the key stakeholder groups and utilising a snowball method (Glaser & Strauss 1967) to identify individuals. A convergent interviewing technique (Dick 1998) was applied in which open-ended questions were initially posed and modified to include probe questions in subsequent interviews for confirmation and disconfirmation. Particular care was taken to allow the interviewees' own perceptions and experiences to be expressed and to avoid, as far as possible, hidden bias or impact due to the researcher's influence (Maxwell 2005). Data were collected via detailed interview notes and analysed using key word/concept identification and coding. Mind Mapping (Buzan & Buzan 2000) was used to facilitate interpretation and identify key themes and connections between concepts.

Critical Reflection

I viewed the process of critical reflection as central to this research study, particularly as a framework to assist me to make sense of the emerging data and to revise the conceptual framework. To facilitate my own reflection and learning, I established an informal network comprised of external innovation practitioners and researchers who were interested in exploring issues on a collaborative basis. My interactions with this network occurred primarily on a one-on-one basis. However, there were a number of occasions when I was able to interact with members of the network including participation in an international study mission to Europe and the UK and attendance at several workshops aimed a refining concepts and theoretical models. Participation in the network provided me with access to a rich body of knowledge and experience. The learning I gained from this interaction was recorded in a reflective journal and included many iterations of the conceptual framework which I developed as the research progressed.

Reflection was also an important learning aspect for the MLA research team to ensure the outcomes from the research and the associated changed practices would become embedded for the future. As noted by Weinstein (1995, p.49), “Reflecting – recalling, thinking about, pulling apart, making sense, trying to understand – is crucial to our learning …. The process of action learning gives us time to do this. It also legitimises reflection.” A variety of techniques were used to collect reflective data from members of the MLA research team including mentored reflection during which I maintained notes. These data were subsequently incorporated into our interpretation of interview data and the development of further probe questions in Cycle 1. They were also used as input into the design of external intervention strategies and internal capability building initiatives in Cycle 2.

Secondary data sources

Firm and industry documents were used as secondary sources of data and included internal MLA documents, R&D project reports, minutes of meetings and company innovation plans. These data were used to provide historical context (see Chapter 2) and to facilitate confirmation and disconfirmation of data collected during interviews and field trials.

Cyclical data collection and data analysis

An important aspect of the methodology was that the data became an integral component in that the research was data driven. Dick (2000b) notes that the cyclical nature of action research enables the researcher to use the emerging data to progressively develop a better understanding of the area being researched and to further refine subsequent data collection phases. Input into the data analysis processes undertaken within cycles included:

qualitative and quantitative data; progressively engaged literature; feedback from industry participants; reflection by researcher and co-researchers.

3.3.6 Rigour and validity

Quality issues in relation to research methodology must be viewed within the context of the particular research paradigm. In qualitative research it may be more important to value responsiveness and relevance over replicability (Dick 1999; Dick & Swepson 1994). Positivist approaches primarily seek universal knowledge about the whole world for use in specific situations. On the other hand, the focus of action research is quite different in that it seeks to achieve action and understanding simultaneously in one complex social situation. As noted by Guba (1996, p.xi), “That action research may not conform to conventional criteria of research rigor is much less important than that it: takes a more democratic, empowering and humanising approach; assists locals in extending their own understandings of their situations; and helps them resolve problems they see as important.” Greenwood and Levin (2000, p.96) argue that “credibility, validity and reliability in action research are measured by the willingness of local stakeholders to act on the results of the action research”.

The fundamental key to achieving rigour and validity in action research lies in the inclusion of dialectical processes i.e. the constant effort to test apparent agreements/disagreements and emerging interpretations during and between action research cycles. Action researchers must ensure that their conclusions and their data have survived attempts to disprove them (Dick 1997; Dick 2000b).

In this study, the following components were incorporated into the methodology specifically to increase the rigour and validity of the research:

- Multiple sources of data were used including: primary and secondary; qualitative and quantitative; and the use of multiple co-researchers. This process is termed *triangulation (*both *data triangulation* and *investigator triangulation)* and it assists in reducing the risk of making associations which are more a matter of chance (due to biases inherent in a specific data collection method) rather than reflecting actual connections (Duffy 1987; Fielding & Fielding 1986; Maxwell 2005)

- Application of *multiple action research cycles* (including cycles within cycles) in which methods and understanding are critiqued and refined at the conclusion of each cycle
- Literature was accessed at multiple stages as understanding emerged and the conceptual framework was refined. This process was adapted from the *iterative triangulation methodology* applied by Lewis (1998) in a theory development study in the field of operations management
- *Active involvement of participants* (members of the MLA research team and industry participants) provided a climate of supportive critique in which only quality interpretations could survive

3.3.7 Ethics

As is the case in all areas of research, business research studies must be designed and conducted in accordance with a strict code of research ethics (Kimmel 1996; Ticehurst & Veal 1999). In addition to the broader ethical principles of integrity and honesty, the business researcher working in the field with real individuals and real organisations must also be concerned with the following specific issues:

- **Harm:** as a core principle, the researcher must seek to ensure that no participant suffers harm or damage attributable to their participation in the study. In the context of business-related research, potential sources of harm would most usually be related to issues of privacy and confidentiality. In this study, I was particularly concerned to ensure anonymity of potentially sensitive information provided by individuals and to maintain the security of confidential information provided by the participating firms. Similar care was taken to ensure that members of the MLA research team did not suffer any negative consequences attributed to their involvement.

- **Informed consent:** I provided the members of the MLA research team with full details concerning the study. Similarly, all individuals interviewed were made aware of the overall scope and objectives of the study and provided their consent for the use of interview data.

- **Role conflict:** a specific ethical consideration in relation to this study related to my dual role as researcher and senior executive within the client organisation (MLA). This situation was not dissimilar to that described by Gummesson (1991) in relation to the dual role of researcher and consultant that may often be experienced by action researchers. In managing the multiple demands, and even conflicts, that may be inherent in these situations, Gummesson (1991, p.181) suggests that, “At the same time as the change agent meets the demands placed on the role of consultant, they also try to meet the requirements of the research community by carrying out certain additional work”. Sandberg (cited in Gummesson 1991, p. 106) proposes the concept of *praxis research* for managing this duality of role by creating a separation between the research activity of *reflection* from the change agent activities of *action* and *dialogue* with the client. In applying these concepts to this study, I undertook the following ‘additional work’ and separation of roles was undertaken to ensure quality of the research component as follows:
  - Maintaining a relationship to other research and theory via extensive engagement with the literature
  - Detailed documentation of each stage of the research study (ultimately in the form of this thesis)
  - Development of a detailed conceptual framework
  - Inclusion of critical reflection within each research cycle

As the study was supported by my employer (MLA), they were provided with a detailed outline of the research proposal. A potential area of conflict was identified related to MLA's role as the primary funder of industry research. Thus a concern was that companies would participate on the premise that their particular research interests would receive preferential treatment in relation to project funding applications. To overcome any concerns in this regards, these issues were discussed openly with participants prior to commencement of the study, and a project approval executive advisory group (comprised of two additional general managers from MLA) was formed to ensure objectivity in project approvals.

3.4 Planning Cycle 1

In keeping with the fundamentals of collaborative action research methodologies, the planning phase for the first major research cycle centred around determining opportunities for active participation by those most likely to be affected by the outcomes of the research: the MLA research team and key industry players. Following is an outline of a structured stakeholder analysis undertaken to ensure relevant industry knowledge was captured.

3.4.1 Stakeholder analysis

A key focus of this cycle of the research was to capture industry knowledge and experience in relation to innovation in the red meat industry. Direct input into the overall scope of the research from industry players was considered important to assist in securing interest and involvement in the study and ultimately to provide legitimacy for MLA's proposed new model of innovation interventions.

It was determined that a series of in-depth interviews would be used to gain this input from industry (see Chapter 4). As it was important to ensure appropriate selection of interviewees, a stakeholder analysis methodology was developed during the planning phase as follows.

Stakeholder analysis methodologies

From as early as the 1970’s, researchers in the fields of innovation and R&D management have recognised the importance of stakeholder participation in the design of innovation systems (Ackoff 1974). In reporting on the Food Foresight studies undertaken in the Netherlands, Reijs (1994) proposed that for change to be successful, it is essential that consensus and commitment about future directions are achieved by bringing together different stakeholders. Similarly, Miller (1995) and Rogers (1996) have suggested that participation by multiple stakeholders (including suppliers, partners, distributors and customers) must be an integral component in designing a total innovation system. More specifically, Carter (1997) and Tipping, Zeffren and Fusfeld (1995) note that different categories of R&D stakeholders have differing interests and perspectives on the innovation process which, if ignored, can undermine important decisions about future innovation strategies.

A significant contribution to the stakeholder literature was provided by the landmark book by Freeman (1984) in which a systematic process for taking account of the impact of stakeholders on organisations was proposed. Methodologically, Freeman begins with a generic stakeholder map which is then extended to include consideration of how processes and transactions between an organisation and its stakeholders are managed.

More recently, Mitchell, Agle and Wood (1997) have developed a stakeholder typology based on the possession (or attributed possession) of one or more of the following relationship attributes:

- Power – the extent to which a party gains access to coercive, utilitarian or normative means to impose its will on the relationship

- Legitimacy – defined as a generalised perception that the actions of a party are desirable, proper or appropriate within some socially constructed system of norms, values, beliefs and definitions
- Urgency – degree to which stakeholders’ claims call for immediate attention

According to Mitchell, stakeholders gain salience (recognition and attention) in the minds of managers through their position on the typology (which is dynamic and may change over time depending on the strategic issues under consideration). Based on this literature, Elias, Cavana and Jackson (2002) proposed a systematic stakeholder analysis methodology which they applied to the management of an R&D project in New Zealand. For this study, I undertook a stakeholder analysis based on the Elias, Cavana and Jackson (2002) approach. My approach is summarised in Table 3.4 and Table 3.5 and in Section 3.4.2.

Table 3.4: Stakeholder analysis methodology

Step	Methodology
1. Develop stakeholder map	Include any group or individual who can affect or is affected by the achievement of the research objective
2. Prepare chart of specific stakeholders	Identify specific stakeholders from within each of the above groups
3. Identify the stake of each group	Chart identifies how they impact or are impacted by the research outcome
4. Determine key stakeholder issues	In depth interviews to determine key perceptions and issues identified by stakeholders.
5. Analyse stakeholder issues	Relate stakeholder issues to major research themes

Adapted from Elias, Cavana and Jackson 2002

3.4.2 Identification of stakeholders

Figure 3.4 captures the outcomes of applying this methodology to the red meat industry.

Figure 3.4: Stakeholder map

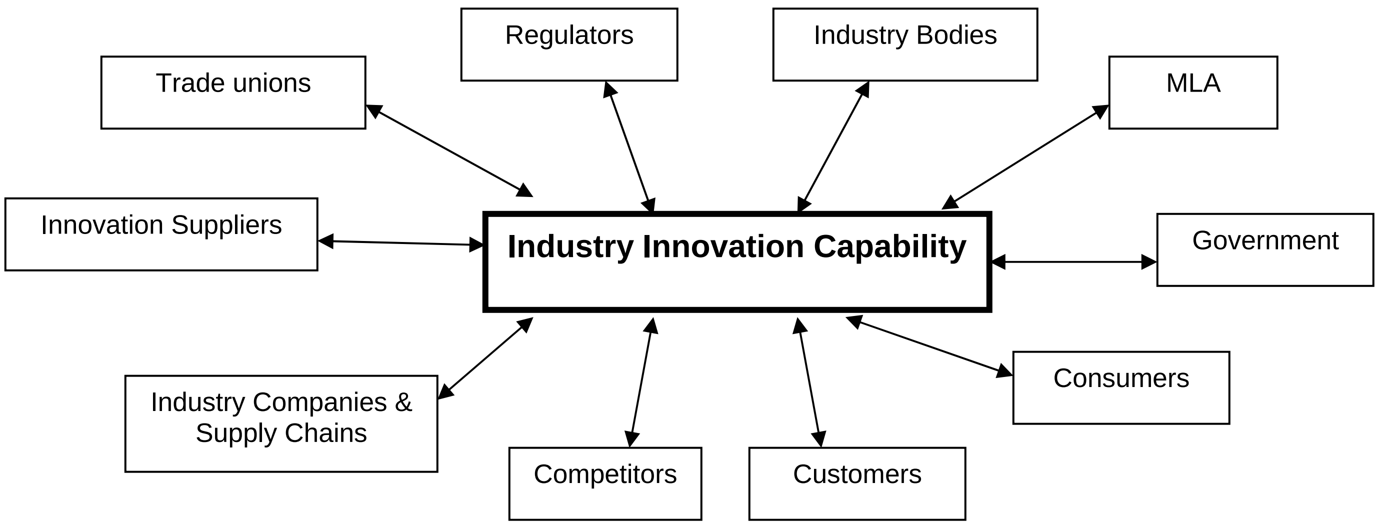


Table 3.5 details specific stakeholders in each of these groups and identifies the stake of each group.

Table 3.5: Stakeholder chart

Stakeholders	***Stake***
MLA - Board members - Managing Director - General Managers - Program Managers	Individuals directly and indirectly involved in the delivery of MLA innovation services (the focus of this research). Responsible for strategic direction of industry innovation programs.
Industry bodies - AMIC - AMPC - AUSMEAT - MINTRAC - AMIEU	Responsible for a range of industry technical, training and political lobbying services. Includes employee representatives. May either facilitate or hinder innovation and entrepreneurship in the industry. Reflects overall industry culture to some degree.
Government/regulators - DAFF - AQIS - State governments	Have a direct involvement in R&D funding and services and an indirect impact via regulatory arrangements.
Industry companies - Meat processors	These companies are the 'executors' of the industry's innovation and entrepreneurship

- Value-adders	strategies. Direct focus of this research study.
Suppliers of innovation - R&D providers -Technology suppliers	Direct involvement in the industry’s ‘innovation value-chain.’ Impact on innovation capability via the concept of ‘resource endowments.’
Customers & suppliers - Retailers, food service - Livestock suppliers	Impact on innovation capability as ‘actors’ in the industry’s markets.
Competitors - Chicken and pork industries	Potential impact on innovation capability as ‘actors’ in the industry’s markets.

As will be discussed in Chapter 4, in-depth interviews based on a convergent interview methodology (Dick 1998) were undertaken with representatives from each stakeholder group. A snowball method was applied in which initial interviewees progressively identified subsequent interviewees (that qualified based on the stakeholder analysis).

3.4.3 Formation of MLA research team

As a specific outcome of this research was to improve practice in the delivery of MLA’s innovation services, an internal MLA research team comprised of seven members of my own management team was formed in the planning phase of Cycle 1. Members of this team were involved in reviewing the emerging data in an iterative process (see Chapter 4) and providing input into the evolution of the conceptual framework.

To facilitate participation in the study by members of the research team, a number of workshops were conducted covering topics including:

- Action research methodologies
- Creativity and lateral thinking
- Mind Mapping
- Innovation and entrepreneurship
- Story telling and business narrative
- Change management
- Socio-technical theory and concepts
- Leadership and managerial competencies

- Mentoring and coaching

Planning for Cycle 1 was undertaken collaboratively with the research team in a two-day workshop and the team met regularly every six to eight weeks during the cycle.

3.5 Summary and Plan for Cycle 1

Based on the thematic concerns identified at commencement of the study (see Chapter 1), the central research question to be addressed was defined as:

How should MLA design and deliver interventions that will significantly enhance the innovation capabilities of the Australian red meat industry in order to sustain competitive advantage in a rapidly changing environment?

Following the preliminary literature review and construction of an initial conceptual framework the following three additional research questions were identified:

How can the concept of ‘firm innovation capability’ be expressed in the context of the red meat industry?

What are the key contextual issues impacting on the level and success of innovation initiatives in the red meat industry?

What skills, strategies and structures will MLA require to deliver the new innovation intervention services?

The key purpose and plan for Cycle 1 was therefore to undertake a series of actions aimed at exploring these questions through:

- Accessing industry knowledge and experience
- Creating opportunities for participation and engagement by industry stakeholders in the research
- Facilitating learning within the MLA research team by involving them directly in the research

The next chapter describes the *act* and *observe* phases of Cycle 1 and provides a detailed description of the specific methodologies employed

CHAPTER 4

ACTING AND OBSERVING: ENGAGING STAKEHOLDERS

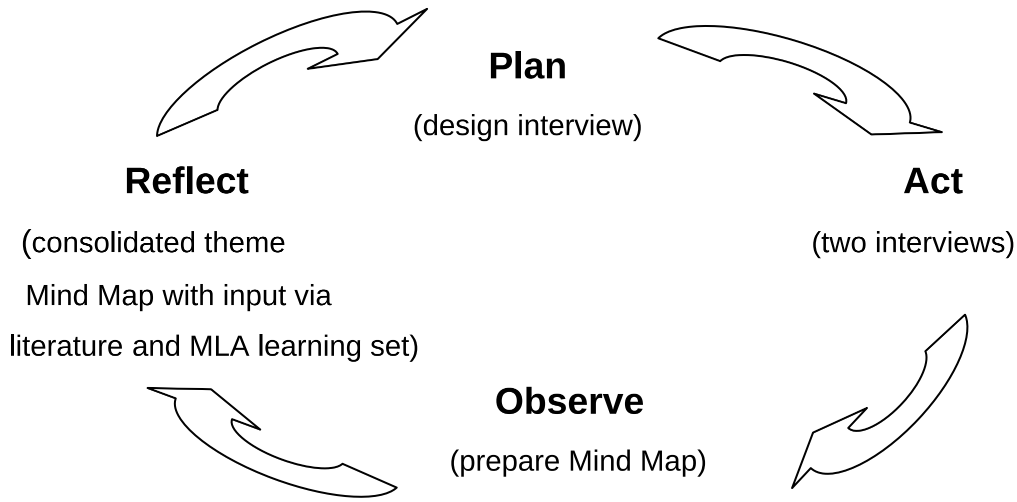
This chapter describes the ‘act’ and ‘observe’ phases of the first major research cycle. The aim of the cycle was to capture industry knowledge to ensure the intervention framework to be developed in this study would have relevance and application for industry participants. The action phase included a series of convergent interviews which involved multiple iterations of data collection, data analysis, engaging the literature and reflection by the MLA research team. During this phase I also had the opportunity to participate in a series of food innovation workshops conducted by NFIS. This provided further opportunities for confirmation and disconfirmation of the concepts being developed. Observations from the cycle are presented in the form of major themes articulated by industry stakeholders. In Chapter 5 the outcomes of a further literature review are combined with these major themes to produce the revised conceptual framework of the sector’s innovation system.

4.1 Acting in Cycle 1: Capturing Industry Knowledge

4.1.1 Convergent interviews

Dick (1998) states that convergent interviewing is a useful technique in the early stages of an action research study when concepts and ideas are still quite ‘fuzzy’ and it is difficult to be prescriptive about questions and approaches to analysis. Figure 4.1 illustrates the convergent interviewing approach used for this study. The cyclical approach allowed me to refine questions, methods and understanding over a series of interviews.

Figure 4.1 Convergent interview cycles



Convergent interviewing is an example of a dialectic process in which different points of view can be systematically explored through confirmation and disconfirmation. The technique facilitates a more focused gathering of potentially large amounts of information. This is an important consideration in qualitative research where quantity of data can sometimes be overwhelming. In addition, the combination of unstructured content with a structured process is also considered to alleviate concerns regarding bias and rigour in qualitative research studies (Dick 1998).

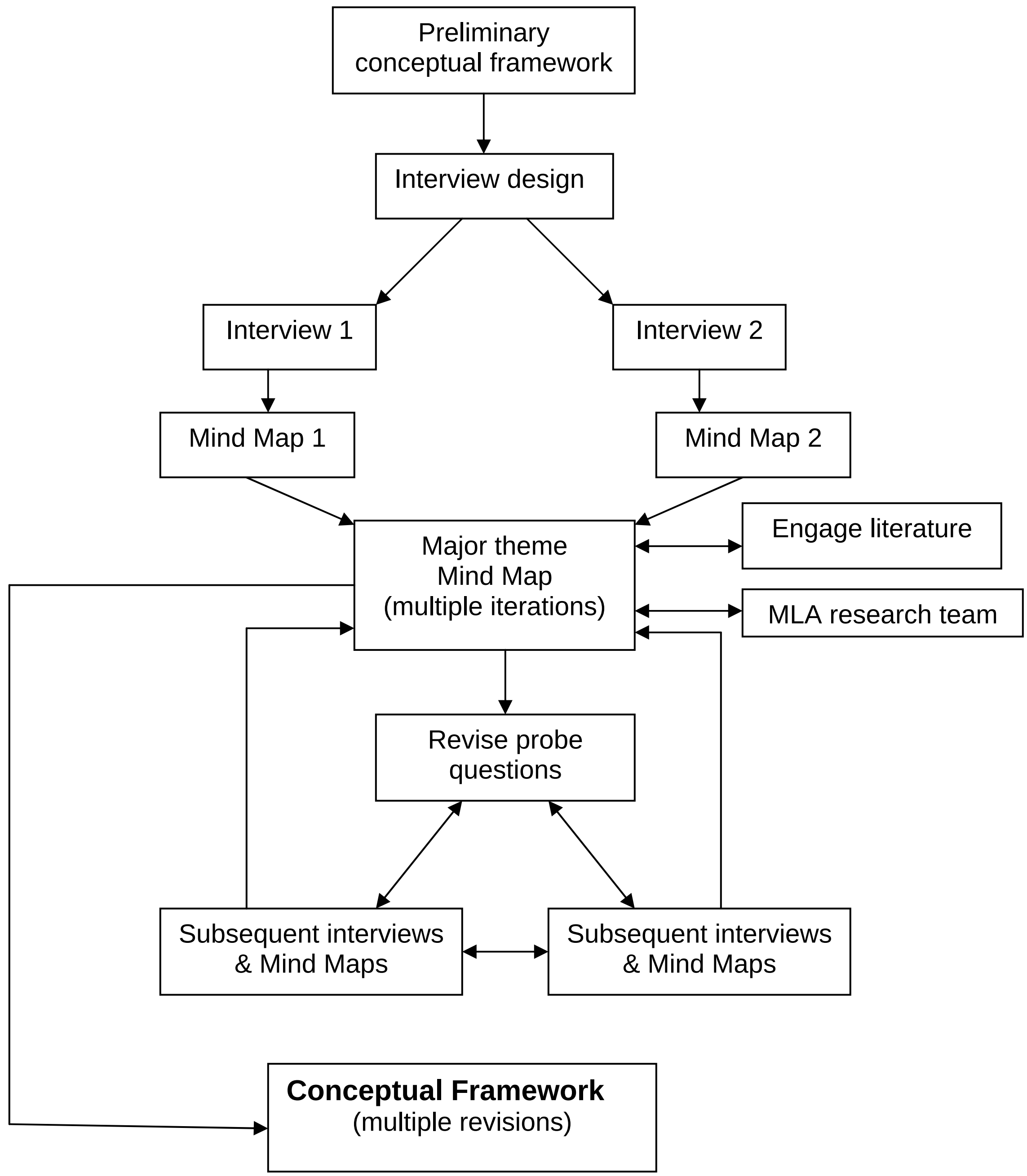
Convergent interviewing was deemed to be the most appropriate technique for this first cycle in the research. Even though the preliminary conceptual framework (discussed in Section 3.2) provided guidance for the content of the research themes, it was important not to pre-empt understanding of the how the issues were perceived and understood by the industry.

Application of the convergent interview technique in this study involved the following activities.

1. An initial list of five potential interviewees was developed from the stakeholder analysis and a telephone call ascertained their agreement to participate. This was followed up with a written invitation, which included a brief overview of the project and discussed issues of confidentiality and how data would be used.
2. The interview date was agreed with an expectation that approximately 1.5 hours would be the timeframe (actual interviews ranged from 1 to 2.5 hours).
3. An interview plan was developed with a general opening question being used to encourage the interviewee to begin to reveal their thoughts and ideas on the topic of industry innovation culture and capability. The aim was to ensure the opening question was as content-free as possible so as not to influence the interviewee's thoughts and perceptions. For each interview, a list of probe questions was also prepared based on:
   - Which stakeholder group the interviewee represented
   - Items identified from earlier interviews which required confirmation or disconfirmation.
4. Detailed notes were taken during each interview and a Mind Mapping process (Buzan & Buzan 2000) was used to code and analyse the data (see Section 4.1.2). The Mind Maps were used to uncover key elements and propose initial relationships.
5. Because only one interviewer was used in this stage of the research, a modified paired interview process was developed based on the model proposed by Dick (1998). Initially two interviews were undertaken, notes and Mind Maps were prepared, and then I engaged the literature and the MLA research team to assist in the preparation of a consolidated theme-based Mind Map before developing the plan for the next two interviews.
6. Finally, the interview data and findings of the further literature review were combined to identify the overall elements of the innovation system and a revised conceptual framework was developed (described in Chapter 5).

Figure 4.2 summarises the iterative approach which was based on a methodology developed by Lewis (1998).

Figure 4.2: Data collection and analysis: iterative triangulation



As noted by Lewis (1998 p.457), "Systematic iterations that develop a chain of triangulated evidence may enhance the scientific value of the resulting constructs and theory by improving their validity, reliability and logical consistency." This approach is considered to be particularly useful when the area of study is 'fuzzy' and multidimensional, and where developing useful frameworks requires an understanding of complex interrelationships between human, technical and organisational systems.

Systematic iterative triangulation methodologies have been identified by a number of researchers (Bourgeois 1979; Weick 1989) as providing superior processes for the development of higher quality theories. Methods based on one-dimensional approaches were not considered appropriate for this study for the following reasons:

- Those relying solely on the literature are thought to stifle creativity (Bourgeois 1979)
- Grounded theory, which relies on collecting large amounts of primary data, was considered to be cost prohibitive and resource intensive (Eisenhardt 1989; McCutcheon & Meredith 1993)
- Relying solely on my own experience and intuition may have limited the quality and utility of the outcomes and risked the rediscovery of existing theories (Lewis 1998)

Iterative triangulation may result in a number of different outcomes including: the development of theoretical constructs; the forming of testable propositions; and/or the construction of comprehensive theoretical frameworks upon which to base subsequent research stages. It was this latter outcome that was of particular interest in this study and as stated by Lewis (1998 p. 467), "The methodological approach provides means to clarify multidimensional concepts and to develop a comprehensive theoretical framework representative of complex dynamic organisational reality".

As noted previously, subsequent interviewees were identified using a snowballing technique (Glaser & Strauss 1967) in which respondents were asked to identify people who fitted one or more of the following criteria:

- Likely to be interested in the study outcomes
- Known to have views and ideas on the topic
- Directly involved in a key component of the preliminary conceptual framework
- Experience in the industry
- Belonged to one of the identified stakeholder groups
- Key influencer who could act as an inhibitor or facilitator during subsequent implementation phases

A total of 28 interviews were undertaken at which time it was determined that saturation (Glaser & Strauss 1967) had been reached as little additional information was being elicited and further interviews were not considered necessary.

4.1.2 Data analysis

As noted by Miles and Huberman (1994), data analysis involves: selecting, condensing and transforming data; displaying these data in an organised way; and drawing conclusions from the condensed display. A systematic approach to analysing data from qualitative interviewing as proposed by Rubin and Rubin (2005) was used in this study as follows:

<u>Step One:</u> Recognition involving a breakdown of the data (from the detailed interview notes) into data units in order to identify themes, concepts, events and notable quotes.

<u>Step Two:</u> Data reviewed across interviews to clarify and synthesise what is meant by specific concepts and themes.

<u>Step Three:</u> Elaborate and integrate themes and concepts in order to develop new ideas, identify connections and develop a holistic understanding.

Step Four: Develop codes (and brief labels) for each of the concepts, themes, and events (based on the initial conceptual framework; as suggested by the literature; and most importantly, as indicated by the data itself).

Step Five: Code the data by highlighting the data units.

Step Six: Progressively build up the main themes (and ultimately a revised conceptual framework) based on a detailed analysis of the coded data, progressive engagement with the relevant literature, and reflection by the research team.

This iterative process bears some relationship to the grounded theory methodologies espoused by Glaser and Strauss (1967). However, the systematic engagement with the literature provides a degree of theoretical underpinning which avoids the risk of rediscovering existing theories (Lewis 1998).

Mind mapping (Buzan & Buzan 2000) was chosen as the tool to both analyse and display the data. As noted in Buzan and Buzan, Mind Maps are ideally suited to academic endeavour as they assist the researcher to:

- Explore all possibilities
- Clear the mind of previous assumptions
- Create new conceptual frameworks within which ideas can be organised
- Find new connections and association of ideas
- Identify patterns
- Develop and capture flashes of insight
- Manage large quantities of information
- Bridge the gap between thinking and writing
- Convert complexity into understanding and simplicity

The merging of the data analysis approaches proposed by Rubin and Rubin (2005) with a mind mapping tool developed by Buzan and Buzan (2000) occurred as follows:

- Interview summaries were prepared and broken down into data units and coded following each interview. As coding categories were progressively built up during the whole sequence of interviews, early interviews initially produced a narrower set of coded data. These summaries were subsequently revisited and further analysed as the interview schedule progressed.
- A *Respondent Mind Map* was prepared following each interview in which key concept and theme codes were projected as primary, secondary and tertiary branches of the Mind Map (known as *Basic Ordering Ideas* in Mind Mapping). At this stage, the purpose was to identify connections between concepts and themes from the respondents' perspectives.
- Following each paired interview sequence (14 in total) *Theme Mind Maps* were prepared and subsequently revised. Inputs from the reflections of the research team and additional concepts derived from further engagement with the literature were incorporated into the theme Mind Maps.
- Based on the outcomes of the analysis at the conclusion of each paired interview sequence, probe questions for the next paired sequence were prepared to enable confirmation/disconfirmation.
- At a number of points during the interview sequence, the preliminary conceptual framework was also revisited and revised.

The outcomes of the detailed analysis of the interview data are presented in this chapter in Section 4.3. The final conceptual framework and the review of the literature engaged during this cycle are presented separately in Chapter 5 to assist the reader to distinguish those elements that have been principally data-driven (based on the themes identified by industry respondents) from those that are the outcomes of a combination of reflection and engagement with the literature.

4.2 Confirmation Opportunity: Food Innovation Workshops

As noted in Section 2.3.3, the Federal Government initiative, the National Food Industry Strategy (NFIS), was established in 2002 to address a number of challenges and opportunities in the Australian food industry. During the course of this study, I engaged in a number of interactions with staff and industry participants involved in this broader initiative (see Table 4.1). This provided me with opportunities to evaluate the concepts being developed in this study with other experienced researchers and practitioners and to explore their application beyond a single industry sector.

Table 4.1: NFIS food innovation workshops

NFIS Workshop	My Role	Outcome
Think Tank to explore concepts of food innovation conducted on 2 Dec 2003 15 participants from research groups, govt., & food companies	Participant	I presented a draft of the firm innovation capability model which was strongly supported by participants. I also prepared a Mind Map from the discussions and incorporated this into subsequent identification of key themes.
Stakeholder workshop for proposed NFIS food innovation centre held on 16 June 2004 13 participants from food companies	Co-facilitator	Understanding of broad stakeholder concerns and potential interventions (see Section 4.2.1)
Food Innovation Workshop held on 21-22 June 2004 17 participants from research groups, govt., & food companies	Presenter & participant	I presented revised model of firm innovation capability and facilitated discussion of the individual components. I used feedback from this workshop to modify the final version of the conceptual framework.

4.2.1 Input from NFIS stakeholder workshop

The NFIS workshop conducted on 16 June 2004 focused specifically on identifying the key concerns of a wide number of food industry stakeholders.

From this discussion a strong need for provision of a range of innovation intervention services was identified. The outcomes of this workshop are included here as they provided key input into the design of the intervention initiatives undertaken in Cycle 2.

At a strategic level, the food industry participants identified the need for the following broad services:

- Market studies on emerging market opportunities, and on emerging technologies and their impact
- Market and foresighting studies on emerging consumer preferences
- Regulatory compliance guidance
- Export market information
- Information about and input into government policy on industry training
- Innovation management best practice studies and benchmarking opportunities

At an operational level, the participants articulated a need for the following services:

- Support for contract development, leverage of purchasing power, and support for funding applications, through a system of SME accreditation using an innovation scorecard approach
- Access to an executive talent bank for consulting and mentoring services
- Access to a registry of business experts in non-core, non-competitive areas
- Access to a technical experts' registry, a general suppliers' registry, and an ingredient suppliers' registry (all preferably accredited)
- Access to international and national 'Food Australia' brand marketing campaigns
- Participation in an innovation showcase to network innovative suppliers and product developers, preferably an Asian Pacific regional event
- Industry networking opportunities through executive forums

- Facilitated access to new technologies

4.2.2 Endorsement of the model

Members of the NFIS innovation team made numerous presentations to food companies in the period December 2003 to June 2004 in which they introduced the model of firm innovation capability I developed during this study. The following quotes from a number of NFIS documents are included here to illustrate the level of endorsement received for the model. It is estimated that the model has been exposed to representatives from more than 60 food companies and NFIS senior staff reported very positive feedback on the design of the model and agreement that it provided a basis for the development of intervention services.

"The endorsement of the Christine Raward model of food innovation as a probable and very credible basis for the common definition of food innovation in an Australian context."
Source: NFIS document "Food Innovation Centre Meeting" 14 April 2004

"Christine Raward from Meat & Livestock Australia made a major contribution to the (December) Workshop by sharing with us a roadmap she was developing for her academic studies……The NFIS Team judge that there was unanimous support for this model amongst participants at the December Workshop and that we should adopt the roadmap as a basis for our initiative and move onto how we can bring this live for food companies and promote it in a format that is meaningful to them".
Source: NFIS document "Welcome to Food Innovation Workshop Participants" 11 June 2004

"We propose a model for understanding the components of innovation, and for describing in such a common language the critical elements for success in innovation and entrepreneurship at both the industry and the company level. This model of organisational innovation capability, developed by Christine Raward from Meat & livestock Australia, describes the underlying capacities which enable an industry or a company to be innovative on a sustained basis. The framework can be effective in focusing attention by the industry and by individual companies on the capabilities required to manage innovation successfully."
Source: NFIS document "Innovation Central Prospectus" 12 July 2004

The level of endorsement by food companies and the academic researchers who participated in the NFIS workshops plus the adoption of the model by NFIS as the basis of their future strategy provided me with a degree of confidence in the model and its suitability as a framework for developing intervention strategies.

4.3 Observations From Cycle 1: Major Themes

The analysis of the interview data and the results of the NFIS Food Innovation Think Tank (Dec. 2003), provided insight within the following major themes:

- Elements of the overall red meat industry innovation system
- Characteristics of firm innovation capability within the context of the red meat industry
- Role of individuals in the red meat industry innovation system
- MLA's role in developing interventions to enhance the red meat industry's innovation culture and capability

Following is a description of the elements within each of the major theme areas as reported by the interview participants. The terminology used to describe the various elements is taken directly from the data wherever possible with direct quotes from participants included to add richness and authenticity. In Chapter 5 these major themes are triangulated with the literature to produce the revised conceptual framework of the sector's innovation system.

4.3.1 Characteristics of an innovative industry

Innovative industries were seen by industry participants as being those which consistently demonstrate the "capacity to position the right products and services, at the right price, in current and emerging markets by meeting customer demands better than their competitors" (*industry association* *representative).* Participants judged innovative industries to be generally characterised by:

- Success in entering new markets
- Adoption of new technologies and business models
- Transformational change over time
- Proactive, flexible, adaptive cultures
- Creating 'new rules for competition'
- Ability to attract new people with new skills

Participants believed that for the red meat industry to be classed as innovative, it must become more proficient at identifying new trends and opportunities in the external environment and it must "learn how to act before they have to" (*industry association representative).* The red meat industry was reported to exhibit relatively low levels of 'innovativeness' when compared with other industries and it was generally agreed that it will face a significant challenge if it is to prosper in the future. Participants believed that there was an imperative for the industry to urgently develop a strong growth strategy which would achieve a balance between "being smart at what they do now" (*industry association representative)* combined with a focus on developing innovative approaches to address future challenges. As stated by a senior industry executive "The imperative to change and innovate is now with us."

Innovation was seen by participants as a critical strategic area for all companies within the industry if they are to maintain competitive advantage. Benefits directly to firms from innovation were thought to occur in a range of areas including:

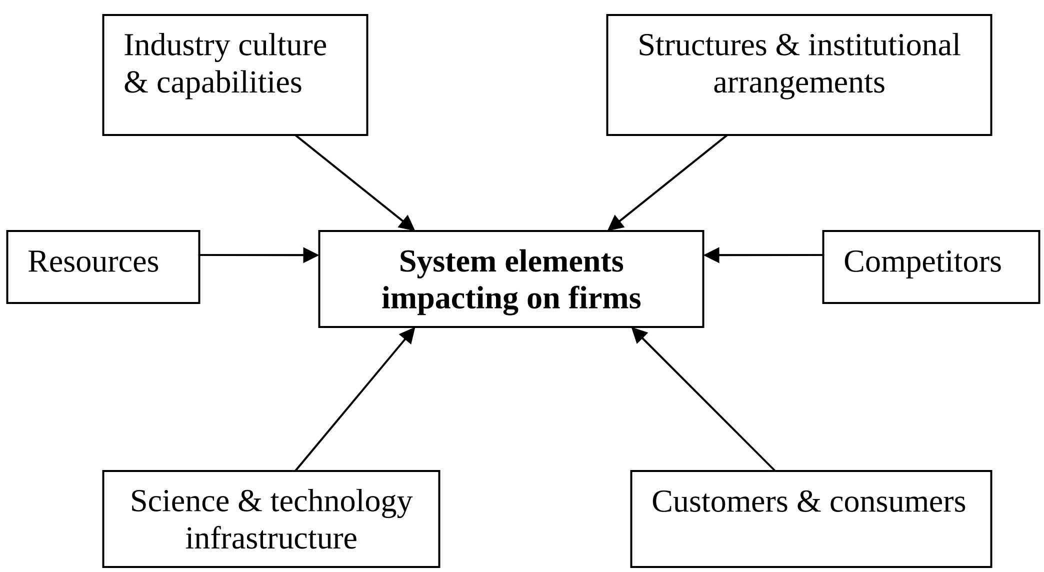
- Increasing competitiveness and profitability
- Supporting growth
- Reducing costs and improving margins
- Increasing demand for products and services

- Satisfying customers
- Ensuring sustainability
- Creating a better place to work making it easier to attract and retain people

4.3.2 Industry innovation system

From the data, it is apparent that in addition to the broad contextual environment of geography, economic, social and political conditions, participants believed that innovation in the red meat industry is being impacted upon by a number of specific interconnected elements. These elements are represented in Figure 4.3 below.

Figure 4.3: Industry innovation system



These elements were articulated by the participants as follows:

Industry structures and institutional arrangements

The fragmented structure of the meat industry was seen to have a significant and primarily negative impact on the level of innovation. Participants believed that a lack of integration across the supply chain is resulting in a generally poor flow of information and market signals may not always be getting through to individual firms. As stated by a senior executive from an industry association, "Only about 20% of the industry is even aware of the threats and opportunities emerging in the new global environment".

Lack of innovation in value chain thinking was thought to have resulted in over-specialisation and lack of coherence in new product and marketing strategies. For processing companies, relationships with livestock suppliers were seen to be often based on adversarial behaviour patterns which inhibit the scope for co-operation and value chain innovation.

The nature of industry ownership was also thought to have an impact on innovation, although clear patterns have not yet emerged. A number of participants believed the relatively high level of multinational ownership (in the beef industry in particular) may result in a decrease in innovation as R&D is undertaken offshore by parent companies. Owner-operated businesses were also seen to exhibit low levels of innovation as they are: often not growth-oriented; are less professional and sophisticated in terms of their management skills; do not appear to embrace high-risk initiatives; and display low levels of reinvestment in business infrastructure.

Finally, institutional arrangements within the industry were also considered to create barriers to innovation. Despite several restructures over the past two decades, a plethora of industry bodies was seen to remain with a high degree of paternalism still being exhibited. These institutional arrangements were thought to have produced a range of dysfunctional behaviours including: lack of transparency; a focus on crisis-management; over dependency; complacency; and even misuse of power by industry representatives "who seek to protect their own vested interests by maintaining the status quo and smothering unacceptable information and ideas" (*CEO of an industry service provider)*. The 'socialised' approach adopted by some industry organisations was thought to have inhibited the impact of “normal competitive market forces which would provide advantages and incentives for more innovative companies” *(industry association executive).*

Similarly, the very high level of state and federal regulatory involvement in the industry (food safety, food labeling, OHS, environment) was also considered to present problems for innovation with the range of perceptions that:

- It creates confusion
- Is not science-based
- There are too many rules which are time consuming and don’t add value
- Regulators have limited industry or commercial knowledge
- They are too powerful and industry is scared to take them on as they fear repercussions
- They are too slow to adapt to new technologies
- They are resistant to change
- They are locked into an historical paradigm regarding their interpretation of their role as “representing the customer not serving the industry.” *(industry association executive).*

For the industry to move forward, a better of understanding of the impact of these structures and institutional barriers to innovation was considered to be a high priority. It was recognised that it would be difficult to achieve changes in these areas and that this will require a long term commitment. Several participants indicated that they believe industry structures will be forced to change as a result of global competitive pressures. As noted by a CEO of a processing company, “Meat processing companies will need to become fully integrated, economies of scale will become more important, and streamlined value chains will become the most effective business model”.

Industry culture and capabilities

Participants believed that this is a very traditional industry characterised largely by a culture of suspicion, lack of trust and ruthless competition based on winning short term gains. The competitive environment over the past 30 years was reported as being dominated by a narrow commodity-based strategy with an almost exclusive focus on cost cutting and using livestock purchasing muscle to exclude new entrants. It was suggested by several participants that this environment has produced a number of large companies intent on preserving the *status quo*. These companies have enjoyed substantial success based on this paradigm and they may not be willing to accept that the environment is changing and that new innovative business models will be required in the future. As noted by a manager from a processing company, “We are very good at what we do, we sell all the meat we produce, we’re pretty right.” While there are pockets of innovative activity, the industry culture is not considered to be supportive of innovators who were described by one participant as, “They’re the ones with the arrows in their backs” *(retired processing CEO).*

Past R&D failures and a lack of commercialisation success were thought to have produced a very risk adverse culture. Participants reported that most companies were not willing to be the first to try anything new. Innovation is perceived to be too risky and disruptive to production schedules which firms can not afford due to small margins and cut throat competition. Many companies have explicit strategies of either being ‘fast followers’ or relying on innovations to filter into the Australian market from overseas. Participants acknowledged that if everyone took this stance, the industry will come under increasing pressure from low cost competitors such as Brazil.

A key issue reported by participants was the lack of exposure to formal training and education by most of the senior managers currently in the industry, combined with their long tenures in a limited number of companies.

This was considered to cause them to be reliant on approaches that have worked well in the past and does not allow them to easily embrace new ideas or become aware of approaches that have worked elsewhere. As one participant noted, “They do not want to move outside their comfort zone as they do not have the relevant experience, exposure or qualifications” (*research program manager).* Many of the participants believed that until there is a significant ‘changing of the guard’ it will be very difficult to change the industry’s culture and “only a major, and probably disastrous, shock will shake the industry from its current position” (*industry association representative).*

Competitors

Participants were aware that the red meat industry operates in an extremely competitive global environment and has been losing market share for the past 30 years to competitors such as other proteins (chicken and pork) and other red meat producing countries. Participants thought that the meat industry needs to be aware of the strategies adopted by competitors. This would enable them to learn from their successes and develop innovative responses to counter their efforts to gain further market share. A number of participants referred specifically to the differences between the Australian and New Zealand industries. New Zealand counterparts were deemed to be much more professional and sophisticated as result of a strong export focus. Based on their own analysis, several participants considered the New Zealand industry to demonstrate greater innovation capability as evidenced by:

- Employment of more highly qualified personnel
- Close links with the R&D community
- Productive relationships with regulators
- Greater awareness of the value of investment in innovation
- Adoption of new ideas and technologies

- More responsive to external environment and aware of emerging challenges and opportunities
- Coherent industry structures based on ‘competing as a country’

Comparisons were also made with the chicken industry, which was reported as having increased market share through a focus on product development delivered by innovative firms and value chains. Finally, reference was made to the emergence of Brazil as a major competitive force in export markets with advantages such as access to low cost labour and large areas of productive land. Developing superior competitor intelligence and implementing strategies to respond to competitive threats were seen as major issues for the future success of the industry.

Consumers and customers

Participants thought that consumers will be the main stimulus for innovation in the future and that emerging consumer trends provide the industry with many opportunities. As customers and community perceptions change regarding nutrition, health, convenience, sustainability, animal welfare and food quality, participants believed the industry will need to demonstrate integrity and the capability to deliver. “Industry will need to be aware of these changing consumer needs and be smart about how they are addressed” *(processing CEO).* This will require innovation efforts to be directed towards developing more modern production methods combined with innovative marketing strategies. As noted by a representative of an industry association, declining consumer demand cannot be ignored because, “The game has changed and the imperative to change and innovate is now with us”.

Retail and food service end-users were also reported as impacting on innovation by providing an interface with consumers and creating a pull-through effect through the supply chain. In some cases however, it was reported that large global supermarket customers can inhibit innovation if there is too narrow an emphasis on cost-cutting. Thus, “If your customer doesn’t want you to innovate too much there are lots of challenges to overcome” (*innovation manager from a processing company*). Participants also noted that, in some instances, large retailers are in a position to capture a disproportionate share of the benefits of innovation and this can become a disincentive for their supply chain partners to continue to drive for improvements.

While participants reported considerable room for improvement in industry responsiveness to consumer drivers, a few examples were given of the industry demonstrating a capability to innovate in response to new demands. One such example was the fact that the industry has become more customer-focused in the last 10 years with the emergence of a new feedlot sector aimed at meeting Japanese consumer specifications. This innovation was supported by industry bodies which assisted firms to access scientific capability and to implement the required quality systems. As a result, a significant number of players were able to move away from the “gatherers and sorters commodity mentality that used to dominate the industry” (*industry association executive)*.

Science and technology infrastructure

Participants saw the science and technology infrastructure supporting the industry as being both “part of the problem and part of the solution” to the industry’s innovation challenge (*research program manager)*. While science and technology providers were identified as an important part of the R&D pipeline, innovation was considered to be the responsibility of the industry. It was noted that the meat industry has invested many millions of dollars in R&D but there has not been much success to-date. Participants believed that this was because most R&D has been focused on reactive short term problem solving and has not been about helping the industry to proactively develop completely new concepts. Old scientific paradigms have persisted with many scientists who “speak a different language which is not aligned with industry needs or commercial drivers” *(research program manager).* Many scientists are thought to be more focused on furthering their own academic careers through publications rather than delivering real value to the industry.

In contrast, those participants directly involved in R&D management believed that industry lacks patience and an understanding of the time it takes to complete R&D. These participants also reported that there may be a naive perception by industry about what science will deliver and many appear to be hoping for a ‘silver bullet’ that will be easy for them to adopt and will solve all of their problems.

Participants believed it will be critical for linkages to be developed to bridge the ‘cultural divide’ between researchers who have the technical skills to produce new ideas, and industry that has the skills to execute solutions. Participants identified a need to find competent science and technology providers and to work with them to expand their understanding of industry commercial issues and to ensure greater alignment with industry innovation strategy requirements.

Resources

Participants identified that the key resources needed for successful innovation were skilled people and adequate financial resources available for investment in R&D. In relation to people, participants reported that the industry is struggling to attract and retain the right mix of skilled management and technical staff. This was believed to be due to a combination of the following factors:

- Community perceptions about the unpleasant nature of work in the industry
- Low educational base of the majority of people within the industry making it difficult for them to up-skill into more technical areas

- Industry culture which tends to be suspicious of anyone they think is "too qualified in an academic sense and lacking in a practical sense" (*industry association executive)*.

Participants considered it to be of critical importance for the industry to develop innovative ways to build diversity into the workforce and to gain access to a much wider pool of skilled labour resources. Initiatives resulting in better alignment between the industry's training and development needs and providers of educational services were also considered to be important.

In relation to finance, it was reported that the low margins that characterise the industry have reduced the level of funds available for investment in innovation. With competing priorities for these limited resources, company representatives interviewed reported that they are more likely to make investment decisions that they believe will deliver immediate returns rather than invest in longer term, risky R&D projects. One of the R&D managers interviewed reported that they had received advice from the finance sector that the perceived volatility of the industry makes it unattractive for external investors. Some banks and venture capital firms are known (to the participant) to have specific policies which preclude them from investing in meat processing companies.

Table 4.2 summarises the key themes identified by the participants regarding the elements in the industry's innovation system.

Table 4.2: Industry innovation system elements

Element	Major Themes
Industry structures and institutional arrangements	• Paternalism leading to complacency • Highly political, lack of transparency • Misuse of power • Fragmentation, lack of coherence • Adversarial relationship with suppliers • Market signals blocked • Over-regulated, not science-based
Industry culture and capabilities	• Inward looking & risk adverse • Low skill base • Narrow basis of competition • Resistance to change • Crisis focus, short term behaviour
Competitors	• Changing competitive environment • New entrants, more innovative • Competitors are less fragmented • Gaps widening in performance
Customers and consumers	• Major driver of innovation • Perceptions regarding industry integrity • Retailer pull-through effect • Information feedback critical • New opportunities emerging
Science and technology infrastructure	• 'Different language' • Lack of alignment with industry • Old paradigms • Industry wants the 'silver bullet' • Passive industry, naïve reliance • Insufficient technology providers • Poor commercialisation • Better R&D facilities required
Resources	• Insufficient technical skills • Difficulty attracting skilled people • Need for creative and entrepreneurial 'innovation champions and leaders' • Lack of access to risk capital • Low margins means low investment

4.3.3 Firm innovation capability

Participants indicated that in the red meat industry, firm innovation capability is the product of a number of interconnected elements which are similar to those identified at the system level. Participants believed that the focus at this level was more to do with how effectively individual firms interact with and influence these elements in the external system. Following is a description of the issues related to firm innovation capability as articulated by the participants.

Market Orientation

The responsiveness of firms to market drivers was seen as a key determinant of innovation capability. Innovative firms were described by participants as being better positioned to receive market signals from integrated supply chain structures and more sophisticated in their scanning and intelligence gathering activities. According to participants, firms that have identified the key consumer and customer trends, and are adapting their products and processes to address emerging concerns, will be the most likely to grow and prosper in the future. Conversely, those that continue to position themselves on the basis of fighting for market share with a narrow focus on cost-cutting and reacting to competitor advances were seen as less innovative and less likely to survive in the new global business environment. As stated by a manager from a processing company, firms "must be able to identify opportunities in what is a very complex external environment and be open to change as a result of this."

Innovative firms were seen to be the most capable at responding to opportunities presented by new technologies. They were also reported as having the most success in attracting and retaining the appropriate mix of skilled and experienced labour to deal with the new level of complexity. Participants generally agreed that for most firms to change from their current position of complacency and resistance there would need to be the perception of a 'major shock' occurring in the external environment. Some participants believed that this 'shock' was already apparent, others that it is rapidly approaching.

Leadership

Participants agreed that the level of leadership provided for innovation was the most fundamental element in ensuring the success of a firm's innovation efforts. CEO's were considered to drive the firm's culture and their ability to sell the vision and articulate the benefits of innovation will ultimately determine the effectiveness of strategy. As a processing company CEO noted, "If the CEO is not interested in innovation, nothing will happen ….. the CEO must give their imprimatur to innovation or no-one else will be committed."

Participants suggested that CEO's must be focused on a smaller number of 'big picture' critical success factors that will deliver long term sustainability and they must be flexible and open to challenge. Specifically, participants agreed that to ensure effective execution of innovation strategy, CEO's must:

- Allocate sufficient resources
- Ensure that appropriate systems are established
- Encourage managers to spend a percentage of their time and budgets on innovation
- Hold people accountable for innovation through performance management systems
- Implement rewards and recognition schemes.

A senior processing company executive stated that "The CEO must see innovation as a key organisational asset which must be developed and fostered ….. they must build innovation as a core capability and responsibility of the senior management team."

Participants reported a problem that many current CEO's are hampered by a lack of formal training and education, lack of exposure to diverse industries and experiences, and a conservative and risk adverse mindset. This was reported as making them overly reliant on approaches that have worked well in the past but not allowing them to embrace new ideas or be aware of approaches that have worked elsewhere. Participants suggested that CEO's require information about new methodologies that will help them to advance their innovation capabilities, and a safe place to "bounce ideas and have concepts challenged" *(research program manager.)*

Culture

Organisational culture was deemed by participants to have an important impact on the likelihood of a firm engaging in a wide range of innovative activities. The CEO's attitude and behaviour were considered to play the dominant role in determining culture. To move towards a more supportive innovation culture, firms "will need different people, with different skills and mindsets at all levels" *(research program manager).* Participants believed that firms will have to find ways to overcome their 'try-fail-back off' mentality and will need to build learning into their normal ways of operating.

Strategy

A key component of a firm's success in implementing innovation activities was seen as the quality of innovation strategy and the alignment of innovation plans to overall business goals. Several participants from within processing companies *(senior managers and supervisors)* reported a paradox between "managing the day-to-day performance of the business with the longer term need for innovation". Participants believed that in the red meat industry, innovation strategies need to be characterised by a long term focus with some projects extending beyond a five year horizon. It was reported that in some instances, firm innovation strategies are developed in an *ad hoc* manner. It was suggested by several participants that a range of strategy development tools such as scenario planning, technology scanning and a detailed analysis of consumer and competitor trends would be useful. Participants indicated that firms would benefit from building relationships with a range of external partners who would assist in generating ideas, providing technical support, reducing risk, and commercialising R&D outcomes.

Resources

Participants believed that innovation success depends on firms being able to attract, retain and develop a range of new skills and capabilities in their people. In particular, the role of the senior management team in leading a firm's innovation efforts is crucial and it was recommended that training programs should be developed in the following skill areas (list comprised of suggestions from a number of participants):

- Entrepreneurship
- Communication
- Business skills
- Relationship management
- Change management
- Creativity
- Awareness of new technologies
- New product development
- Innovative business models
- Value chain innovation
- Exposure to other industries
- R&D project management

In addition, it was emphasised that firms need to ensure they foster opportunities for creative individuals to have the time and resources required to explore new concepts and ideas. Participants believed that firms must actively recruit people who think differently and they should empower and motivate them to make a difference through new flexible organisational structures and reward schemes. In addition to the investment in people, participants noted that firms must also ensure an appropriate allocation of financial and technology resources to innovation including the establishment of a sophisticated ICT infrastructure. However, as noted by a research program manager, the ability of processing companies to respond innovatively to these pressures is limited by their low technical skills and knowledge base “even at the most senior level they have very little formal education and they don’t know what they don’t now”.

Systems & processes

Participants identified that firms must develop and implement a range of proven R&D methodologies if they are to reduce the risk of failure and create incentives to continue to reinvest in innovation. Participants suggested that in parallel with formal systems and processes, the concepts of knowledge management and organisational learning must also be considered and embedded. An innovation manager from a processing company believed that a major difficulty confronting management is finding a way to “increase employee knowledge and awareness by getting the communication processes right.”

Performance measurement

A common theme was the challenge for firms to develop appropriate measures of innovation performance such as project deliverables, commercially focused indicators and qualitative evidence of innovation success. Participants acknowledged that innovation performance measurement represents a difficult area but one which requires concentrated effort if the full benefits of innovation are to be realised.

Table 4.3 below summarises the key themes identified by the participants regarding the elements of firm innovation capability.

Table 4.3: Firm innovation capability elements

Element	Major Themes
Market Drivers	• Understanding of benefits of innovation • Perception of environment • Consumer concerns • Positioning re competitors & market share • Skilled labour • New technology
Leadership	• Sell the vision • Drive culture • Articulate value of innovation • Allocate resources & drive execution • Balance immediate commercial needs with long term growth • Needs skills, information & support
Culture	• CEO attitudes • Become more adaptive to change
Strategy	• Long term clear vision • Balanced portfolio • Scanning and capturing new ideas • Quality of external relationships
Resources	• Technical, R&D and change management skills • Better management skills • Nurture creative individuals • Allocate time for innovation and creativity • Financial • ICT
Systems & processes	• Proven methodologies • Learning systems • Idea generation • Innovation strategy development
Outcome measures	• Must be quantified • Commercial focus • Difficult to measure

4.3.4 Role of individuals in the innovation system

A number of participants described innovation as fundamentally a people process and indicated the importance of identifying and supporting the development of people as a key component of any intervention strategy. While the comments made in this area were very broad, the following categories of key individuals emerged:

Industry innovation champions

These were identified as individuals who, by virtue of their position as key influencers, would become very important in the evolution of an industry innovation culture and capability. Participants believed that these people need to be respected by their peers and that they will make an impact on the whole industry if they are seen to support innovation and to challenge negative perceptions regarding innovation.

Innovation 'doers'

These were identified by participants as individuals within firms that influence innovation outcomes through their ability to generate creative ideas and to mobilise resources around key projects. They were described as the people who can "make sense of the patterns emerging from the external environment" (*research program manager*). Participants considered that these entrepreneurial individuals are usually people with strong strategy execution capabilities that ensure creative ideas are captured and brought to market effectively.

Innovative researchers

A number of participants identified a special group of scientists who are not only good at the science and 'blue-sky' concepts, they also play a key 'translation' role between their own organisation and industry. These 'special' scientists were reported to be able to understand the specific environmental drivers and commercial imperatives facing the industry. Participants felt they have a particular skill at finding the right match between concepts that are being worked on and industry needs. They ensure that the scientists "let go of the research" (*representative from a research provider*) at the most appropriate time in its development cycle.

Innovation integrators

Participants identified these individuals as similar to the innovative researchers described above but operating at a more independent level. A number of participants indicated that they believe this is a key role for MLA Innovation Program Managers. It was acknowledged that there is considerable complexity in these roles and that they require a suite of quite different skills including:

- Able to see the 'big picture'
- Identify and prioritise environmental threats and opportunities
- Understand the science and where the solutions might be found
- Develop and execute comprehensive innovation strategies
- Build relationships across multiple stakeholders
- Respond to commercial imperatives
- Facilitate adoption of innovation outcomes
- Measure and communicate the benefits of innovation

A key challenge was seen as the identification, recruitment, development and support of all of these key individuals throughout the industry.

4.3.5 Potential MLA interventions

Participants considered that there were opportunities to improve the innovation culture and capability within the industry and that there was an imperative for appropriate interventions to be developed and implemented around this theme. Specifically, a number of important areas for MLA to intervene in the system were identified by participants and are summarised in the Table 4.4 below. These suggestions were incorporated into the design of new intervention strategies which were developed during the second major research cycle.

Table 4.4: Potential MLA interventions as identified by participants

Intervention areas	Potential Elements
Measure & communicate benefits	• Develop new impact evaluation approaches • Ensure commercial relevance of measures • Must be communicated to accelerate adoption and encourage industry investment in innovation • Benchmarking
Build industry engagement	• Address industry culture & politics • Encourage industry independence • Build firm capability • Engage with government & regulators • Identify & support innovation champions • Facilitate industry learning • Remove barriers to innovation
Investment in innovation	• Facilitate industry innovation strategy development • Idea generation & fast track development • Invest in new enabling technologies • Avoid duplication by scanning • Identify world-class providers • Reduce risks of investment • Co-invest with commercial partners • Access alternative funding mechanisms
Implement innovation framework	• Develop industry skills • Provide information • Disseminate proven methodologies • Develop innovation capability diagnostic • Develop innovation toolkits • Facilitate CEO awareness & commitment • Implement staged development processes
Build resources & capability	• R&D providers - alignment • Incubate and assist technology providers • Support industry innovation leaders • Attract technical capability to industry • Assist in labour retention programs • Develop creative & entrepreneurial people

4.4 Summary

This chapter documents the outcomes of the detailed analysis of interview data which are presented in the form of major themes articulated by industry stakeholders. The design of the interviews was informed by the preliminary conceptual framework developed at the commencement of this study. However, care was taken to ensure that interview participants' voice was heard and that the researcher did not pre-empt understanding of how the issues were perceived and understood by stakeholders.

An iterative triangulation methodology was used in this cycle (Lewis 1998) which involved multiple iterations between analyses of emerging data, systematic engagement with the literature, and reflection by the MLA research team. This iterative process enabled a balanced approach to the progressive building of theoretical concepts which bears some relationship to the grounded theory methodologies espoused by Glaser and Strauss (1967) but which avoided the potential risks associated with rediscovering existing theories when literature is ignored. In Chapter 5 the major themes emerging from the data collected in this cycle are triangulated with the literature to produce the revised conceptual framework of the sector's innovation system.

The main objectives of this first cycle were to capture industry knowledge and to provide opportunities for participation by key stakeholders in the study. Both these objectives were achieved and it was apparent that there exists a vast amount of knowledge and insight available within the industry. This provided confidence that a support platform existed that would be invaluable in subsequent stages of the research. Similarly, the endorsement of the conceptual models developed during the cycle by a significant group of researchers and participants from the broader food industry also provided confidence that the approach being taken had potential merit beyond the immediate scope of the study. The themes emerging from the data revealed a significant opportunity for MLA to make a contribution to the industry's long term sustainability and competitiveness.

Finally, and perhaps most importantly, experiences during this cycle revealed the potential for the study to impact directly on the MLA research team.

Differences in the way individual team members reacted to the new concepts and changes that were emerging varied considerably. While some were excited about the possibility of significantly changing how the team would operate in the future, others appeared to become increasingly uncertain about their ability to cope with the new level of complexity and changing roles. This issue clearly required a more sophisticated internal change management approach and this was subsequently included in the design of the second major research cycle.

CHAPTER 5

REFLECTING: REVISING THE CONCEPTUAL FRAMEWORK

As was discussed in Chapter 4, the first major research cycle was based on an iterative process in which data collected from in-depth interviews were combined with theoretical concepts derived from a more extensive literature review. The reflective phases of the cycle included input from the MLA research team. The steps undertaken during this cycle were specifically aimed at refining the preliminary conceptual framework developed at commencement of the study. While the data collection and literature review processes undertaken during this stage were closely linked, the outcomes are presented in two separate chapters. This approach was used to distinguish those elements of the final framework which were principally data-driven (reported as major themes in Chapter 4) from those based on the linkages identified when the data and literature were combined (presented in this chapter).

This chapter begins with an overview of the findings from an extensive search of the literature in the areas of innovation systems theory and strategic entrepreneurship. Linkages between the literature and the data are identified and incorporated into the revised conceptual framework. As will be discussed in Chapter 6, it is proposed that this more comprehensive representation of the red meat industry's innovation system supports the development of an integrated intervention model (the core research question for this study) and represents an advance on the narrower perspectives that characterise current innovation policies. To complement the overall conceptual framework, a model of firm innovation and entrepreneurial capability was also developed.

5.1 Linking Innovation and Entrepreneurship

5.1.1 Importance of innovation and entrepreneurship

As noted in Chapter 3, there is a growing body of literature about the nature and importance of innovation (Chandler, Keller & Lyon 2000) and the link between the effectiveness of innovation management and sustainable competitive advantage. According to Lin (2001, p.1), “Success in the twenty-first century can only come from competing through continuous corporate innovation.”

Similarly, the emerging field of entrepreneurship has also generated considerable attention in the research literature based on its importance to corporate vitality and wealth generation in today’s global economy. Zahra, Kuratko and Jennings (1999) state that entrepreneurship increases national prosperity by impacting on employment creation and the development of new goods and services. Guth and Ginsberg (1990), Lumpkin and Dess (1996), Miller (1983) and Naman and Slevin (1993) propose that corporate entrepreneurship can be used to improve competitive positioning and to transform corporations, their markets and industries as opportunities for value-creating innovations are developed and exploited. Lee and Peterson (2000) argue that entrepreneurship is the main mechanism for transforming global industries. They believe that higher levels of entrepreneurship are associated with higher levels of global competitiveness, more wealth and affluence, and long-term growth and viability. The reasons for this are the increased value-creating outcomes associated with the successful launch of new products and services and the efficiencies gained through technological advances. There is now a firmly established empirical base for claiming the effectiveness of corporate entrepreneurship in revitalising the profitability and competitiveness of firms, industries and whole nations (Lumpkin & Dess 1996; Zahra & Covin 1995).

5.1.2 Research concerns

There remain significant levels of concern among researchers regarding the efficacy and value of much of the work in the fields of innovation and entrepreneurship to date. Lumpkin and Dess (1996) argue that a broader theory of entrepreneurship has not yet been postulated and that despite significant research, there has not emerged a widely held belief regarding the characteristics of entrepreneurship. Similarly, Wolfe (1994, p.405) states that, “The most consistent theme found in the organisational innovation literature is that its research results have been inconsistent.” This has been attributed to the fact that researchers have failed to clearly identify innovation characteristics, the stages of the innovation process, and the types of innovation studied (Abrahamson 1991; Damanpour 1991).

Brazeal and Herbert (1999) have identified the importance for entrepreneurship research to avoid counterproductive fragmentation and to identify areas of convergence with other fields of academic endeavour. They particularly note that the closely related fields of change, innovation and creativity present opportunities for cross-disciplinary research. Covin and Miles (1999) argue that of all the various dimensions of firm-level entrepreneurial orientation defined in the literature, innovation is the common theme underlying all forms of corporate entrepreneurship. Despite this, the benefit of convergence in the innovation and entrepreneurship fields has largely been ignored by researchers to date.

Many labels have been used to define entrepreneurship including: entrepreneurship (Miller 1983); corporate entrepreneurship (Morris & Paul 1987; Zahra 1991, 1996; Zahra & Covin 1995); corporate venturing (Biggadike 1979); intrapreneurship (Kuratko 1993; Pinchot 1985); entrepreneurial posture (Covin & Slevin 1991); and entrepreneurial orientation (Dess, Lumpkin & Covin 1997). Based on the literature review undertaken during this cycle, it was determined that the concepts of *corporate* *entrepreneurship*, *entrepreneurial orientation* and *innovation* have most relevance for this study. Following is a brief discussion of these concepts.

5.1.3 Corporate entrepreneurship

Corporate entrepreneurship has been defined by Sharma and Chrisman (1999, p.18) as, "the process whereby an individual or a group of individuals, in association with an existing organisation, create a new organisation, or instigate renewal or innovation within that organisation." Covin and Miles (1999) conceptualise four forms of corporate entrepreneurship which may exist separately or concurrently in entrepreneurial organisations. Table 5.1 provides a brief description of their definition of each of the four forms. With reference to the data discussed in Chapter 4, it can be seen that the industry participants interviewed in Cycle 1 identified that all four forms of corporate entrepreneurship are likely to be important to future growth and prosperity in the red meat industry.

Table 5.1: Categories of corporate entrepreneurship

Category	Manifestation
1. Sustained regeneration	• Firms continuously engaged in new product & new service development • Characterised by cultures and systems which support innovation • Considered to be 'learning organisations' • Successfully embrace change • View innovation capability as an essential core competency
2. Organisational rejuvenation	• Seek to improve competitiveness by altering internal processes, structures or capabilities • Does not necessarily involve change in strategy • May include reconfiguring the value chain or the pattern of internal resource allocation
3. Strategic renewal	• Firm seeks to change basis of competition by redefining relationship with markets or competitors • Involves changes to the firm-environment interface • May assist industry leaders to maintain competitive superiority
4. Domain redefinition	• Firm proactively creates a new market position not yet recognised by others • Advantage is conferred on first mover status • Firms may be able to create industry standards in order to bypass competitors

Source: Covin and Miles 1999

5.1.4 Entrepreneurial orientation

Lumpkin and Dess (1996) define the five key dimensions of an entrepreneurial orientation as autonomy, innovativeness, risk taking, proactiveness and competitive aggressiveness. Their model refers both to the propensity of a firm to engage in entrepreneurship and the processes by which entrepreneurial activity occurs. Lee and Peterson (2000) propose a model in which key cultural dimensions are seen as having a direct impact on the expression of entrepreneurship by virtue of the sector's ability to engender a strong entrepreneurial orientation within its firms. As was revealed in the data analysis in Chapter 4, the culture of the red meat industry appears to have a negative influence on the expression of entrepreneurship and this may be impacting on the sector's ability to maintain global competitiveness. This aspect of the sector's innovation system is discussed further in Section 5.3 and is incorporated into the revised conceptual framework.

5.1.5 Innovation

Wolfe (1994) believes that innovation research has also been confused by the wide variety of terminology used to describe different aspects of the innovation process. A well accepted definition for innovation has been proposed by Livingstone (2002, p.3) as, "the process whereby new ideas are transformed, through economic activity, into a sustainable value-creating outcome". However, Hindle (2002) argues that there remains ongoing confusion and inconsistency by academics and policy makers. He proposes an alternative definition in which 'small-i' innovation refers more specifically to, "any form of new knowledge capable of providing the basis for a Big-I transformation process" (2002, p.51). He argues that at this stage in the process, small-i innovation has only developed a concept to the point where its commercial potential may be evident but is not yet realised. 'Big-I' innovation is the term he employs to encompass the entire transformation of ideas into, "an outcome that results in value creation and sustainability"

(2002, p.52). While there are a number of labels for this transformational ability including “innovative capabilities” (Dodgson & Bessant 1996: *passim*) and “entrepreneurial competence” (Penrose 1995, p.34), Hindle uses the term “entrepreneurial capacity” (2002: *passim*). He proposes that the key determinants of entrepreneurial capacity are motivation (which is directly impacted on by the prevailing cultural perception regarding the social legitimacy of entrepreneurship) and skills (which may be developed by a combination of formal educational mechanisms and experiential learning). Data collected from the interviews supports this distinction between the generation of new ideas and the transformation of these ideas into commercial outcomes through effective commercialisation. The data suggest that the red meat industry lacks transformational capabilities in particular and that these should be a focus of future interventions.

5.1.6 Convergence

As can be seen from this brief overview, multiple labels are used to describe the many concepts being studied in the innovation and entrepreneurship domains. In many instances there appear to be overlaps between the two areas. Brazeal and Herbert (1999) and Covin and Miles (1999) identified that the study of the two fields would benefit from higher levels of convergence. As noted previously, opportunities for combining the concepts have largely been ignored in the literature. For the purposes of this study, concepts from both fields are included in the revised conceptual framework of the sector’s innovation system and the model of firm innovation capability. It is proposed that this combined approach provides a more solid basis for understanding the sector’s innovation system and is well supported by the data collected from interviews with industry participants.

5.2 Innovation Systems Theory

5.2.1 Overview

Innovation has been a subject of interest to a wide range of researchers since early in the twentieth century with the emergence of a plethora of theories. As suggested by Wolfe (1994), one of the key challenges in innovation research is to understand the complex, context-sensitive nature of the phenomenon itself. This requires acknowledgement that different theories of innovation will be more or less useful depending on the environmental contexts within which innovation takes place. A number of researchers (Abrahamson 1991; Poole & Van de Ven 1989; Tornatzky & Fleischer 1990; Van de Ven & Rogers 1988) suggest that research effort should be directed at determining the contingencies that govern when various innovation theories apply. Kanter (1988) also identifies external factors as playing an important role in determining the degree of innovation occurring at the firm level. Her work focuses primarily on the institutional environment including: government policy; regulation; industry institutional arrangements such as trade unions; supporting infrastructure; and societal expectations.

More recently, there has been a convergence in the literature of innovation theory and systems theory. This has given rise to the concept of national systems of innovation (Dosi et al 1988; Freeman 1987; Lundvall 1992; Nelson 1993). Systems approaches to innovation propose that firms cannot undertake innovative activities in isolation. Specifically, their decision-making must involve complex interactions with an array of variables in their environment.

The innovation environment may be conceptualised at two distinct levels (Smith 1996):

- The immediate environment which relates to the interactions between a firm and its customers and suppliers, referred to as the value chain concept. Smith argues that these interactions should be viewed as more than simplistic arms-length market transactions. Rather they may involve long-term relationships which impact directly on a firm's learning and innovation initiatives.

- The broader environment covering the social and cultural context that also shapes the innovative behavior of firms. This includes institutional arrangements, science and technology infrastructure and the processes by which new knowledge is created and distributed. Adner (2006) refers to this broader context as the firm's innovation ecosystem.

The basic argument of the innovation systems thinking approach is that the system conditions will have a decisive impact on the extent and direction of firm innovation strategies including the freedom with which they will be able to execute their innovation decisions. Smith (1996, p.5) claims that the inclusion of systems thinking in the study of innovation represents, "a significant step towards an innovation-based growth theory". He believes this approach has not been adequately addressed by the mainstream economics or industrial organisation literature. This literature generally presents a narrow concept of uncertainty, an inadequate theory of the creation of technological knowledge and the interdependence of firms and no real analysis of the role of policy interventions. Alternatively, innovation systems approaches to economic growth focus on the dynamics of industrial development and pay more attention to business structures and the conditions that encourage innovation and entrepreneurship than do the more classical economic models. For this reason, Smith (1996) believes the systems approaches are more useful than the narrower economic models to policy makers seeking to stimulate technological development and growth.

Based on the range of issues identified by participants in Cycle 1 as impacting on the innovation performance of the red meat industry (see Section 4.3), I determined that the innovation systems approach provided the most relevant theoretical basis for this study. The following sections describe the key elements of an innovation system, with a particular focus on sectoral innovation systems, as this was the primary unit of analysis in this study.

5.2.2 Elements and processes in an innovation system

Lundvall (1992, p.2) defines an innovation system as:

> *A system of innovation is constituted by elements and relationships which interact in the production, diffusion and use of new and economically useful knowledge…..a national system encompasses elements and relationships, either located within or rooted inside the borders of a national state.*

A number of researchers (David & Foray 1995; Lundvall 1992; Smith 1996) identify that fundamental to the effective operation of an innovation system is the quality and depth of interactions between actors within the system and the efficiency of knowledge creation and learning processes that flow from these interactions. It is the nature and dynamics of learning processes which emerge as central issues in the notion of innovation capability at both a firm and a system level. Lundvall (1992) describes learning within an innovation system as occurring in multiple ways. These include: organised market learning between suppliers and customers as they co-operate to develop new products; interactive learning between producers and users of new technologies; and the institutionally based exchange of knowledge between firms and R&D providers

David and Foray (1995) also identify a variety of processes whereby knowledge is distributed within the innovation systems context:

- Distribution between universities, research institutes and firms
- Distribution within a market or along the value chain
- Re-use and combination of knowledge
- Distribution between dispersed R&D projects

- Dual technological developments between industry and government

They make the distinction however, that a sector's innovation performance is not solely dependent on knowledge creation and learning. It also depends on the appropriation and the distribution of power within the system and, "the system's capability to ensure timely access by innovators to the relevant stocks of knowledge." (David & Foray 1995, p.34)

Lundvall and Borras (1998) elaborate the concept of an innovation system to include elements which are embedded in cultural norms and social history such as:

- Anatomy and integration of science and technology institutions
- Education of engineers and skilled labour
- Labour market dynamics, labour market training and inhouse learning
- Industrial relations and the level of conflict and co-operation between management and workers in the processes of change
- Networking among firms and with knowledge producers
- Trust and social capital as a basis for interactive learning
- Role of tacit versus codified knowledge in innovation
- Individual and collective entrepreneurship

5.2.3 Sectoral systems of innovation

In the global economy in which most firms operate today, the influence of many of the conditions and factors that impinge on innovation are likely to transcend national boundaries. Instead, opportunities and pressures for firms to innovate are more likely to be influenced by: global markets; the availability and application of new knowledge and technologies from anywhere in the world; and the behaviour of emerging international competitors seeking to capture new markets and to displace the market share of existing incumbents. Malerba (2002, 2004) argues that innovation systems are most appropriately studied at the sectoral level in terms of the key elements in the environment that shape and ultimately determine innovation performance.

Malerba (2004) found that differences in the effectiveness of the innovation system greatly affect the international performance of sectors across different countries. This impact is specifically related to: deficiencies or failures in the sources of knowledge; the types and competencies of actors; effectiveness of networks; and the role of institutions. When the elements of the sectoral system are well articulated into a system of information sharing, innovation will be more frequent and better managed leading to more sustained competitive advantage. While an important component of the overall system is the strategic innovation capabilities of individual firms, a properly functioning innovation system will underpin these capabilities and provide collectively what firms cannot provide for themselves.

Malerba (2004, p.428) defines a sectoral system as, “the collection of economic activities organised around a common technological or knowledge base in which individual enterprises are likely to be either actual or potential competitors with one another.” Sectoral approaches to studying innovation systems complement the national innovation systems approach. While they encompass those systemic elements that may be viewed best from the national perspective (legal, policy and social institutions), they also overcome some of the limitations of the national approach which tends to downplay the influence of powerful international factors (Scott-Kemmis et al 2005). As the Australian red meat industry competes in a strong international market, the sectoral innovation systems approach is deemed of most relevance for this study.

The theoretical basis for the sectoral innovation systems approach relies on many of the components reported in the early national innovation systems literature. These include:

- Consideration of non-firm organisations and institutions (David & Foray 1995; Freeman 1987; Lundvall 1992; Nelson 1993; Smith 1996)
- The importance of relationships and networks (Edquist 1997; Inkpen 1996)
- The cluster-based theory of industrial competitive advantage (Porter 1998)
- Technological systems which looks at the interaction between system elements required for the diffusion of technological innovations (Callon 1992; Carlsson & Stankiewitz 1995)
- The evolutionary literature which proposes that industry performance and competitiveness is related to the co-evolution of knowledge creation and learning processes that occur primarily at the sector level and are uniquely embedded in firm capabilities (Smith 1996).

Malerba (2002) notes that sectoral boundaries are not always clear or static as changes can occur in any of the individual system elements or in the interactions between elements. The sectoral system can therefore be viewed as, “a collective emergent outcome of the interaction and co-evolution of its various elements” (Malerba 2002, p.251). Changes to a sectoral system generally result from the imbalances and disequilibrium that characterise external environments such as those caused by new technological shocks. System elements may be viewed as self-organising as they respond to these shocks, and the speed and adaptive capacity of individual actors will ultimately determine their success in terms of competitive advantage.

Malerba (2002, 2004) and Malerba and Orsenigo (1997) propose a new approach to the study of innovation at the sectoral level based on a multi-dimensional view of the interaction between key actors within the sector. More recently, the sectoral systems approach has been found useful in the Australian context in a comparative study of innovation across six discrete sectors (Scott-Kemmis et al 2005). Similar to the perspectives on national innovation systems (Coombs & Tomlinson 1998; David & Foray 1995; Hagedoorn & Schakenraad 1990; Lundvall 1992; Lundvall & Borras 1998;

Patel & Pavitt 1994), the sectoral systems approach conceptualises a number of key elements in the system environment which impact directly on the overall organisation of innovation. These elements are discussed in the following sections.

Interaction of multiple actors:

Sectors are characterised by the presence of a wide range of actors who engage in both market and non-market transactions. Actors include individuals (consumers, entrepreneurs, scientists, innovation champions), individual for-profit firms, supply chains, universities, R&D institutes, technology providers, knowledge brokers and consultants, and industry bodies. As sectors respond to change there is a tendency towards greater heterogeneity of actors. New categories of actors emerge to assume new roles in the organisation of innovation activities. At different stages of an industry's life cycle the dominance of different types of actors is also apparent. For example, when capital constraints are high and firms have limited capacity to invest in innovation, specific financial intermediaries such as venture capitalists become more important to the effective functioning of the sectoral innovation system.

There is also an increasing emphasis on the importance of networks and interactions between firms and other organisations to co-ordinate innovation. Non-market transactions arise as actors participate in numerous networks and interact via multiple mechanisms encompassing communication, knowledge exchange, co-operation and competition. This perspective was reinforced in an international comparative study of the red meat industry undertaken by Griffiths (2000). This study examined the impact of state and industry linkages and the presence of value-adding chains in the Australian industry compared with competitor industries in the United States, Netherlands and Denmark. Griffiths found that in turbulent environments in particular, sustained improvements in competitiveness are reliant on high levels of integration within value chains and between industry and state bodies. Griffiths referred to this more aligned approach as the 'resource leverage' model which is dependent on the capacity to facilitate new linkages within institutional and industry infrastructure arrangements.

Knowledge creation and learning processes:

Knowledge creation and learning processes are seen to underpin many of the relationships between individual actors within an innovation system. These relationships may change over time as actors seek new knowledge in order to adapt to new threats and opportunities. Accessibility to knowledge depends on a range of factors including: movement of human capital; whether knowledge is locked-up in private firms or is publicly available; and the individual firm's capability to appropriate new knowledge (Cohen & Levinthal 1989). Innovation processes involve the effective integration of a diverse range of knowledge components and usually require a multi-disciplinary approach and substantial costs. The complex and interdisciplinary nature of relevant knowledge bases generally means that innovation is most likely to occur as a result of interaction and co-operation among different types of actors who command complementary resources and competencies.

When knowledge bases are transformed, then the organisation of innovation within the sector will also change. This may result in redefined sectoral boundaries as new actors appear to complement the existing knowledge base and knowledge obsolescence produces changes in industry leadership. In sectors where the knowledge base is becoming more complex (such as pharmaceuticals and biotechnology) a firm's ability to interact effectively with scientific institutions will increasingly determine success.

As the demands of knowledge increase and firms require greater access to knowledge about markets (consumers, customers and competitors) and key scientific and technological developments, then knowledge acquisition and learning processes will become increasingly decentralised, externalised and internationalised (Coriat & Weinstein 2004). Over time, tacit industry knowledge (which is often embedded in skilled personnel at the shop floor) may become increasingly codified. It will also be more available to a wider number of firms through the accreditation of training providers and the emergence of service industries to support and disseminate the knowledge base (such as specialised engineering design firms).

Institutions:

The institutions which define the rules of the game are likely to have a strong influence (either positive or negative) on firms in their pursuit of innovation. The study of the role of institutions in sectoral systems is still considered to be in its infancy. However, more recently there has emerged the notion of specific sectoral institutions which include norms, routines, common habits, established practices, and industry standards which have a strong role in shaping sector culture (Edquist & Johnson 1997).

At the sector level, these specific institutions may arise due to the planned and deliberate actions of firms or other organisations through such means as industry codes of practice. They may also emerge as unintended consequences of the interactions between actors such as in the division of intellectual property rights in collaborative R&D projects. As noted by Levin et al (1987), in some cases a sector which is of major national economic importance can shape national institutions.

Co-evolutionary processes:

Changes in the knowledge base and learning processes of firms result in transformations in the behaviour and structure of actors within the system as firms react in order to survive in their changing environments. An example of this co-evolutionary process was reported in a case study of the chemicals industry in Europe (Cesaroni et al 2004). In that study, changes in community expectations regarding the environment resulted in a number of significant changes in innovation activities within the sector. As the demand for environmentally safe products increased so too did the level of product development activity within firms. Firms were required to build their capacity to develop new products and processes by acquiring new knowledge and technical skills. To respond to this need, new knowledge support infrastructure in universities, educational institutes and knowledge-based service companies emerged. Governments imposed new regulations thus altering the institutional framework. Industry, in turn, responded by developing a self-regulatory approach via standards and codes of practice

Successful interaction among the various elements of an innovation system is particularly important for smaller industrialised nations such as Australia to ensure maximum return from the limited resources available.

System functions:

Finally, the functions within the sectoral innovation system which are likely to impact on actors and either impede or enhance their innovation efforts include:

- Effectiveness of industry-university linkages and the availability of trained scientists and engineers specialised in specific sector related disciplines
- Strength of the sector's capacity in relation to basic science and the generation of new knowledge
- Availability and mobility of skilled labour
- Perceived attractiveness of the sector to the finance community and the sector's access to new venture capital
- Sector patterns of regulation and competition

5.3 Entrepreneurship at the Sector Level

5.3.1 Overview

A review of the entrepreneurship literature reveals a similar interest in industry sectors as a focus for research. Researchers in the entrepreneurship domain that take a macro view propose that a firm's entrepreneurial orientation may be viewed as a response to certain environmental conditions that will either help or hinder their efforts (Lee & Peterson 2000). Several researchers (Johnson & Van de Ven 2002; Mezias & Kuperman 2000; Shane & Venkataram 2000) note that innovation opportunities are seldom commercialised by individual entrepreneurs or firms in isolation. Instead, entrepreneurial success depends largely on the actions of many entrepreneurs interacting with complementary elements in the environment to collectively build a new innovation infrastructure that replaces the existing system.

According to Covin and Slevin (1991), the external environment includes the economic, political/legal and social forces that provide the broader context for a firm's operations and more broadly a sector's response to the problems and opportunities perceived. Hostile economic factors may hinder the emergence of entrepreneurial activity by impeding the level of capital investment and by imposing fiscal and regulatory barriers on innovative and entrepreneurial endeavour (Foster 1986). Conversely, economies which ensure that scarce economic resources are available for value-creating activities will ensure more entrepreneurial development occurs (Morris 1998). A favourable political and legal environment in which government actions include removing unnecessary regulations and barriers to entry and providing funding for high risk R&D will encourage entrepreneurial potential (Baumol 1990; Willis 1985). Finally, as discussed by Berger (1991), societies that encourage individualism, independent thinking, non-conformist behaviour and a strong drive for higher material wealth also tend to be more entrepreneurial.

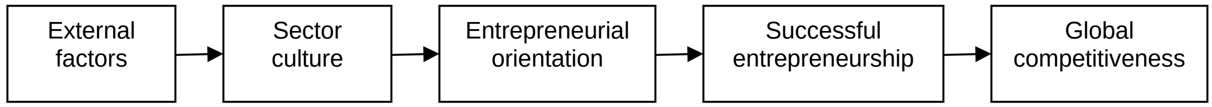
5.3.2 Sector-level entrepreneurship strategy

Based on the concepts of cultural dimensions developed by Hofstede (1980) and Trompenaars (1994), Lee and Peterson (2000) extend the debate concerning the influence of environmental conditions on entrepreneurial success. They proposed a model of entrepreneurship in which key cultural dimensions are seen as having a direct impact on a society's expression of entrepreneurship by virtue of the culture's ability (or otherwise) to engender a strong entrepreneurial orientation within its firms. Their approach is based on the model of entrepreneurial orientation developed by Lumpkin and Dess (1996) which refers both to the propensity of a firm to engage in entrepreneurship and the processes by which entrepreneurial activity occurs. Firms which display a strong entrepreneurial orientation are characterised by:

- Autonomy (act independently)
- Innovation (encourage experimentation)
- Risk taking
- Proactiveness (take initiative)
- Competitive aggressiveness

Lee and Peterson (2000) propose that external factors (economic, political/legal and social) are likely to impact on a sector's culture. In turn this will determine the level of entrepreneurial orientation within firms that make up the sector. At the sector level, entrepreneurial orientation is a mediator between cultural factors and successful entrepreneurship endeavours as shown in Figure 5.1.

Figure 5.1: Relationship between culture, entrepreneurial orientation and sector transformation



To understand the emergence and actions of successful entrepreneurial firms, Johnson and Van de Ven (2002) advance the *industrial communities* perspective as a model to explain the co-evolution of firms and the elements within the industrial (or sectoral) infrastructure supporting them. Within this model, numerous roles emerge from a diverse set of entrepreneurs (inside for-profit firms) and public and private organisations. The model focuses on the issues, actors and interactions which combine to form the infrastructure that facilitates or constrains entrepreneurship. Four key elements are articulated within the model:

1. Institutional arrangements including laws, regulation, standards, and norms.
2. Public resource endowments which include scientific knowledge, financing mechanisms, the pool of competent labour, education and training resources.
3. The market of consumers who are informed about and motivated to purchase products.
4. Firm capabilities which relate to how effectively competencies in key areas such as R&D, manufacturing, and marketing are mobilised to commercialise products.

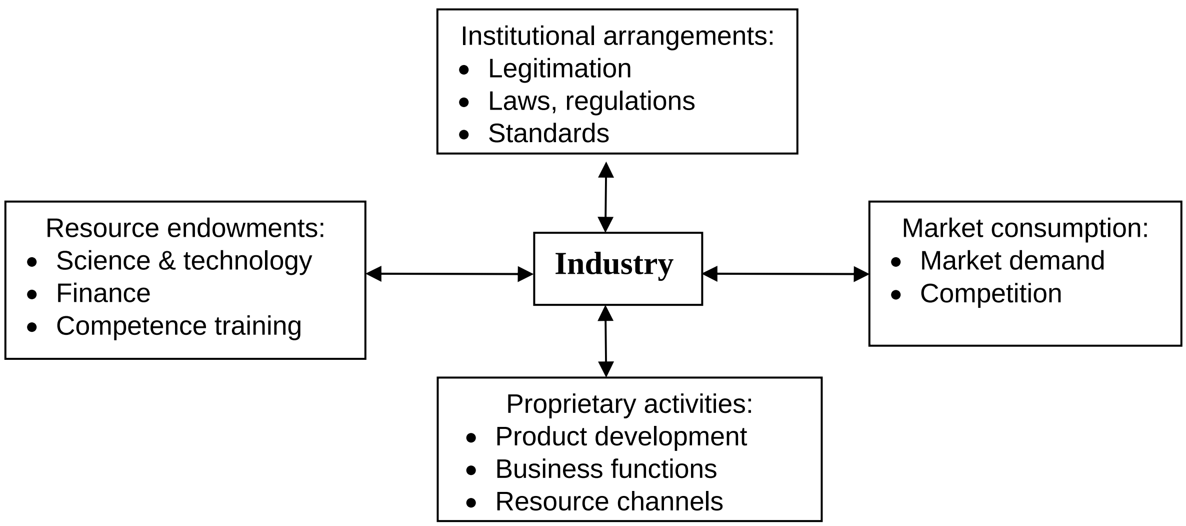
These elements are seen as impacting on a firm's entrepreneurial potential and the firm is also conceived as having the capacity to impact on the elements via a range of mechanisms. Johnson and Van de Ven (2002, p.80) claimed success of entrepreneurial firms is dependent on, "achieving competitive advantage in any of the four areas of activity: resource endowments, institutional arrangements, proprietary activities and market consumption." Successful entrepreneurial firms therefore require many things from the sectoral system including:

- Acceptance from regulators
- Knowledge from R&D institutes

- Access to a pool of appropriately trained workers
- Positive reputation with the finance sector

Entrepreneurial firms have a capacity to recognise opportunities that arise from the specific interactions of the elements within the sectoral system of innovation and an internal capability to capitalise on these opportunities. This model of sector-level entrepreneurship has been represented by Johnson and Van de Ven (2002) as shown in Figure 5.2.

Figure 5.2: Industry view in industrial community perspective



Source: Johnson and Van de Ven 2002, p.77

The industry sector is not a common level of analysis in the study of entrepreneurship. The evolution of this model of sector-based entrepreneurship therefore represents a significant departure from previous research in which infrastructure components are treated largely as externalities to entrepreneurship. However, as argued by Johnson and Van de Ven (2002), the framework is critical to the systematic evaluation of how actors and elements interact to support or inhibit entrepreneurship.

5.3.3 Convergence with innovation systems theory

There are clearly many areas of overlap in the study of innovation and the study of entrepreneurship. A comparison of the frameworks developed for the study of sectoral systems of innovation (see Section 5.2.3) with the model of entrepreneurship at the industry sector level articulated here further reinforces this view. Despite this, the benefit of convergence in these apparently closely related fields has largely been ignored and there is almost no evidence of cross-referencing in these two bodies of work. Brazeal and Herbert (1999) and Covin and Miles (1999) suggest that the study of the two fields would benefit from higher levels of convergence. By combining the findings from the analysis of data from Cycle 1 with this review of the literature from both fields, this study therefore seeks to explicitly link the concepts of innovation and entrepreneurship in a revised conceptual framework (see Section 5.5).

5.4 Firm Innovation and Entrepreneurial Capability

5.4.1 Overview

An important component of the overall effectiveness of an innovation system is the strategic innovation capabilities of individual firms (Malerba 2004). A number of researchers (Bryant 1998; Scott-Kemmis et al 2005) argue that a key role for policy and intervention is in the area of building firm innovation capability and increasing the number of innovative firms. However, designing suitable interventions requires an understanding of the complex changes and adaptations that must take place within the firm to enable innovation and successful entrepreneurial activity to occur. Brazeal and Herbert (1999) identify that many firms find that the occurrence of occasional innovations is not unusual. In addition, Wolpert (2002) determines that innovation is often cyclical, exhibiting a ‘boom-bust cycle’ as the fortunes of a firm fluctuate with changing economic conditions.

However, Wolpert (2002) believes that while it is appropriate that innovation is responsive to changes in market conditions and company strategy, it is critical that a more stable approach is adopted in which innovation is seen as a core corporate capability. Similarly, Dougherty and Hardy (1996) propose that for firms to truly grow and prosper they must develop a more integrated capability. This enables them to create and manage the prolonged and sustained processes which foster multiple innovations (both incremental and radical) across multiple levels of the firm and at different stages of the firm's life cycle.

Peeble (2003) notes there are many views on what constitutes the key to successful and sustained innovation within firms. Her interviews with leading innovative firms revealed a diverse range of approaches which included: disciplined and structured process models; broad ranging innovation strategies which go beyond narrow product development strategies; the creation of multi-disciplinary teams which foster collaboration across functional areas; and cultural models based on risk taking and learning from mistakes.

Dougherty and Corse (1996) indicate that it is not easy for firms to become more adaptive to innovation opportunities and maintaining a sustained innovative capacity requires significant adjustment. These researchers adopt a sociological perspective to building innovation capability which defines the firm as a complex social system based on shared norms, routines and relationships. They argue that this approach provides a more viable explanation of the issues which impact on a firm's innovation performance when compared with the more mechanistic approaches that have previously pervaded the literature (Griffen & Hauser 1993; Jelinek & Schoonhoven 1990; Wheelwright & Clark 1992). Similarly, Seely-Brown (2002, p.105) argues that in order to keep pace with the rapid changes that are occurring, there is a need for, “New technological and organizational architectures that make possible a continuously innovating company.”

5.4.2 An integrated model of firm innovation capability

The concept of firm innovation capability was discussed in the preliminary literature review and is documented in Chapter 3 (Section 3.2.2). From this preliminary review, the following five core concepts related to innovation capability were distilled:

- Adaptive leadership
- Cultural competency for change management
- Learning organisation
- Integrative strategy and structure
- Enabling processes and systems

The broader literature review in the entrepreneurship domain undertaken during Cycle 1 of this study (and documented in the preceding sections of this chapter) also refers to a capability construct. Hindle (2002) calls this a firm’s entrepreneurial capacity which he views as being comprised of appropriate skills and a specific mindset within an organisation. Covin and Slevin (2002, p.324) believe that firms successful in implementing entrepreneurship strategies strike a balance between what they term the ‘hardware’ of organisational architecture (strategy, structure and systems) and the more subtle ‘software’ elements such as culture, behaviours, beliefs and assumptions. It is these software elements that fundamentally determine whether entrepreneurship is embraced or rejected.

There appear to be only a few integrated models of firm innovation capability that have been applied specifically to research into the design of capability building interventions. One such study was undertaken by Cormican and O’Sullivan (2004) in which a best practice model was developed with the aim of facilitating firm capability building in the specific area of product innovation.

In their model, these researchers describe the following five core firm attributes that they consider essential for effective product innovation:

- Strategy and leadership
- Culture and climate
- Planning and selection
- Structure and performance
- Communication and collaboration

Similarly, a model of technical innovation capability was developed by Chiesa, Coughlan and Voss (1996) as a basis for designing a technical audit tool to be used by firms in the United Kingdom to improve their technical innovation management processes. Their process-based model is comprised of core and enabling elements as shown in Table 5.2.

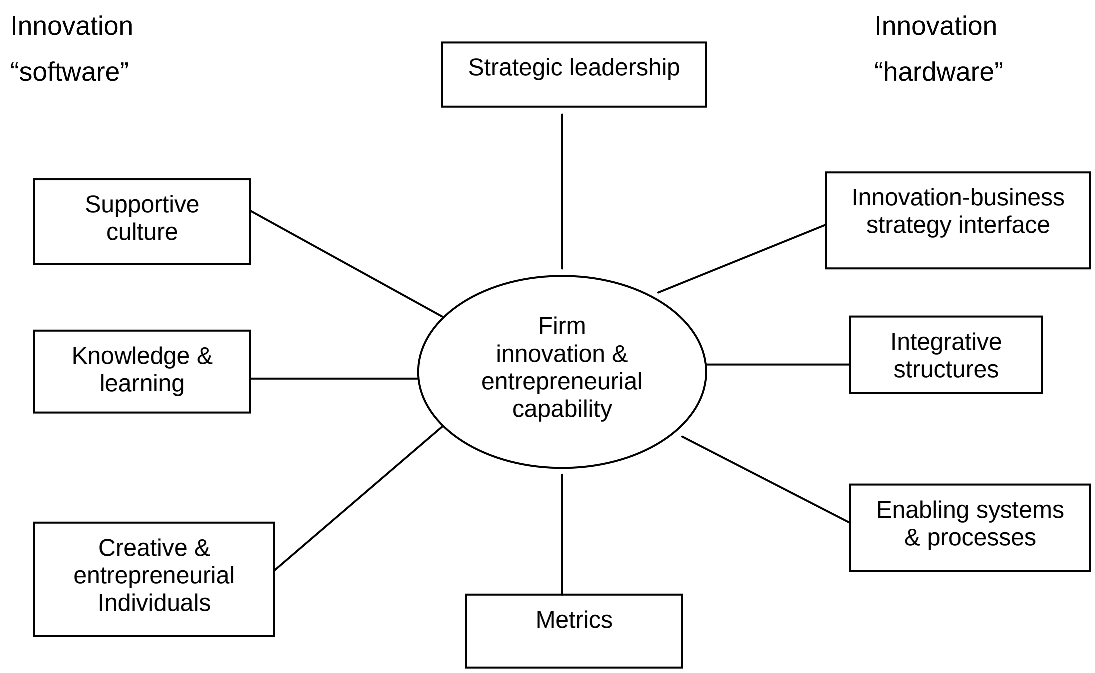
Table 5.2: Process-based model of technical innovation capability

Core processes	**Enabling processes**
• Concept generation • Product development • Process innovation • Technology acquisition	• Deployment of human and financial resources • Innovation systems and tools • Leadership

Source: Chiesa, Coughlan and Voss 1996

Based on this more extensive literature review combined with the analysis of data from the interviews undertaken during Cycle 1 (and reported in Chapter 4), I developed a more comprehensive model of firm innovation and entrepreneurial capability (see Figure 5.3).

Figure 5.3: Model of firm innovation and entrepreneurial capabilities



While my model builds on the work of previous researchers by amalgamating their core elements, it also encompasses additional capability components identified from the data collected during this study (see Sections 4.3.3 and 4.3.4). Similar to Covin and Slevin (2002), I propose that innovation and entrepreneurial capability requires both a structured and disciplined approach to managing innovation (innovation 'hardware') combined with flexibility and tolerance for complexity (innovation 'software'). As noted in Chapter 4, during this study this model was widely circulated in the food industry and received strong endorsement from leading practitioners in the innovation field.

Following is a brief discussion of the key components of the model. As discussed in Chapter 4, the components of the model progressively emerged as an outcome of the iterative process undertaken in Cycle 1 (see Figure 4.2) and include findings supported by both data and the literature.

5.4.3 Leadership and vision

As was identified by participants in Cycle 1, leadership and vision appear to be the principal moderators of all other components of innovation capability (see Section 4.3.3). This is well supported in the literature with a number of researchers (Badaracco 2002; Bennis 2000; Dauphinais, Means & Price 2000; Tushman & O'Reilly 1997) noting that it is leaders that drive innovative practice at all levels of the organisation. Innovative and visionary leaders are able to visualise the future and to share and communicate a vision of the firm's positioning which inspires and motivates the whole firm (Rowe 2001; Westley & Mintzberg 1991). Allocating adequate resources in all areas appropriate to achieving the desired outcomes is seen as a key leadership responsibility. Leaders must be adaptive and recognise that resource needs may change throughout various stages in the firm's life cycle (Van de Ven et al 1999). Fundamental to an innovative firm is the leader's tolerance for ambiguity (Ahmed 1998). Leaders must create the 'ambidextrous organisation' (Tushman & O'Reilly 1997: *passim*) by being adept at balancing strategy for today's needs with innovation and entrepreneurship for tomorrow's growth (Hamel 2002; Leifer et al 2000). In the process of confirmation and disconfirmation that was undertaken in successive interviews I was able to confirm that industry participants generally agreed with this perspective on the role of leaders in firm innovation.

5.4.4 Innovation-business strategy interface

As reported in Chapter 4, industry participants perceived the innovation-business strategy interface as critical to a firm's success. Similarly, researchers (Anthony, Eyring & Gibson 2006) also believe that firms must articulate the explicit 'bottom-line' contribution of innovation and corporate entrepreneurship strategies via sophisticated 'game-plans'. Without an appropriate plan, innovation can simply become a 'hit-or-miss' collection of random projects as firms randomly adopt the approaches of competitors and risk falling prey to indiscriminate bandwagon behaviours (Fiol & O'Connor

2003). Several researchers argue that innovation strategy must be broad based and not limited to product and service innovation (Laurie, Doz & Sheer 2006; Moore 2004). McGahan (2004) suggests that for a firm's innovation strategy to succeed it must be aligned with the industry's overall change trajectory. Similarly, Moore (2004) believes that the focus of a firm's innovation strategy should be aligned to the market's life cycle, with different strategies delivering greater potential at different stages.

As was suggested by industry participants, effective innovation strategies are therefore built up from sophisticated foresighting and scanning activities which include identifying global trends (in consumers, technology, and markets) and applying portfolio analysis tools to ensure an appropriate mix. Laurie, Doz and Sheer (2006) suggest that innovation strategies should seek to deliver sustainable growth by identifying opportunities to create new growth platforms based on:

- New or converging technologies
- Changes in the regulatory environment
- Emerging social pressure

Innovation can be seen as encompassing both incremental and radical change, with several researchers (Anthony, Eyring & Gibson 2006; Christensen 1997; Hamel 2002) believing that radical, disruptive innovations create the highest potential to generate growth. Industry participants did not express strong views on whether incremental or radical approaches were more desirable. However, there was a view by participants that firm innovation strategies should be focused on more long term issues in order to deal with the major shocks likely to occur in the external environment.

5.4.5 Integrative structures

Integrative structures are based on the concept of collaboration and application of an 'open innovation' model (Chesbrough 2003; Quinn 2000;

Sawhney & Prandelli 2000). Capability building and the generation of new ideas result from productive relationships and interactions with external partners. The most successful inter-firm networks are those that maintain a focus on future-oriented capability building (Hagel & Seely-Brown 2005). Empirical studies (Kamien & Zang 2000; Narula & Hagedoorn 1998) demonstrated that there is greater ultimate economic gain in systems where there is inter-firm co-operation on R&D compared with systems that rely more on competition. Advantages include: higher total investment in R&D; better diffusion of results; elimination of duplication of effort; and accelerated access to new markets.

Similarly, flexible internal structures (such as cross-functional teams) have also been found to impact on successful innovation particularly where agility is required to mobilise resources to meet many different needs (Cormican & O'Sullivan 2004; Patil 2003). However, while adopting structural models that involve cross-functional teams promotes diversity and stimulates an increased flow of creative ideas, they can also create a level of complexity that in some cases has been found to inhibit innovation and problem-solving (Sethi, Smith & Park 2001).

It was apparent from the interviews undertaken in Cycle 1 that the concept of collaborative structures (both internally and externally) has not yet been fully exploited by the red meat industry. Several participants discussed the importance of relationships with customers, supply chain partners and R&D providers and a number indicated that the New Zealand industry was more advanced in this area.

5.4.6 Enabling systems and change management processes

Drucker (2002, p.102) states that, "Above all, innovation is work rather than genius". He adds that success in innovation comes from systematically evaluating opportunities and implementing rigorous processes of project monitoring. There is a considerable body of literature (Irwin & Lotherington 2005; Tidd, Bessant & Pavitt 2001; Van de Ven et al 1999; von Stamm 2003) regarding the importance of enabling systems and processes which reflect a disciplined and managed approach to innovation. These approaches include: project selection; project management; stage-gate approaches; and risk management.

Similarly, fundamental to the successful adoption of technological innovation is the firm's capability to effectively undertake organisational change. Failure to plan and take the need for organisational change strategies into consideration may increase the chance of unfavourable outcomes (Bryant 1998). Beer & Nohria (2000) identify the need to combine both hard, economically focused change management methodologies with softer, more people-oriented approaches in order to engage the organisation effectively at all levels.

5.4.7 Supportive internal culture

Data from Cycle 1 supported the key role that organisational culture plays in determining the likelihood of firms engaging in innovation activities. There is also a substantial body of research (Buckler 1997; Denison & Mishra 1995; Kotter & Hesket 1992; Pinchot & Pinchot 1996; Schneider, Brief & Guzzo 1996) which suggests that the key to innovation success is a supportive internal culture in which innovation is positioned as a core value. To be innovative, firms must be tolerant of failure and willing to celebrate achievements. Extensive studies by Deshpande, Farley & Webster (1993) in Japan and Ekvall (1993) in Sweden support a strong relationship between culture and innovativeness.

Denison and Mishra (1995) propose that for firms to establish cultural effectiveness in relation to innovation they need to reconcile the four cultural traits of:

- High levels of involvement and participation
- Balanced consistency which supports integration and co-ordination but does not become overly resistant to change
- Adaptability and the capacity for internal change in response to external conditions and market signals
- A sense of mission and long term vision which provides purpose and meaning without compromising the capacity for situational adaptability.

Judge, Fryxell and Dooley (1997) argue that the distinguishing feature of an innovative culture is one in which there is a binding sense of community in the workplace. Such a culture is based on: a balanced autonomy in relation to operational and strategic freedom; high levels of personalised recognition for individual contribution; an integrated socio-technical system which fosters group cohesiveness; and increased scope for innovation as a result of organisational slack. Ambler (2000) believes that the key enabling factors that make up an innovative culture are freedom to fail, autonomy for the innovation team and a willingness to change by the firm.

Trust is also viewed as a key characteristic of a supportive culture as it facilitates teamwork and underpins innovation and growth (Bryant 1998). Of particular importance in enabling an innovative culture to emerge, is the design of rewards and recognition programs which encourage the emergence of new ideas and creative behaviours at all organisational levels (Badawy 1997; Ekvall 1990).

5.4.8 Knowledge and learning

A recurrent theme from industry participants was that knowledge management and the creation of new knowledge and learning are fundamental to successful innovation strategies. Nonaka and Takeuchi (1995) developed one of the first coherent theories regarding the contribution of knowledge management and learning to innovation. They identify that innovation is a different kind of work, it must be organised differently, and it requires a different kind of generative learning which generates new knowledge and ideas through collaborative interaction.

As noted by Barker (2002, p. 184), “Getting knowledge workers to share what they know and learn collaboratively may be the greatest challenge for any organization seeking to innovate”. In a study based on the top 2,000 organisations in Australia, Farrell (2000) identifies a significant link between a learning orientation and positive organisational performance. In this study the most important determinant of a learning orientation was the role played by senior managers in facilitating the task of unlearning detrimental, traditional practices. Similarly, Birchall and Tovstia (1999) propose that the effective management of knowledge is the key to long term business performance. They believe that firms must be able to capture and use knowledge to: better understand customers; develop improved products and services; and deliver superior innovative performance.

However, understanding and managing knowledge is complex. Perhaps one of the earliest proponents of knowledge management as an enabler of innovation was Drucker (1985) who insists that firms should resist the urge to view the concept as a technological project but rather to recognise that knowledge work is done by people and that knowledge management is principally about managing human relationships. As noted by Stringer (2000), most companies are not radical innovators because they are more likely to seek to preserve the status quo as their structures, cultures and people do not learn fast enough and well enough to successfully commercialise new ideas. Any effort to promote innovation within a firm must take account of the way people learn and must develop new ways to help them learn together.

5.4.9 Creative and entrepreneurial individuals

Creativity is a key driving force behind innovation as it is one of the principal sources of new ideas and concepts. Similarly, there is growing evidence that entrepreneurial behaviour within firms is a significant factor in organisational effectiveness (Davis 1999). However, while organisational culture and systems can support creativity and innovation, it is individuals that actually develop creative ideas (Stringer 2000). Industry participants also identified that creative and entrepreneurial individuals are fundamental to a firm's innovation culture. Participants considered that, to a degree, all employees need to exhibit a level of creativity and a capacity for risk taking. Firms should therefore seek to supplement their pool of talent by hiring more creative people and encouraging existing employees to develop creative thinking capabilities. Creative and entrepreneurial employees should be identified and protected and it may be necessary to create new roles and career paths specifically to accommodate these people (Ahuja & Lampert 2001; Antoncic & Hisrich 2001; Borins 2000; von Stamm 2003).

5.4.10 Metrics

Ambler (2000) believes that innovation is one of the most difficult areas to measure. While a number of innovation output measures are proposed, Ambler argues that it is more important to measure the strategic, cultural and process indicators of a firm's innovation health. Collins and Smith (1999) also propose an innovation metrics framework which is based on a measurement continuum from lagging to learning in the areas of: stakeholder strategies; innovation processes; resources; and culture.

While acknowledging the difficulty in measuring innovation, Shapiro (2002) believes that a more sophisticated measurement model will provide a powerful stimulant for innovation by:

- Revealing the true strengths and weaknesses of a firm's innovation efforts

- Ensuring a focus on outcomes rather than the more traditional input measures such as R&D expenditure
- Motivating the organisation to achieve levels of stretch performance

Von Stamm (2003) proposes a best practice innovation measurement framework which focuses on metrics that are meaningful for innovation such as strategy, culture and outcomes and are tailored to the firm's specific needs. As previously discussed in Section 3.1.2, in this study a proprietary diagnostic instrument developed to assess firm innovation capability (Bubner 2001) was adopted for application in this study.

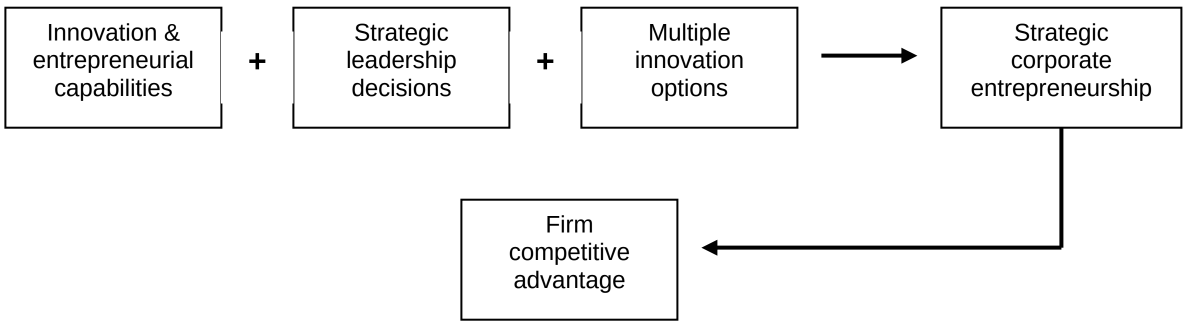
5.4.11 Firm capability and corporate entrepreneurship

As noted in the earlier definitions (see Section 5.1.3), corporate entrepreneurship is essentially a process whereby firms engage in value-creating activities which bring into existence new products or services, new product-market arenas, improved strategy execution leading to increased efficiencies, or redefined competitive positioning. Kazanjian, Drazin and Glynn (2002) argue that an essential element of corporate entrepreneurship is the development and reconfiguration of key organisational resources (particularly knowledge bases). They believe that a firm's main source of competitive advantage resides in the optimal convergence of strategy, leadership and firm innovation capabilities.

Developing a firm's innovation and entrepreneurial capability is clearly a critical precursor to effective implementation of innovation and entrepreneurship strategies. However, to achieve long term competitive success, it is necessary for the firm to effectively deploy this capability. Hindle's (2002) concepts of small-i and Big-I innovation serve to reinforce the distinction between capabilities and the transformational processes embodied in the concept of corporate entrepreneurship.

In revising the conceptual framework for this study, competitive advantage (defined as global competitiveness, profitability and sustainability) is therefore seen as the outcome of *strategic corporate entrepreneurship.* This, in turn, is the result of the effective mobilisation of specific firm innovation and entrepreneurial capabilities combined with strategic leadership decisions applied to multiple innovation options (see Figure 5.4).

Figure 5.4: Relationship between capability, corporate entrepreneurship and firm competitive advantage

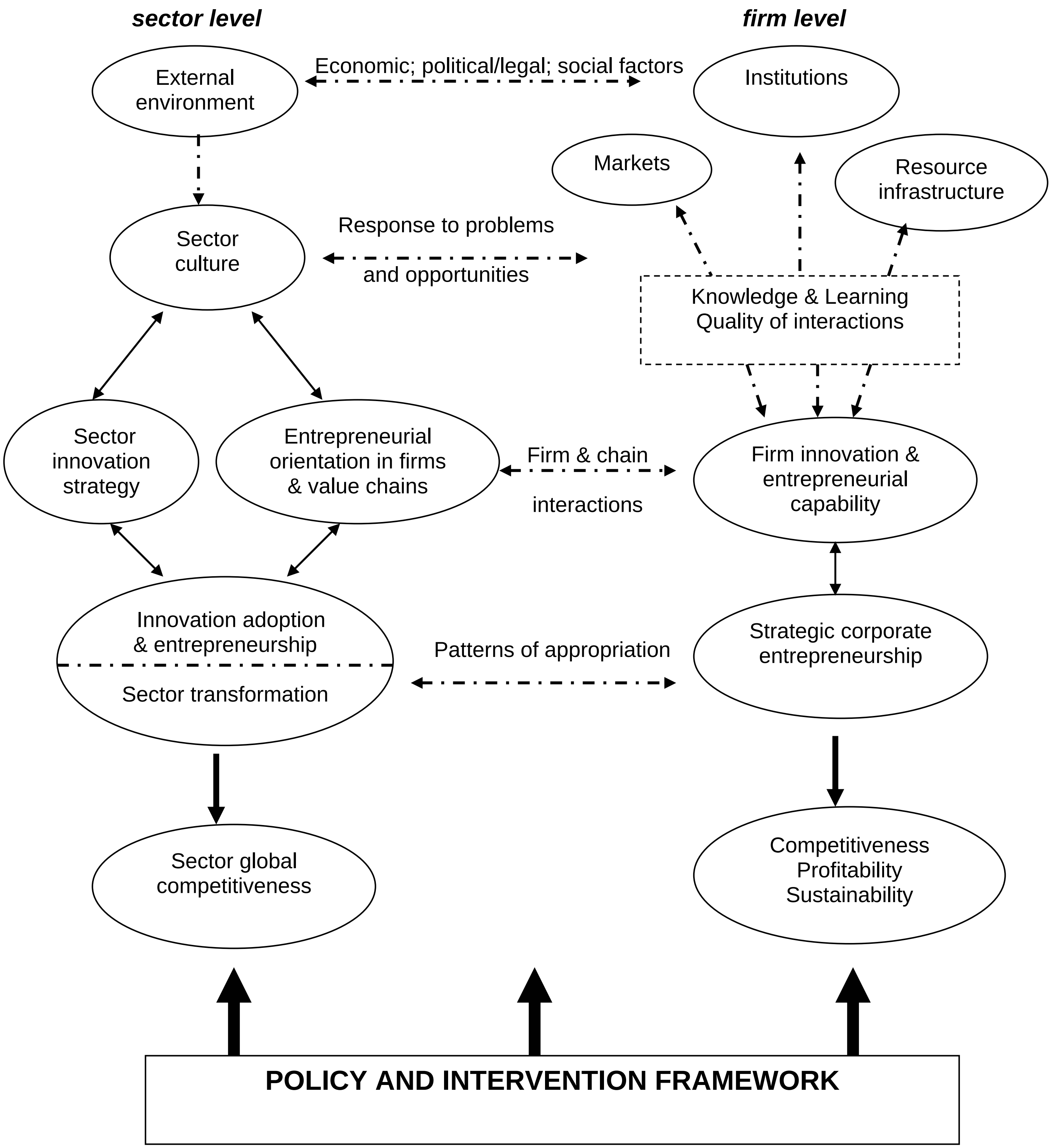


This relationship is incorporated into the revised conceptual framework described in the following section.

5.5 Sectoral Innovation and Entrepreneurship System

Based on the iterative review of the innovation and entrepreneurship literature combined with the evaluation of data undertaken in Cycle 1, a revised conceptual framework of the innovation and entrepreneurship system applicable to the red meat industry was developed as shown in Figure 5.5. The various components included in the framework are well supported by the literature. However, the integrated model proposed here incorporates multiple elements from diverse theoretical perspectives combined with concepts and major themes identified by industry participants.

Figure 5.5: Sectoral innovation and entrepreneurship system



The basic premise of the framework is that at both the industry sector and the firm level, innovation and entrepreneurship are context sensitive and should be conceptualised within a systems perspective. At the level of the industry sector, the proposition is that the over-riding sector culture (mediated by environmental impacts such as economic, social and political/legal conditions) will determine the degree to which firms in the industry exhibit an entrepreneurial orientation. The sector culture, and the resulting entrepreneurial orientation, will impact on how problems and opportunities arising from changes in the external environment (in markets, institutional arrangements, resources, new knowledge and technological advances) are perceived by the sector. This, in turn, will determine how proactively the sector decides to respond and how this will be manifested in the sector innovation strategy (which in the red meat industry is collectively funded and implemented by MLA).

At the level of the firm, it is proposed that these external conditions (markets, institutional arrangements and resource infrastructure) also impact directly on a firm's innovation and entrepreneurship capability. In turn, this determines the level and success of corporate entrepreneurship strategies and ultimately the firm's ability to capture competitive advantage. The framework proposes that the impact of the external elements is mediated by a two-way relationship between the firm and its environment. The degree to which a firm is able to capture new knowledge and learning from their interactions with other actors within the system is particularly important.

Clearly the concepts at firm and sector level are interconnected. Ultimately the level of innovation adoption and entrepreneurship occurring within the sector will determine the degree to which the sector transforms itself and achieves the desired level of global competitiveness. However, this success is dependent on a variety of factors and interactions including: the level of entrepreneurial orientation within firms; the innovation options developed as a result of the sector’s innovation strategy; the level of interaction between firms and value chains; and the patterns of appropriation associated with individual firm entrepreneurship.

This revised conceptual framework was specifically developed to provide a basis for the analysis of the sector’s innovation system that was undertaken in the second major research cycle and is reported in subsequent chapters.

5.6 Summary

The revised conceptual framework of the sectoral innovation and entrepreneurship system applicable to the red meat industry described in this chapter represents the key outcome of Cycle 1. This framework provided a comprehensive theoretical base upon which to develop the next stage of the research. In particular, the framework specifically addresses the following two research questions which were posed at the beginning of the study (and are discussed in Chapter 3):

1. **How can the concept of firm innovation capability be expressed in the context of the red meat industry?**
2. **What are the key contextual issues impacting on the level and success of innovation initiatives in the red meat industry?**

The framework was specifically intended to assist me to undertake an analysis of the red meat sector’s innovation system and to inform the development of a methodology to address the central research problem of this study:

> **How should MLA design and deliver interventions that will significantly enhance the innovation capabilities of the Australian**

red meat industry in order to sustain competitive advantage in a rapidly changing environment?

To arrive at the final framework, the findings of the analysis of data from Cycle 1 (reported as major themes in Chapter 4) were integrated with concepts derived from an extended literature review in the broad areas of innovation systems theory and strategic entrepreneurship. It is noted that the convergence of these two closely related fields has largely been ignored by researchers to date and there is almost no evidence of cross-referencing between the respective bodies of work. As will be discussed in Chapter 8, this study explicitly seeks to address the recommendations of several researchers (Brazeal & Herbert 1999; Covin & Miles 1999) that the two fields would benefit from higher levels of convergence.

In addition to the revised conceptual framework at the sectoral level, the chapter also includes an integrated model of innovation and entrepreneurial capability at the firm level. There are numerous studies in the literature of the various elements that constitute firm innovation capability. However, there appear to be only a few integrated models that have been developed specifically for the purpose of designing capability building interventions. This apparent gap in the literature was reinforced when the model was presented to more than 60 experienced innovation practitioners across the food industry. These practitioners acknowledged that the models developed in this study offer a real contribution to the field both in terms of theoretical knowledge and the potential to improve practice.

CHAPTER 6

PLANNING CYCLE TWO: IMPLICATIONS OF THE INNOVATION SYSTEMS APPROACH

This chapter documents the planning phase of the next cycle of the research. In Chapter 5 an integrated conceptual framework of the red meat sector's innovation and entrepreneurship system was developed, based on an extensive review of the innovation systems and strategic entrepreneurship literature and supported by data collected during Cycle 1. To complement the overall sectoral framework, a model of firm innovation and entrepreneurial capability was also proposed. As will be discussed in this chapter, the innovation systems (SI) approach is now a widely accepted concept in modern innovation research. An important condition for successful innovation policy is the capability of governments (and their intervention agencies) to understand how various policy areas interact and how policies need to be coordinated into a coherent and integrated intervention framework. Developing a comprehensive model of an innovation system is therefore seen as an important first step in the design of innovation policy and intervention strategies. During this planning phase for Cycle 2, two new and emerging areas in the literature were identified: firstly in relation to the concept of 'mapping' the effectiveness of an innovation system; and secondly the concept of system failures and its application to the design of innovation policy and interventions.

The chapter begins by outlining the implications for policy and intervention strategies when the new systems approach is employed. In the current environment of limited resources and increasing complexity, it is critical to ensure that innovation policy and intervention strategies are comprehensive, efficient and cost effective. Strategies must therefore be focused on the areas where problems are having the greatest impact but also in areas where interventions are most likely to succeed. It is argued that the traditional neoclassical economic theories that have dominated innovation policy are based on the concept of ‘market failure’ which many researchers now consider to be too abstract and blunt an instrument to be useful.

As will be discussed in the chapter, the systems approach to understanding innovation presents a new economic paradigm which acknowledges that innovation occurs as a result of complex interactions at many different levels. However there is, as yet, very little theoretical or practical information to inform policy development in this area. To address this, a number of researchers (Bryant 1998; Edquist et al 2004; Scott-Kemmis et al 2005; Smith, K. 1998) propose an alternative approach to identifying deficiencies in the functioning of a system known as ‘system failures’. This chapter builds on the work of these previous researchers and proposes an analytical framework based on six areas of potential system failure. The chapter concludes with a plan for the second major action research cycle in which the framework is used as the basis for designing an intervention strategy at the sectoral level.

6.1 Implications for Policy and Intervention Strategies

There is substantial empirical evidence (Bryant 1998; Dodgson & Bessant 1996; Dodgson & Rothwell 1994; Freeman 1994) that innovation and entrepreneurship are important drivers of economic growth at the micro-level of the firm and at the sectoral, national and global levels. More recently innovation has also been seen as a critical component of government policy in terms of ensuring long term economic prosperity and environmental and social sustainability (see policy initiatives titled *Backing Australia’s Ability,* Commonwealth of Australia 2001*)*. In recent Australian studies undertaken by Scott-Kemmis et al (2005), it was noted that not all problems and opportunities that emerge can be adequately addressed by individual firms. Hence additional resources and interventions may be required to facilitate a particular innovation system to become self-organising. It is generally accepted (Edquist et al 2004) that governments, through various policy instruments and associated agencies, play an important role in fostering conditions that support innovation and competitiveness.

6.1.1 Evolution of innovation policy

As noted by Bryant (1998), there is increasing pressure on policy-makers to ensure that innovation policies are efficient, cost-effective and they deliver real impact in terms of enhancing industry performance. For the past 40 years, academic research has attempted to define what has been learned about intervening in the innovation landscape from multiple experiences throughout the world. Table 6.1 summarises the significant evolution in recent decades in innovation policy approaches.

Table 6.1: Evolution of innovation-related policy

Period	Policy Focus
1950's-60's: Science Policies	Countries implemented science policies based on a narrow view of the link between science and economic growth.
1960's-70's: Science & Technology Policies	Concept broadened to embrace both science and technology as understanding developed that technology did not equal science.
1980's-90's: Innovation Policies	It was realised that to achieve real economic impact there was a need to extend beyond the early stage of R&D and to include commercialisation and technology diffusion. Policies still based on a linear model of R&D.
Current: Systems-Based Policies	Emergence of systemic models which address the more complex concept of a knowledge-based economy. This approach is still in the early stages of development and an indistinct and fuzzy understanding of the issues remains.

Modern innovation policy may be seen as a broad concept that encompasses not only science and technology areas but also overlaps industrial, environmental, labour and social policies. The broad aim of public innovation policy is to strengthen the competitiveness of a national (or regional or sectoral) economy in order to increase societal welfare through economic success and longer term sustainability.

However, as noted by Edquist et al (2004, p. 427), "from a policy viewpoint the results are disappointing. No simple and obvious formula for reliably achieving success in promoting or fostering innovation has emerged." Edquist et al (2004) and Metcalfe (1995) argue that the traditional neoclassical economic theories that have dominated innovation policy are based on the concept of 'market failure' and are not helpful for policy makers as they:

- Present too blunt an instrument
- Assume the policy maker has access to the same information as private decision makers and evaluates options from an identical ideological paradigm
- Do not indicate the explicit dimensions of policy instruments such as how large subsidies and grants should be
- Provide no guidance on how to intervene or which policy instruments to apply in particular circumstances
- Are too general and do not address specific system problems

Hindle (2002) believes that in Australia, innovation policy has been too narrowly focused on the development of R&D capabilities and the generation of new knowledge. Hindle goes on to warn that government expenditure on innovation will fail to generate economic benefit due to a lack of focus on the development of transformational and entrepreneurial capacity within the system.

6.1.2 System failures and innovation policy design

Smith (Smith, K. 1998) argues that although there have been significant advances in the development of the new systems approach to innovation, there is very little coherent information to inform policy development in this area. The systems approach to understanding innovation presents a new economic paradigm which acknowledges that innovation occurs as a result of complex interactions at many different levels. Smith believes the task of conceptualising the appropriate rationales for policy intervention is an important one which will lead to the development of more effective policy instruments and implementation methods. Simplistic and overly generic policy instruments are unlikely to be useful and there will rarely be a single best way of managing innovation processes.

Applying the innovation systems framework enables deficiencies in the functioning of the system, known as 'system failures' (Edquist et al 2004; Smith, K. 1998), to be identified. This shifts the emphasis away from actions at the individual firm level to the broader system dynamics and interactions. A more comprehensive intervention model is the result and policy instruments are likely to achieve greater relevance within the target system.

The concept of identifying system failures as the basis for designing intervention strategies has been espoused by a number of researchers. For example, Smith (Smith, K. 1998) proposes four areas of potential systemic failure upon which policy and interventions may be based.

1. **Infrastructure failures:** relate to inadequacies in the innovation infrastructure in relation to physical, resource, or knowledge bases. Public sector intervention is justified in this area as adequate infrastructure is unlikely to be developed effectively by private investment due to: the large scale usually required; the very long time horizons; and the inability of individual firms to appropriate benefits.
2. **Transition failures:** these arise when unexpected and significant changes in technological paradigms occur faster than the skills and adaptiveness of firms are able to respond. Limitations of firms are imposed by their narrow knowledge base and their tendency to focus on products and technologies that they know best and are comfortable

exploiting. Firms generally have strong competence within their area of technological knowledge but relatively limited capabilities to adapt technically and organisationally in even closely related areas. Smith (Smith, K. 1998) reports that there is considerable evidence to suggest that even relatively minor shifts can cause serious problems for firms, particularly in smaller economies such as Australia. Policy interventions are therefore justified in this area of transition failures.

3. **Lock-in failures:** prevailing technological paradigms can persist because they are embedded in a complex system of scientific knowledge, physical infrastructure, engineering skills and processes, product characteristics, and firm-based social routines. This often occurs at a system-wide level and whole industries can become so locked-in to current technologies that adoption of alternatives is strongly resisted. In this scenario, change will be a complex and integrated process required at the overall system level. This generally takes significant effort, resources and time. It is unlikely that simplistic macro-economic measures aimed at individual system elements will be successful at overcoming lock-in failures. External interventions are required which generate significant incentives to develop technological alternatives and facilitate the adoption of new socio-technical systems.
4. **Institutional failures:** there are powerful arguments (Lazonick & West 1995) to suggest that institutional arrangements and regulatory differences can shape innovation and impact directly on economic performance. Policies in theses areas can therefore have a significant impact on the capacity for firms to innovate by removing barriers and creating conditions that foster flexibility.

Edquist et al (2004) apply the innovation systems framework to identify more generic areas of deficiencies in the functioning of the system which could become the focus of policy interventions. These are:

1. Functions in the SI may be inappropriate or missing

2. Organisations may be inappropriate or missing
3. Institutions may be inappropriate or missing
4. Interactions or links between elements within the innovation system may be inappropriate or missing.

Edquist et al (2004, p.434) believe that, “innovation policy should focus not only on the elements of the system but also, and perhaps primarily, on the relations among them.” In particular, Edquist argues that it is essential that policy makers understand the nature and cause of system failures before determining where interventions may be best directed.

6.1.3 General principles for justifying policy interventions

Edquist et al (2004) note that the role of policy intervention in the innovation system is the subject of both ideological judgments and careful analyses and there are two important conditions which must be satisfied before public policy intervention can be justified. Firstly, a problem must exist in which market mechanisms and firms must fail to achieve desired objectives in relation to specific economic growth outcomes or in areas of long term environmental and social sustainability. In this case innovation policy should seek to complement firms and markets, not replace or duplicate them. In addition, Edquist et al (2004, p.432) suggest that some policy interventions may also be directed where no problem currently exists and that this may be termed, “opportunity creating or anticipatory policy.” Secondly, the policy intervention instrument must have the ability to solve or mitigate the problem. It may not always be possible to know this with certainty in advance. However, there must be a reasonable expectation that solutions are possible before the decision to intervene is taken and measurable impact objectives must be articulated.

Having identified the justification for policy interventions and the general focus of interventions based on an understanding of system failures, there are a number of general principles which should guide policy makers in designing interventions. In a recent Australian study, Scott-Kemmis et al (2005) argue that the policy framework should focus on:

- Supporting international competitive analysis between sectoral innovation systems
- Providing mechanisms for increased collaboration, particularly in the area of public-private partnerships for the purpose of analysing opportunities, diagnosing problems, exploring options and strategic planning
- Facilitating learning and building firm innovation capability
- Ensuring flexibility within the policy framework itself to ensure responsiveness to changes in the innovation landscape as interventions impact on the elements within the system

Bryant (1998) believes intervention policies should be based on:

- Supporting and encouraging experimental behaviour by fostering an industry culture which tolerates mistakes
- Focusing on redesigning social and legal institutions which inhibit innovation and ensure appropriate competition policies that encourage co-operative innovation
- Encouraging linkages and interactions between key elements and actors within the system that possess complementary skills and competencies
- Facilitating access to skills and diverse knowledge bases through specialist education programs and support for an excellent research infrastructure
- Promoting learning organisations and increasing the number of innovative firms. This particular area of focus has also been articulated by the OECD (2000, p.212) who state, “a variety of government actions have to be directed towards a single end: increasing the population of innovative firms in the economy.”

Edquist et al (2004) note that systems are not static and that there is a need to evolve in times of significant turbulence. A system can become outmoded, and may therefore be required to break from the past accumulation of knowledge and current expertise and capability. During such periods, the innovation system will experience substantial stress due to difficulties of aligning incentives and the capabilities of actors to meet the requirements of emerging problems and opportunities. Incumbent actors often underestimate the scope and magnitude of the changes required and there is a tendency to rely on reactive rather than adaptive responses. This behaviour of firms may have a flow-on effect which retards adaptation in other parts of the system. Edquist et al (2004) suggest that in these circumstances, it is critical for policy agents to recognise the potential impact of emerging technologies and environmental conditions and to assist industry to develop an appropriate direction for innovation strategy.

6.1.4 Capability of policy and intervention agencies

As noted by Hofer and Polt (1998) and Smith (Smith, K. 1998), the innovation systems approach to innovation policy adds complexity to the policy process itself and places greater emphasis on building competence among policy and intervention agencies. Policy makers will be required to develop a much more sophisticated understanding of specific systems including industrial structures, institutional frameworks, and technological bases. Intervention initiatives will need to be based on a precise understanding of how the system's knowledge bases are constructed and how new knowledge evolves. Even apparently simple industries may have complex scientific knowledge requirements to underpin innovation. Innovation policy itself must become more experimental and must be prepared to develop and trial new policy tools. Scott-Kemmis et al (2005, p.27) confirm the imperative for policy advisory bodies to continually evolve their own knowledge and competence base and state that, "the development and maintenance of competencies in these organisations is as important as the competencies of firms." As will be discussed in Chapter 7, it became necessary for the intervention agency in this study (Meat & Livestock Australia) to develop a range of new tools and competencies to implement the innovation systems approach.

6.2 System Failure Framework for Designing Interventions

As identified in the previous section, the concept of identifying system failures as the basis for designing intervention strategies has been proposed by a number of researchers (Bryant 1998; Edquist et al 2004; Hindle 2002; Scott-Kemmis et al 2005; Smith, K. 1998). Various researchers (Carlsson & Jacobsson 1997; Edquist et al 2004; Malerba 1999; Smith, K. 1998) provide broad guidance for the areas where system failures are likely to occur. However, the application of these concepts to the design of innovation policy and interventions has only very recently been addressed in the literature (Chaminade & Edquist 2005; Woolthuis, Lankhuizen & Gilsing 2005). Scott-Kemmis et al (2005, p.28) suggest that, “Assessing whether our innovation systems are sick or healthy is complex”, and Woolthuis et al (2005, p.618) that, “the current (SI) approach still under-exploits its potential to provide practical guidelines and/or rationales for policy makers.”

The concept of ‘innovation system mapping’ has emerged in recent years as an approach to analysing empirical data (Stevens 1997) and comparing innovation systems (Bikar, Capron & Cincera 2006; Georghiou 2002; Nelson 1993). System maps represent an analysis of the various elements of a system that are seen to have an impact on innovation performance. In Australia, an extensive mapping exercise has recently been completed: *Mapping Australian Science & Innovation Study* (Commonwealth of Australia 2003). As noted in that study however (2003, p.41), “there is no definitive consensus on the details of a map, and probably no general agreement on methods.” In addition, the study clearly implied (2003, p.27) that there is an opportunity to extend this methodology as, “While it (the mapping study) will lay the groundwork for future policy development, the study does not develop recommendations or consider policy options.”

6.2.1 System failure analytical framework

Based on the literature and the conceptual framework of the red meat sectoral innovation and entrepreneurship system discussed in Chapter 5, a system failure analytical framework was designed specifically for this study. The framework (see Figure 6.1) identifies six categories (with 24 dimensions) of potential sectoral innovation system failure.

The framework is closely aligned to the approach developed by Woolthuis, Lankhuizen and Gilsing (2005) and also incorporates the concept of analysing the effectiveness of required ‘system activities’ as discussed by Chaminade and Edquist (2005). The basic premise is that ‘failures’ in the system are caused by key system activities being missing or ineffective and/or key actors being missing or ineffective. The overarching purpose of an innovation system is fundamentally concerned with the creation, distribution and application of knowledge to produce value-creating innovations. System failures may be viewed as the barriers or inefficiencies which impact achievement of this core objective.

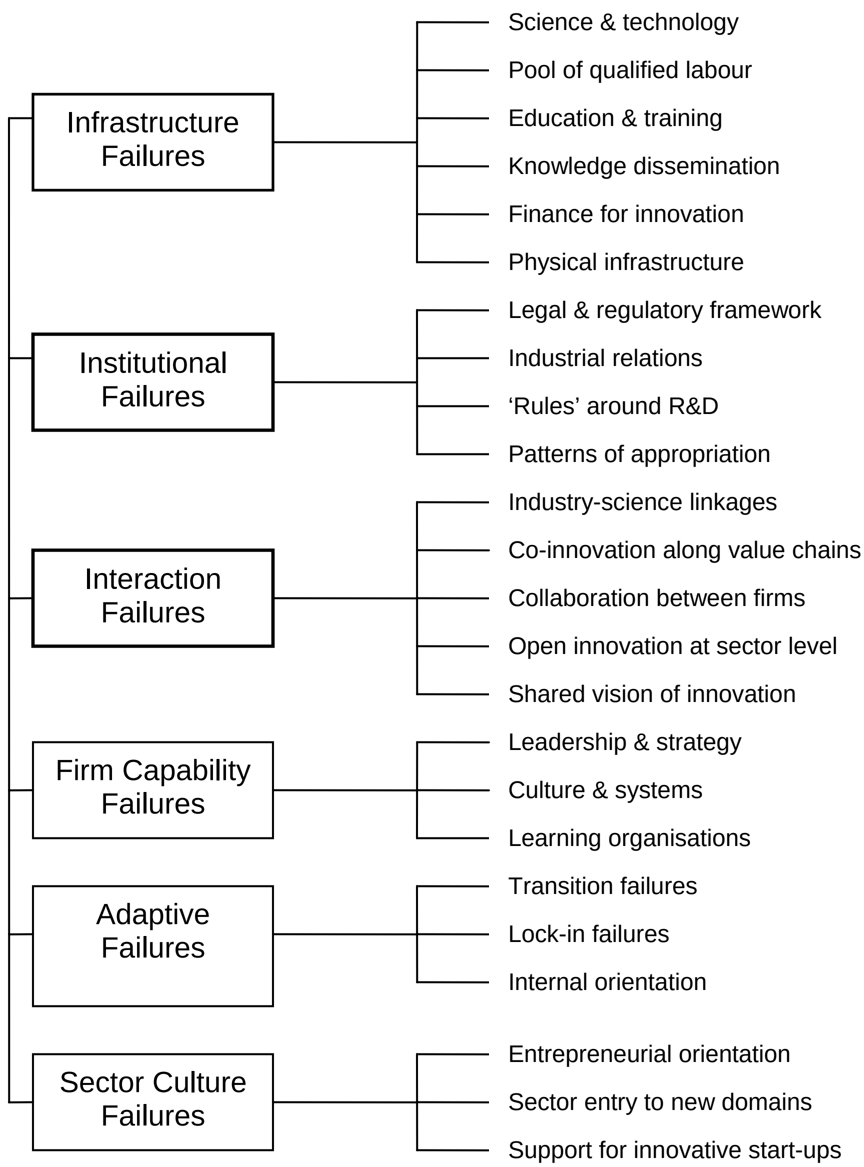
The approach was slightly modified from that developed by the earlier researchers as the circumstances of this research differed in the following aspects:

- Both the studies cited were directed towards determining the appropriateness and direction of government intervention in innovation policy and, in particular, the division of responsibility between public and private actors in the system. In this study, the opportunity for MLA to intervene presents a new dimension of integrating both public and private interventions which will be discussed further in Chapter 7.

- Both the studies cited take a broad perspective on innovation systems (encompassing national; regional and sectoral models), and therefore discuss the concept of system failures and corresponding interventions from a generic perspective. This research is focused on a specific sectoral innovation system, and it was therefore possible to customise the analytical framework more specifically to address the concept of sectoral systems.
- Neither of the two studies cited used the framework to inform the design of an intervention framework and Woolthuis, Lankhuizen and Gilsing (2005, p.615) note that, “the SI-framework has not been used yet for policy planning”. Chaminade and Edquist (2005) discuss the approach from a theoretical perspective. Woolthuis and her colleagues were only able to apply the framework retrospectively to a number of specific innovation interventions in order to hypothesise, “that a project that is executed in congruence with the SI-policy framework will be more successful in actually solving bottlenecks and achieving success” (2005, p.616).

In their conclusion, Woolthuis, Lankhuizen and Gilsing (2005) state that there remain significant opportunities to extend the approach through further study which could test the application in practice as a tool to analyse system failure and to design and evaluate intervention measures. As will be discussed in Chapter 8, this research makes a contribution to the field by extending the application of the SI-framework (based on the concept of system failure) to the design of an integrated intervention strategy within a sectoral innovation system context.

Figure 6.1: System failure analytical framework



The following discussion elaborates each of the six categories of system failure from the perspective of identifying the core activities and the roles of key actors required within the system for the effective functioning of innovation and entrepreneurship. As will be discussed in Section 6.3, these six system failure categories were applied in this study as a basis for identifying system failure in the red meat industry.

6.2.2 Infrastructure failures

A key function of the SI infrastructure is to provide adequate knowledge bases and resources in the following areas (Chaminade & Edquist 2005; Hindle 2002; Malerba 2004; Porter 1998; Smith, K. 1998):

Science and technology (S&T)

It is critical that the innovation system is able to provide the sophisticated physical and human resources that individual firms are unlikely to provide for themselves due to large capital investment, scarcity of skilled people, high levels of risk, and inability of firms to capture benefits exclusively. Key activities of the S&T infrastructure include: the production of new knowledge; developing enabling technologies; commercialising R&D outcomes; assisting firms to generate new ideas; helping industry to solve complex problems; and providing a vehicle to leverage inward knowledge flows from more technologically advanced countries. Key actors in the Australian S&T infrastructure include:

- Universities
- State government R&D agencies
- Major research facilities
- Public and private research institutes
- CSIRO
- Individual private organisations that provide a range of consulting, knowledge brokerage and support services such as management of intellectual property
- Technology commercialisers

To be effective, the S&T infrastructure must include a critical mass of scientists with appropriate skills in areas that are aligned to industry needs. It must demonstrate an ability to identify specific areas of excellence that may be unique to Australia and it must maintain strong international linkages which facilitate effective adoption and commercialisation of emerging technologies.

Pool of skilled labour

To support effective implementation of innovation strategies, firms within a sector require access to a pool of appropriately skilled labour and suitably qualified science, engineering and managerial personnel. This means that people with the relevant skills and experience must be available and willing to work in an industry sector. The sector must in turn be able to identify their specific skill requirements and to attract and retain people with effective human resource practices. In assisting firms to manage their competency base, the innovation system must support the development of new core competencies and must help firms acquire competencies through enhanced individual mobility.

Education and training structures

To complement the availability of a pool of skilled personnel, education and training bodies are required to align training and education programs to meet the specific competence needs of a sector. This is likely to include the development of specific programs aimed at building competencies within firms as well as incorporating specific industry content into more generic technical and professional programs. In this way new graduates are better equipped for employment within the industry.

Knowledge dissemination mechanisms

In addition to facilitating the knowledge production process, a sectoral innovation system must also ensure that adequate mechanisms exist for the dissemination of knowledge in order for it to be exploited by firms. Consultancy services (including both public and private knowledge brokers) often provide an important knowledge transfer role in an innovation system. In a number of studies undertaken by the OECD (2001), the provision of these types of services was seen as critical in facilitating the development of capacities for innovation. It is noted that in the red meat industry, MLA provides a key service in this area.

Finance for innovation and entrepreneurial activity

The provision of adequate finance for innovation and entrepreneurial activity is necessary to support the commercialisation of R&D outcomes. In industry sectors where margins are low there is little surplus capital available for high risk investments. An effective innovation system will require a variety of additional support mechanisms including:

- Access to R&D subsidies and seed capital
- Willingness of finance sector to release funds for innovation
- Active venture capital and business angel network

Physical infrastructure including ICT

In many instances (Edquist et al 2004; Woolthuis, Lankhuizen & Gilsing 2005), provision of adequate ICT infrastructure has been identified as a key determinant in the effective functioning of an innovation system. This impact is related to the role of ICT in enabling firms to access large amounts of knowledge and to facilitate efficient exchange of knowledge between individual elements within the system. In a more general sense, firms and organisations involved in the generation of knowledge also require access to adequate physical R&D facilities.

6.2.3 Institutional failures

Researchers have identified institutional arrangements as having a significant impact on the functioning of an innovation system (Carlsson & Jacobsson 1997; Edquist et al 2004; Smith, K. 1998). Creation, abolition and change of institutions (the ‘rules of the game’) are key activities within the system which can either enhance opportunities for innovation and entrepreneurship or alternatively constrain and inhibit. Woolthuis, Lankhuizen and Gilsing (2005) distinguish between hard institutional elements which relate to the legal and formal regulatory framework, and soft institutional elements which relate more to the conditions which evolve and determine the way business is done within a particular system. While the majority of institutions are determined at the national level, there may also be specific activities at the sectoral level as follows:

Legal and regulatory impost

Depending on the specific products and markets of a sectoral system, a range of consumer and employee protection laws and regulations generally evolve with a number of organisations emerging to regulate and enforce these rules. From a policy perspective, it is important to determine whether there is an appropriate balance between protecting consumers and employees, and creating conditions which allow reasonable operational flexibility. In the red meat sector these regulations relate to a wide range of areas including food safety, worker health and safety, environmental impact and animal welfare, all of which impose restrictions on production processes and incur significant compliance costs.

Industrial relations

At a national level there are a range of labour laws which ensure appropriate working conditions are provided. At a sectoral level there may also be specific industrial agreements. These determine more specifically how work is performed and may constrain the flexibility available to firms to develop new ways of operating or to introduce new technologies. In addition, sectors may evolve within a particular industrial climate which will impact on innovation processes and will determine the ease with which technological change can be introduced.

‘Rules’ around R&D

Specific sectors may agree to implement R&D strategies in particular ways at the sectoral level in addition to the commercial R&D activities of individual firms. In the rural sector within Australia there has evolved a unique approach to funding industry R&D which involves an equal investment from industry and from government. This model was not intended to constrain commercial investment in R&D. However, it may have had the unintended impact of reducing engagement by individual firms in innovation as they believe that it is being taken care of elsewhere on their behalf. It is noted that within this rural R&D model, a number of different standards for the treatment of intellectual property have also evolved, some of which may be beneficial to facilitating innovation, but others which may limit incentives for greater investment.

Patterns of appropriation

David and Foray (1995) make the distinction that a sector’s innovation performance is not solely dependent on knowledge creation and learning but is also affected by patterns of appropriation and the distribution of power within the system. When particular segments within a value chain are able to capture disproportionate benefits from innovations the result is often a reduction in innovation effort by other segments within the chain. An example of this is the dominance of large supermarkets in domestic value chains who are able to capture most of the margins associated with new product development and production efficiencies.

6.2.4 Interaction failures

A number of researchers (David & Foray 1995; Edquist et al 2004; Lundvall 1992; Smith 1996) demonstrate that fundamental to the effective operation of an innovation system is the quality of interactions between actors within the system and the efficiency of knowledge creation and learning processes that flow from these interactions. The complex and interdisciplinary nature of relevant knowledge bases means that innovation is most likely to occur when there is co-operation between different types of actors who command complementary resources and competencies (Malerba & Orsenigo 1997). Successful interaction among the various elements of an innovation system is particularly important in smaller nations such as Australia as it means there will be maximum return from the limited resources available and there is no wastage of talent or innovative potential. It is important to note that effective interaction and the formation of inter-firm networks requires high levels of trust and social capital within the innovation system (Coombs & Tomlinson 1998). Interaction activities which facilitate the distribution of knowledge within an innovation system include:

Industry-science linkages

The long term innovative performance of firms, particularly in industries with a strong science and technology base, is strongly dependent on the quality of interactions between firms and universities and research institutes. Integration between internal capabilities and the external science base will ensure firms have access to the most up-to-date research knowledge without the need to invest in high cost in-house facilities. Effective communication between research providers and technology firms will also facilitate commercialisation of the outputs of university based R&D.

Co-innovation along the value chain

Customer input into innovation strategy and an effective user-producer interface in technology development will also enhance the effectiveness of an innovation system. This will lead to: accelerated new product development in response to changing consumer requirements; improved product integrity and traceback systems; and increased adoption of process innovations as information is passed through the value chain.

Collaboration between firms

Participation in networks is a key activity in building competence within a sector as firms innovate based on complex relations which are dependent on reciprocity and feedback mechanisms (Chaminade & Edquist 2005).

Open innovation at sectoral level

Activities within the innovation system must focus not only on facilitating interaction and knowledge exchange between system elements but also on sourcing and integrating new knowledge developed outside the system (Chesbrough 2003).

Shared vision of innovation

Carlsson and Jacobsson (1997) identify an important effect of weak interactions within an innovation system as being the potential to lead to a lack of a shared vision regarding R&D and future technology requirements. This may in turn hinder co-ordination of research effort and investment. Given the collective investment in R&D that occurs within the red meat industry, this issue is of particular relevance.

6.2.5 Firm capability failures

Fundamental to the effective functioning of an innovation system is the extent to which firms are able to develop a range of internal capabilities. Entrepreneurial firms have a capacity to recognise opportunities that arise from the specific interactions of the elements within the sectoral system and an internal propensity to capitalise on these opportunities. Dougherty and Hardy (1996) propose that organisations must develop a capability which enables them to manage complex processes and to foster multiple innovations at different stages of the organisation's life cycle. An integrated model of firm innovation and entrepreneurial capability was developed for this research study and is discussed in detail in Chapter 5.

A number of researchers (Bryant 1998; Chaminade & Edquist 2005; Hindle 2002; Scott-Kemmis et al 2005; Woolthuis, Lankhuizen & Gilsing 2005) suggest that a key activity for an innovation system is to facilitate learning and increase the number of innovative firms by providing support services that build firm innovation capability. A detailed study was undertaken by the consulting firm Arthur D Little (OECD 2001) in order to identify which areas of innovation system activities are most important for the development of firm capacities for innovation. While their findings are quite broad and cover a range of areas in relation to an innovation system, a specific conclusion is that the system should provide direct support services for innovative firms based on an integrated capability model.

6.2.6 Adaptive failures

Adaptive failures relate to specific barriers to the adoption of new technologies which can occur at either the firm or the sector level as follows:

Transition failures

These arise when unexpected and significant changes in technological paradigms occur faster than the skills and adaptiveness of firms are able to respond. Smith (Smith, K. 1998) reports that there is considerable evidence to suggest that even relatively minor shifts can cause serious problems for firms, particularly in smaller economies such as Australia. Innovation systems need to develop strategies to overcome these problems by ensuring that: firms have an adequate knowledge base to forewarn them of future changes; education and training resources are able to be mobilised quickly to equip firm personnel to respond to changing requirements; and R&D support is provided to enable firms to adapt their operations to new technological regimes.

Lock-in failures

Chaminade and Edquist (2005) relate these failures to socio-technical inertia which can hinder a whole sector's ability to respond to changing technological paradigms. Smith (Smith, K. 1998) notes that this inertia is related to deeply embedded dependencies on existing technological routines associated with a complex system of scientific and technical knowledge (both within firms and the supporting infrastructure), and high levels of investment in existing physical infrastructure. In this scenario, whole sectors can become so locked-in to current technologies that adoption of alternatives is strongly resisted at all levels. Problems of this type generally require whole system responses including the generation of incentives to develop new technological alternatives and the facilitation of new socio-technical systems.

Internal orientation myopia

Bogenrieder and Nooteboom (2002) identify a specific case of technological inertia which they describe as being due to an overly internal orientation within a sector. Rather than a conscious resistance to new technologies, sectors may simply be unaware of their existence due to an over reliance on internal knowledge mechanisms and a 'group think' mentality. As noted by Pouder and St. John (1996) what were previously successful networks based on trust and knowledge sharing can become dysfunctional as blind spots develop. Problems of this type require innovation systems to develop reliable and externally focused knowledge networks based on the open innovation concepts espoused by Chesbrough (2003) and to encourage open debates around emerging innovation trends.

6.2.7 Entrepreneurship culture failures

Entrepreneurship refers to the process of transforming new knowledge and ideas (often the outputs of R&D) via complex commercial processes into a value creating business outcome (Dodgson & Bessant 1996; Hindle 2002). Within a sector, entrepreneurship activities will be undertaken by a variety of individuals (entrepreneurs) who may commercialise new ideas via start-up companies. Existing firms may also be involved in corporate entrepreneurship as they undergo processes of renewal and transformation. As discussed in Chapter 5, the prevailing culture of an industry will play an important role in determining the entrepreneurial orientation and capacity of firms within the sector (Hindle 2002). Extensive international research in the field of entrepreneurship (Hindle & Rushworth 2002) indicates that the key activities required of an innovation system are:

- Enhancing entrepreneurship skills via training and education (addressed in Section 6.2.2)
- Facilitating cultural change to ensure positive attitudes towards entrepreneurship

Chaminade and Edquist (2005, p.25) more specifically identify that a key activity of the innovation system is, “to enhance the entry and survival of new firms and the growth of successful SME firms by facilitating and supporting entrepreneurship”.

A healthy entrepreneurial environment will be characterised by: strong participation in start-ups and early stage venturing; evidence of transformation of existing firms into new domains; and the entry of the sector into totally new areas. An example of this in the red meat industry is the early emergence of a new bioactives sector. This initiative involves the application of new technologies and knowledge to the transformation of raw materials into completely new products for new pharmaceutical and functional food applications.

As noted at the beginning of Section 6.2, this analytical framework was developed for this study as the basis for identifying system failures in the red meat industry. In the next section, a preliminary methodology for ‘mapping’ system failures is discussed.

6.3 Evidence of System Failure

To ‘map’ system failures clearly requires evidence which could be derived using either qualitative and/or quantitative methodologies. As discussed earlier in this chapter, the concept of mapping has emerged in recent years as an approach to comparing the functioning of national innovation systems. A review of this literature reveals that the majority of mapping studies have taken a pragmatic approach to the limitations imposed by availability of data and the high costs associated with collection. An important European publication known as the *Oslo Manual* (OECD 1992) recommends that studies rely on indicators based on existing macro-level quantitative data. These indicators are collected by government agencies in countries which comprise the OECD members and have become the principal source of evidence for comparative studies of national innovation systems using an Innovation Scorecard approach (Evangelista et al 1998; Smith 2004).

It can be argued however, that the innovation systems concept is essentially a qualitative concept that may not be easily amenable to quantitative treatments and should therefore not be subjected to overly simplistic or reductionist methodologies. It is also noted that even if quantitative data are to be used, very few of the data sets currently available support analysis at the sectoral level (the focus of this study). In the literature review undertaken for this study, only one article was located which explicitly discussed using qualitative data (collected via semi-structured interviews) applied to a system failure framework for measuring the success of interventions (Woolthuis, Lankhuizen & Gilsing 2005). None could be located that had specifically developed system failure indicators as a methodology to ‘map’ a sectoral innovation system for the explicit purpose of designing intervention strategies. Mapping system failures at a sectoral innovation system level represents a new area of research that several researchers suggest should be pursued

(Scott-Kemmis et al 2005; Smith, K. 1998; Woolthuis, Lankhuizen & Gilsing 2005).

It is proposed that a comprehensive methodology for determining evidence of system failure would require both quantitative and qualitative data. These data could include both positive and negative indicators as evidence of system 'health' or system 'failure'. It is considered that qualitative evidence will be most useful when designing intervention strategies while quantitative data will be required to undertake comparisons over time and between systems. The design of a comprehensive qualitative and quantitative methodology was outside the scope of this study but, as discussed in Chapter 8, is proposed for future research. Table 6.2 is a preliminary list of the types of evidence (based on both quantitative and qualitative data) that could be developed to operationalise the six categories of system failure included in the analytical framework developed for this study. The items in the list were derived from the previously cited studies (Chaminade & Edquist 2005; Woolthuis, Lankhuizen & Gilsing 2005) and were informed by the data collected in Cycle 1.

Table 6.2: Evidence of system failures

Category	System Health	System Failure
Infrastructure	• S&T capability geared to sector • Adequate physical R&D infrastructure • Critical mass of scientific expertise in key areas • Skilled technology commercialisers • Availability of skilled and educated staff • Supportive training and educational structures meeting technical labour supply needs • Competitive intelligence capability developed and used by firms • Access to multiple types of finance for innovation and entrepreneurship • Evidence of investment in R&D in emerging areas such as biotechnology; automation; ICT • Network of knowledge brokers • ICT infrastructure supporting information exchange needs	• Sector lagging competitors in adoption of new S&T • Inability of firms to attract/ retain qualified technical staff • Poor perception of sector by finance industry • Low representation by sector in government R&D programs • Low levels of investment in R&D • Inadequate numbers of S&T providers • Low awareness by firms of emerging issues in key markets • Lack of exposure to formal education and training • Lack of alignment between R&D providers and industry • Low utilisation by firms of external knowledge providers • Inadequate ICT infrastructure and low utilisation of modern ICT

Institutional	• Acceptance from regulators • Balance between consumer protection and operational flexibility • Regulations are science based • Regulators aware of commercial realities • Regulators support innovation and entrepreneurial behaviour • Good collaboration and respect between regulators and firms • High levels of trust between management and employees • Employees involved in innovation and change management • Incentives and rewards in place for innovative firms • Benefits of innovation shared equitably along the value chain • R&D investments support innovative firms	• Industry lagging competitors in relationship with regulators • Regulators perceive role as defending customers at expense of sector • High cost of compliance compared with competitors • Regulators perceived as creating barriers to innovation • Regulators too slow to change • Too many regulations creating confusion and inefficiencies • Regulators lack resources and expertise to address sector issues • High levels of industrial disputes • R&D system discourages private investment in innovation • Benefits from R&D do not flow equally to participants • Outcomes from R&D ‘locked up’ for long periods
Interactions	• Firms have access to and are aware of multiple sources of knowledge and learning • High levels of trust and interaction between firms and R&D providers • Effective user-producer interfaces in development of new technology • High levels of interaction by firms with sophisticated customers • Effective innovation along the value chain • Effective commercialisation of R&D outputs from R&D providers • Evidence of multiple collaborative R&D projects • Participation by firms in multiple knowledge sharing and innovation networks • Adoption of innovation from outside the sector • Widely supported sector innovation strategy • Use of trusted intermediaries to facilitate inter-firm collaboration	• Limited evidence of public-private partnerships • Minimal exchange of staff between commercial firms and R&D providers • Adversarial relations between segments within the value chain (firms and representative bodies) • Fragmented structures with little value chain integration • Absence of industry networks • Low levels of trust and communication between firms • Incompatible information systems between segments within the value chain • Low participation rates in syndicated R&D projects • Low levels of engagement between technology commercialisers and R&D providers • Low levels of international collaboration • Lack of coherence in sector R&D and marketing strategies
Firm capability	• Successful launch of new products • Successful entry to new markets • Successful adoption of new technologies and business processes • Evidence of entrepreneurial behaviour and implementation of growth strategies • Evidence of excellence in environmental and social sustainability • High scores on innovation capability benchmarks • Ability to foster creativity, innovation and risk taking • Cost competitiveness • Ability to attract new people with new	• Falling behind competitors in relation to key performance benchmarks • Low investment in R&D and innovation • Focus on short term payback periods for R&D investment • Absence of skilled R&D and innovation personnel • Absence of clearly articulated innovation strategies • Lack of documented innovation systems • Poor record in implementing change strategies • Poor record in commercialising R&D outcomes • Low scores on innovation capability benchmarks

	skills • Application of concepts of open innovation	• Low participation rates in industry innovation projects • Lack of investment in training in creativity and innovation • Low tolerance for risk taking • 'Stick to the knitting' mentality • Dominance of commodity focus and production oriented mindset
Adaptiveness	• Cost competitiveness as a result of adoption of new technologies • Adoption of new product development platforms • Sector supported technology innovation strategy • High levels of adoption of new technology • Successful commercialisation of new technology	• Slow to respond to changing market requirements which require implementation of new technologies • Loss of market share due to high costs associated with outdated technologies • Evidence of redundancy in skills and capabilities • Lack of support for R&D providers to build capability in new technology areas • Lagging competitors in relation to new technology • Tight control of investment in technological innovation creating barriers • High capital investment in current technology a barrier to innovation • Poor technology foresighting capability • Mistrust of technology providers
Sector culture	• Support for innovative & entrepreneurial firms • Evidence of innovative & entrepreneurial individuals • Acceptance of legitimacy of entrepreneurship • Participation in new venture creation • Investment by venture capitalists and business angels in start-ups	• Low skill levels in entrepreneurship • Negative attitudes towards risk • High failure rate for new ventures • Suspicion and mistrust of innovators and entrepreneurs • Resistance to engaging in new business opportunities • Low participation rates in entrepreneurship support schemes

6.4 Applying the System Failure Approach: Plan for Cycle 2

During the planning phase of Cycle 2 an opportunity became available to incorporate the new approaches being developed within this study in a more structured way into MLA's overall corporate plan. Based on new requirements imposed by the Commonwealth government, it was determined that MLA would need to prepare a more comprehensive 5-year strategy to commence in July 2007. Key requirements of the 5-year plan were:

- More structured approaches to measuring the impact of MLA's innovation strategies
- Stronger emphasis on facilitating adoption of innovation outcomes and building sector innovation culture and capability

- Ensuring an integrated, whole-of-industry approach to innovation

It was apparent that the frameworks and methodologies being developed in this study could make a direct contribution to improving MLA's practice in these areas. It was therefore determined that the focus of Cycle 2 should be explicitly to develop the new intervention framework to underpin MLA's 5-year innovation strategy.

Based on the approaches discussed in the literature and the learning derived from Cycle 1, the following steps were developed for designing MLA's innovation intervention strategy.

1. Develop an appropriate conceptual framework that identifies the key elements in the specific sectoral innovation system being studied
2. Analyse the system to identify stresses and failures in the innovation system
3. Design intervention instruments and projects to address system failures
4. Undertake preliminary acceptance-testing of the proposed interventions to determine potential for impact
5. Develop an integrated intervention framework based on system failures and potential for impact
6. Design broad comparative and longitudinal studies (across sectors; within sectors across countries; and within sectors historically) to track implementation; to determine overall effectiveness; and to refine intervention strategy

Cycle 1 of this research represents completion of the first step in the application of this methodology, the development of the conceptual framework specific to the innovation system operating within the Australian red meat sector (documented in Chapter 5). The plan and objectives for Cycle 2 were developed to address steps 2 through 5 as follows:

- Utilise the analytical framework to review data collected in Cycle 1 and determine evidence of system failures
- Undertake detailed planning for new intervention options to be included in MLA’s future 5-year innovation strategy
- Determine broad industry (and MLA) acceptance of the new approach
- Consolidate the outcomes of the research into an integrated innovation intervention framework underpinned by innovation systems theory

Future research opportunities are identified (step 6) and discussed in the final chapter of this thesis.

CHAPTER 7

CYCLE TWO: BUILDING THE INTERVENTION FRAMEWORK

In Chapter 6, an analytical framework was developed based on six areas of potential system failure. This chapter describes the second major research cycle undertaken for this study and, in particular, the outcomes of applying the analytical framework to the red meat sector via construction of a ‘map’ of system failures. The analysis was based primarily on qualitative data collected via interviews in the first research cycle of this study. The mapping exercise revealed that there is evidence of failure present in the red meat industry in all six categories, and that these failures relate to both missing or ineffective actors and missing or ineffective system activities. Based on a process of rating importance against likelihood of impact, an intervention priority matrix is constructed. In the final stage, a new SI-Intervention Framework was progressively constructed and potential intervention projects were developed and tested for acceptance via engagement with industry participants. As a key outcome of this research was to improve practice within MLA by building capability within the MLA research team, it was considered important to engage the MLA team extensively in the research. The chapter concludes with an overview of the internal capability building interventions undertaken to enhance MLA’s ability to deliver the new approach and to ensure sustainable change in the future.

7.1 Iterations in Cycle 2

The approach pursued during this cycle was based on an iterative triangulation methodology similar to that employed in Cycle 1, with members of the MLA research team more directly involved in analysing the data, designing the intervention options and testing acceptance of a number of the new elements within the industry. This greater level of direct participation by the MLA team was an important aspect of the research design as:

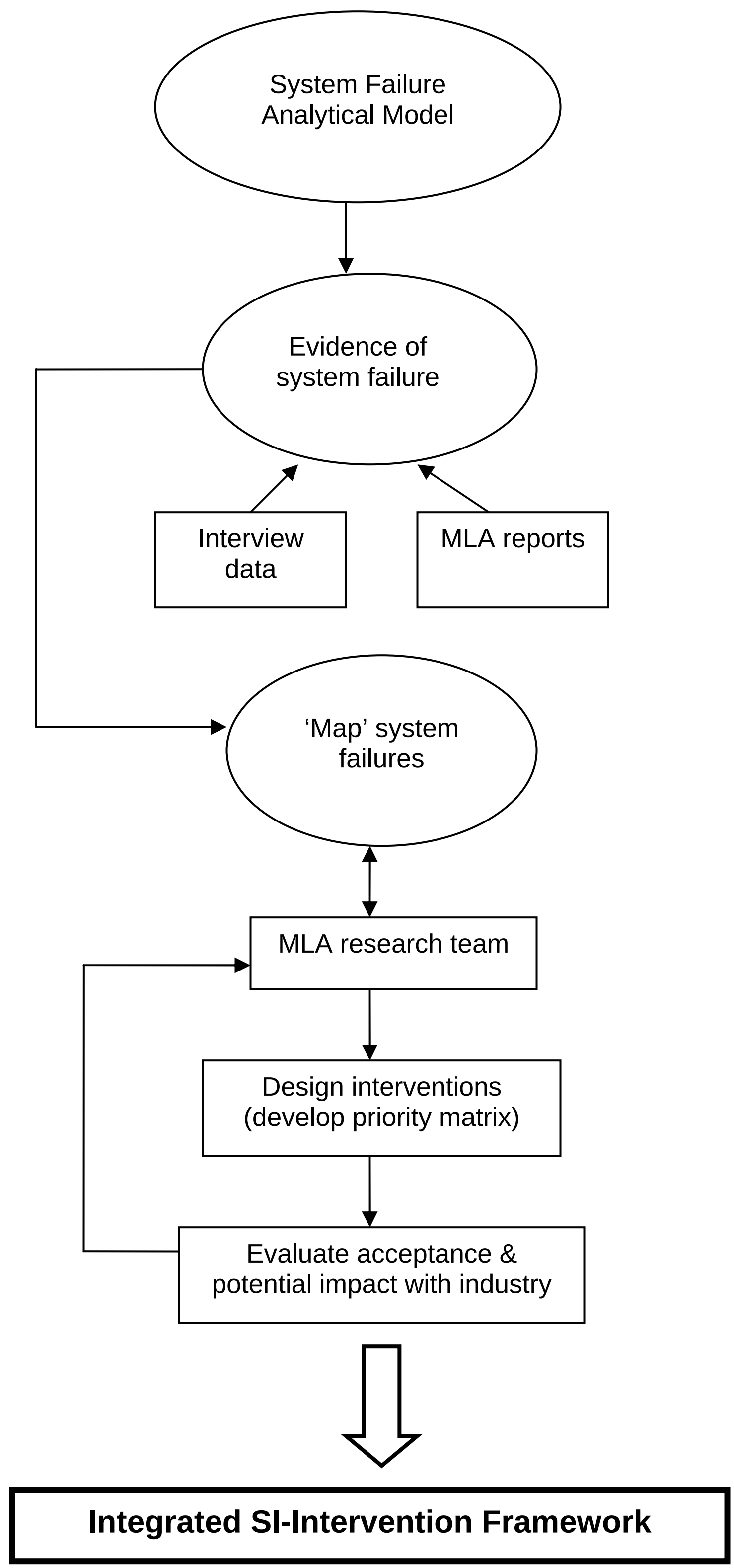
- Team members had the opportunity to learn during the research phase, thus enhancing the likelihood of sustained change in the future
- Different perspectives on interpreting the data by individual team members added validity to the research (triangulation)
- A greater understanding of the competencies required of intervention agencies in the implementation of the more complex innovation systems approach was developed

An overview of the numerous iterations which took place in this research cycle is illustrated in Figure 7.1. A brief summary of the key activities is provided here with the methodology detailed in the following sections:

- Searching for evidence of system failure based on interview data (from Cycle 1) and relevant MLA reports
- Mapping system failures as they related to missing or ineffective activities and missing or ineffective actors. The mapping exercise included a prioritisation of the areas of failure. This was based on importance in terms of the potential impact on effective functioning of the sector’s innovation system
- Developing intervention options and evaluating acceptance by seeking input from industry participants
- Determining the potential for MLA to have an impact in specific areas of system failure. This enabled a priority matrix to be developed based on importance of a specific area moderated by the potential for MLA to impact.

As illustrated in Figure 7.1, several iterations took place during Cycle 2 and the models and frameworks described in this chapter evolved and were modified substantially throughout the cycle.

Figure 7.1: Cycle 2 - Iterative cycles



7.2 Evidence of System Failure in the Red Meat Sector

It will be recalled that the analytical model developed in Chapter 6 is based on innovation systems theory and the concept of system failure. The model consists of the following six categories of potential failure:

- Infrastructure failures
- Institutional failures
- Interaction failures
- Firm capability failures
- Adaptive failures
- Sector entrepreneurship culture failures

In each category, a number of specific dimensions of failure were also identified (see Figure 6.1), with a total of 24 dimensions described. The next step was to apply this analytical model to assess the functioning of the red meat sector's innovation system. Finally, an intervention framework was designed based on the potential for MLA to be able to improve the sector's innovation capability by reducing the impact of the system failures.

The literature reviewed in the planning for this cycle revealed that previous studies seeking to analyse the functioning of an innovation system have taken a pragmatic methodological approach due to the limitations imposed by the availability of existing data and the high costs associated with the collection of specific and targeted data. In Chapter 6 it was noted that there are very few quantitative data sets available which support analysis at a sectoral level. As proposed in the preceding chapter, it is considered that a more comprehensive methodology for assessing the health of an innovation system would include:

- Analysis of qualitative data to identify evidence of system failure as the basis for designing intervention strategies (the purpose of this study)

- Subsequent evaluation of the impact of interventions based on both qualitative data and quantitative data (future research)

In Chapter 6, a preliminary framework was constructed of the types of data that provide evidence of system failure in the six categories of the analytical model (see Table 6.2). Based on this framework, an evaluation of qualitative data collected from interviews in Cycle 1 was undertaken. This revealed significant evidence of system failure in the red meat sector. In addition, a review of selected MLA research reports provided an opportunity to triangulate the interview data. Table 7.1 illustrates specific examples of the types and source (interview data and/or research reports) of evidence of system failure in the red meat sector.

Table 7.1: Evidence of system failure in red meat industry

System Failure Category	**Evidence in red meat sector (*source*)**
Infrastructure	• Industry not aware of R&D outcomes (*MLA/AMPC Impact Report 2004)* • No alignment between R&D providers and industry *(interviews)* • Insufficient technology providers and poor commercialisation history *(interviews)* • Difficulty attracting and retaining skilled staff *(interviews; MLA Report – Abba 2004)* • Education and training providers do not have sufficient industry knowledge *(interviews)* • Low industry awareness of threats and opportunities in global environment *(interviews)* • Lack of benchmarking performance data *(interviews)* • Inadequate physical R&D infrastructure *(interviews; MLA Report – KPMG 2000)* • Inadequate ICT infrastructure *(interviews; MLA/QLD Gov. Report 2001)*
Institutional	• NZ competitors have better relationship with regulators *(interviews; MLA Report – TAP 2000)* • Regulators locked into historical paradigm of representing customer not supporting industry *(interviews)* • Over regulated creating confusion and inefficiencies *(interviews)* • Regulations not science-based and not aligned to commercial realities *(interviews)* • Socialised R&D removes incentives for firms to innovate *(interviews)* • Industry bodies narrow focus on crisis management, not innovation strategy *(interviews)* • Dominance of supermarkets in domestic supply chain removes incentives to innovate *(interviews)*

Interaction	• Limited evidence of public-private partnerships compared with competitors (*MLA Report – MINTRAC study tour 2006*) • Need for closer linkages between industry and researchers *(interviews)* • Fragmented industry structures with little evidence of collaboration along value chain *(interviews; MLA Report – KPMG 2001; MLA Report – Currie 2002)* • Relationships within the value chain limited by adversarial behaviours *(interviews)* • Lack of trust and low levels of collaboration between firms *(interviews)* • Very difficult to engage firms in syndicated projects *(interviews)* • Lack of collaboration has resulted in lack of coherence in industry R&D and marketing strategies *(interviews)*
Firm capability	• Industry firms are dominated by a focus on short-term cost-cutting initiatives at the expense of investment in innovation *(interviews)* • Lack of formal education and training by managers *(interviews; MRC Report – Andrewartha 1995)* • Many CEOs rely on approaches that have worked in the past and are reluctant to embrace new ideas *(interviews)* • Firms are not tolerant of failure and are resistant to change *(interviews)* • General lack of support for creative or entrepreneurial individuals *(interviews)* • Competitors such as NZ firms demonstrate superior innovation capability *(interviews)* • Industry is losing market share to competitors in both domestic and export markets *(MLA Market Intelligence Reports 1999-2006)* • Firms rely on innovations filtering through from overseas and do not take a proactive approach to innovation *(interviews)*
Adaptive	• Firms do not take a proactive approach to technology innovation *(interviews)* • Lack of inhouse professional skill base makes it difficult for firms to adopt new technology *(interviews)* • Industry not prepared to support capability building in R&D providers *(interviews)* • Evidence of possible misuse of power on industry committees to block investment in new technology *(interviews)* • Reinforcement of status quo via shared industry perceptions such as “we sell all the meat we can produce – we are pretty right” *(interviews)*
Entrepreneurship culture	• Negative attitudes towards risks associated with innovation due to past R&D failures *(interviews; MLA Report – PIP Review 2005)* • Need to attract more creative and entrepreneurial people to the industry *(interviews)* • Industry culture is dominated by suspicion and mistrust of innovators *(interviews)* • Industry reluctant to enter new domains *(MLA Report – Bioactives 2005)*

7.3 Mapping System Failure

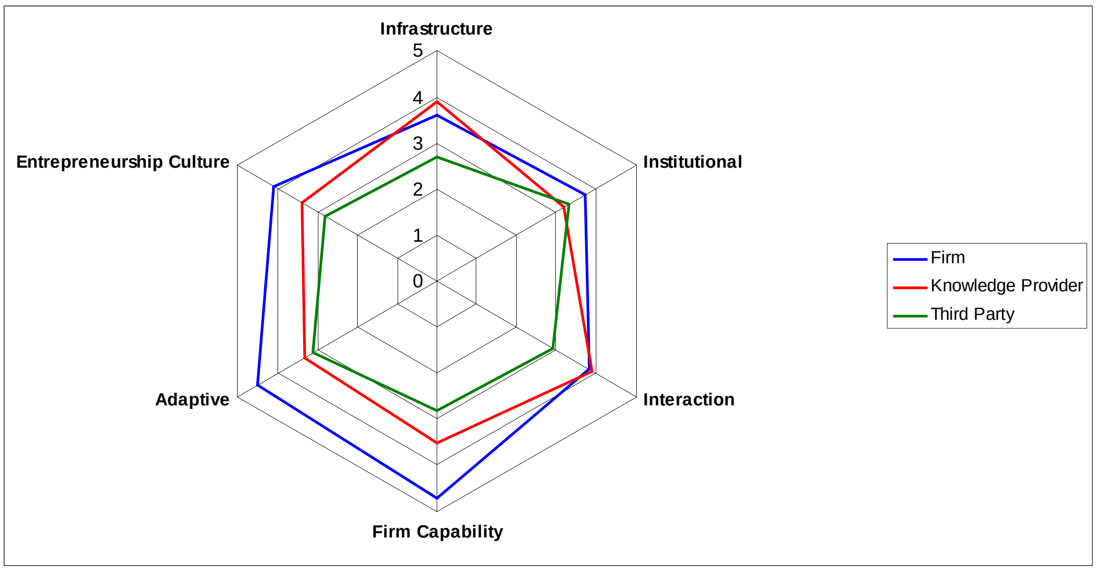
As noted in Chapter 6, the concept of 'mapping' an innovation system has emerged in recent years. Mapping is an approach to analysing empirical data to compare the functioning of a system over time, or in cross-sectoral comparisons (Bikar, Capron & Cincera 2006; Georghiou 2002; Nelson 1993; Stevens 1997). A key recommendation of the Agrifood Innovation Working Group in their submission to the National Innovation Summit (DAFF 1999, p.13) was that, "There may also be value in mapping the agrifood innovation system to identify its strengths and weaknesses and assess the effectiveness of linkages between individual elements of the system. Government and industry will be better equipped to develop appropriate policy responses with this information." However, as noted in a recent mapping of the Australian national innovation system (Commonwealth of Australia 2003, p.41), "there is no definitive consensus on the details of a map and probably no general agreement on methods."

The mapping methodology I have applied in this study is based on the approach developed by Woolthuis, Lankhuizen and Gilsing (2005) in which the effectiveness of system elements is evaluated from the perspective of the key actors within the system. In their model, Woolthuis and colleagues identify the following three groups of actors:

- *Firms/value chains*: large firms; SME's; innovative start-ups; value chain partners such as supermarkets; whole value chains
- *Knowledge providers*: universities; public R&D institutes; technology commercialisers; knowledge brokers and consultants; training and education providers.
- *Third parties*: regulators; finance sector such as banks and VC's; trade unions; industry associations

In this cycle of the research, the MLA research team rated the degree of impact on the effectiveness of the sector's innovation system of each of the six system failure categories (and the 24 dimensions within the categories) by each category of actor. The following Figure 7.2 summarises the outcomes of this mapping exercise.

Figure 7.2: Mapping system failures



A 5-point rating scale was used by the research team to assess the relative importance of each system failure dimension for each of the three groups of actors with a rating of '1' indicating 'not relevant' through to '5' indicating 'critical'. The summary map broadly indicates the perceived level of impact of failures in system activities (by actor groupings) within each of the six categories within the analytical model. As will be discussed in Section 7.5, when qualified by the potential for interventions by MLA to have an impact, this framework provided a mechanism for determining where MLA intervention efforts aimed at improving the sector's innovation capability should be concentrated in the future.

7.4 Developing Intervention Options

The next activity undertaken during Cycle 2 was the progressive design of a range of intervention options that MLA could include in the next 5-year innovation strategy due to commence in July 2007. By engaging the MLA research team directly in the intervention design process, opportunities were captured to better understand and enhance the capabilities of the team. This increased the likelihood that the new approach would be sustainable following completion of the study.

The key inputs into determining potential intervention options were:

- Suggestions made by interviewees during Cycle 1
- Recommendations by participants in the food industry stakeholder workshop undertaken in June 2004
- Review of existing MLA initiatives that the MLA research team believed could be further developed
- Lessons learned from past practice (see Chapter 2)
- Consideration of the priority areas based on the mapping exercise reported in the preceding section

A series of internal workshops with the MLA research team were conducted in which multiple intervention options were identified and considered. A number of interventions were identified for further investigation by evaluating options against the following criteria:

- Intervention fits broadly within MLA's mandate. It was noted that the new approach represents a significant expansion of MLA's role. Specifically the approach explicitly challenges the current paradigm that intervention should only occur in the case of 'market failure'. For this reason a relatively broad interpretation of MLA's mandate was required.
- Intervention fits within the priority areas identified in the mapping of system failures

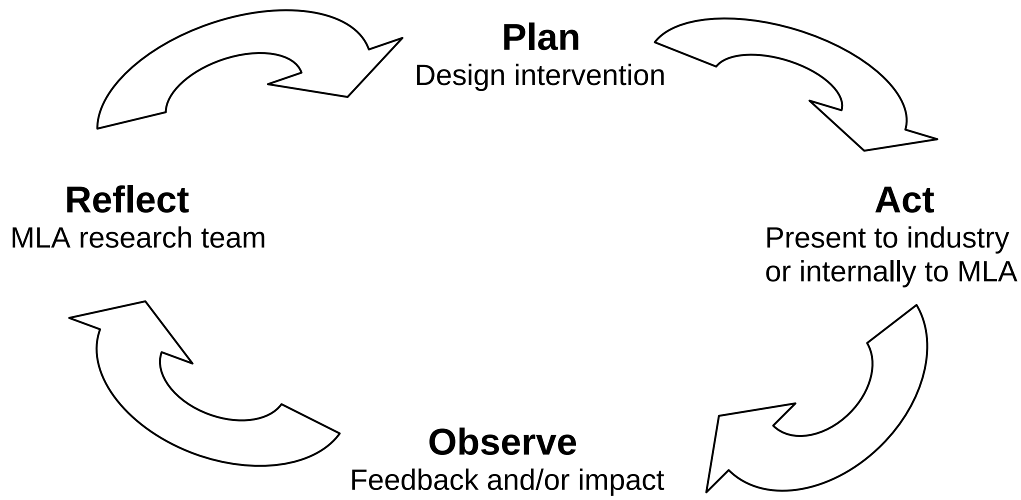
- Intervention does not duplicate a service already provided by other industry or government bodies
- MLA has (or could acquire) the necessary skills to implement the intervention
- Intervention appears to offer a cost-effective solution and is within MLA's broad budgetary constraints
- Intervention would not seriously confront industry political considerations. It was noted that the new approach may encounter some resistance from current incumbents wishing to maintain the status quo.

A key outcome of this cycle was to determine industry acceptance of the proposed initiatives and support for a changing role for MLA. The criteria for determining industry acceptance were based on MLA's existing program evaluation criteria and were as follows:

- **Positive feedback:** the proposed intervention option should receive positive feedback when presented to targeted industry groups
- **Future engagement:** agreement by industry partners to engage in the intervention initiative in the future
- **Adoption and impact:** evidence of early adoption and/or impact arising from preliminary trials of the new intervention initiatives where this was possible to determine

The approach taken for the remainder of Cycle 2 is represented in Figure 7.3. During the period in which Cycle 2 occurred, the MLA research team met to review and reflect on a regular basis which included monthly half-day meetings and three 2-day retreats.

Figure 7.3: Action cycles to develop intervention options

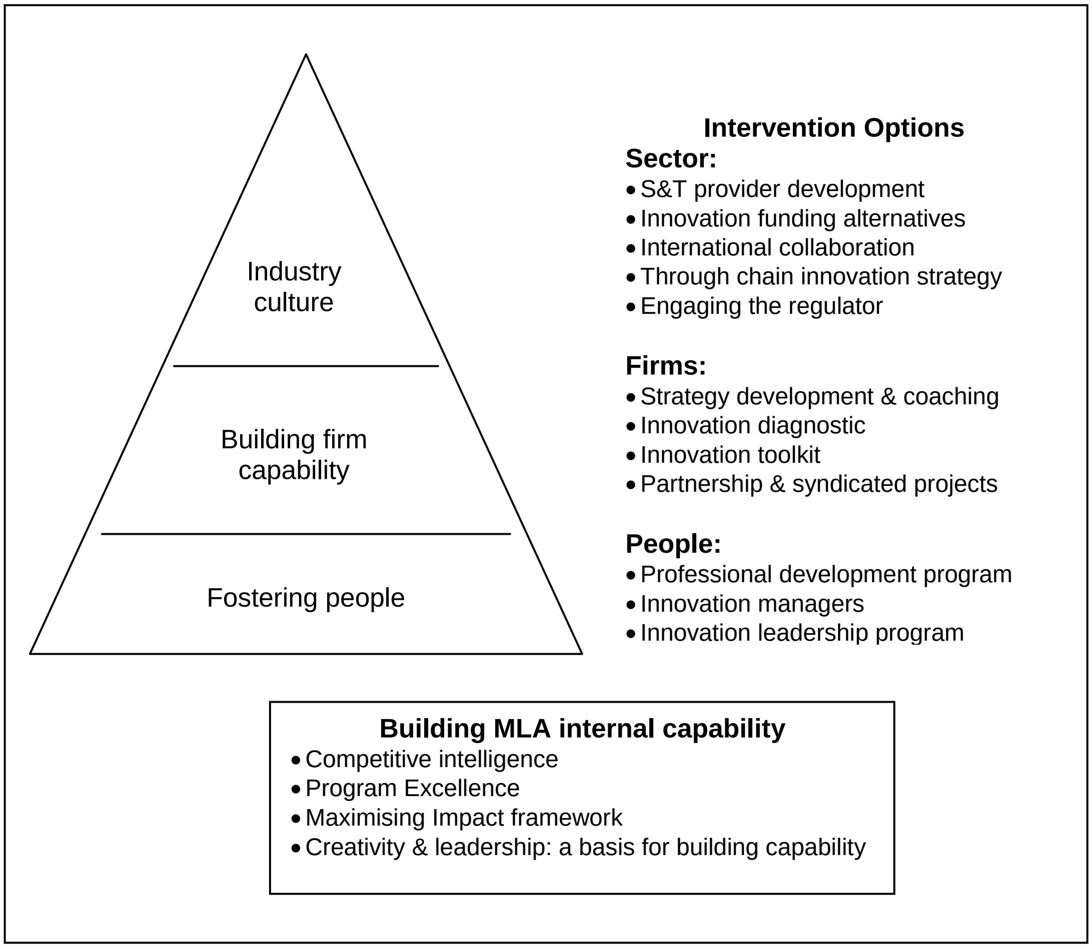


The following discussion provides an overview of the main initiatives undertaken during the cycle with three specific examples included to illustrate how the research team engaged with industry to determine acceptance.

7.4.1 Introducing the new approach

To begin this stage of the study a broad overview of the new approach was presented to industry stakeholders and internally to the MLA board. This was considered important in terms of providing the research team with a 'license to operate' in the new space and also to receive an initial indication of the likely response to the new systems-based intervention approach. It also proved to be an effective mechanism for identifying industry participants who would be willing to work more closely with the research team in the acceptance testing phase. As government would be a key stakeholder in the outcomes of this research study due to the potential impact on future government policy, presentations were also made at two government forums involving more than 90 representatives from a number of Commonwealth departments (August 2004; July 2005). A summary of the outline of the proposed new approach is represented as follows:

Figure 7.4: New MLA innovation culture & capability intervention model



Source: adapted from various presentations I made during 2004-2005

Based on these early presentations, the research team received strong endorsement for the new approach and was able to commence development of the intervention options and to establish mechanisms to secure industry engagement and determine acceptance.

During the remainder of Cycle 2, the MLA research team undertook an extensive development process for the majority of the intervention options identified in the model illustrated in Figure 7.4. Where possible, interventions were designed to address more than one area of system failure. A brief summary of a selection of the intervention options is included here to provide the reader with a sense of the type of activities undertaken. The multiple iterations included in this cycle allowed for feedback from various industry groups plus the opportunities for reflection by the research team. As a result, the design of the projects underwent many evolutions before being deemed finalised for inclusion in MLA’s future intervention strategy. Where proposed intervention options received strong support, detailed implementation plans have been developed. In a small number of instances (discussed in section 7.4.5), initiatives have not yet received full endorsement and further development work will be required.

7.4.2 Professional development program (addressing infrastructure and interaction failures)

As was identified in the analysis of the data, the red meat sector has identified a significant system failure in relation to its ability to attract and retain suitably qualified science and technology personnel. The impact of this failure on firm innovation capability and the industry’s innovation strategy was reported by the industry personnel interviewed for this study to be significant. While much of the effort to overcome these types of failures is usually undertaken by governments at the national level (OECD 2000; 2002), it was identified that there were opportunities to also address this problem at the sectoral level.

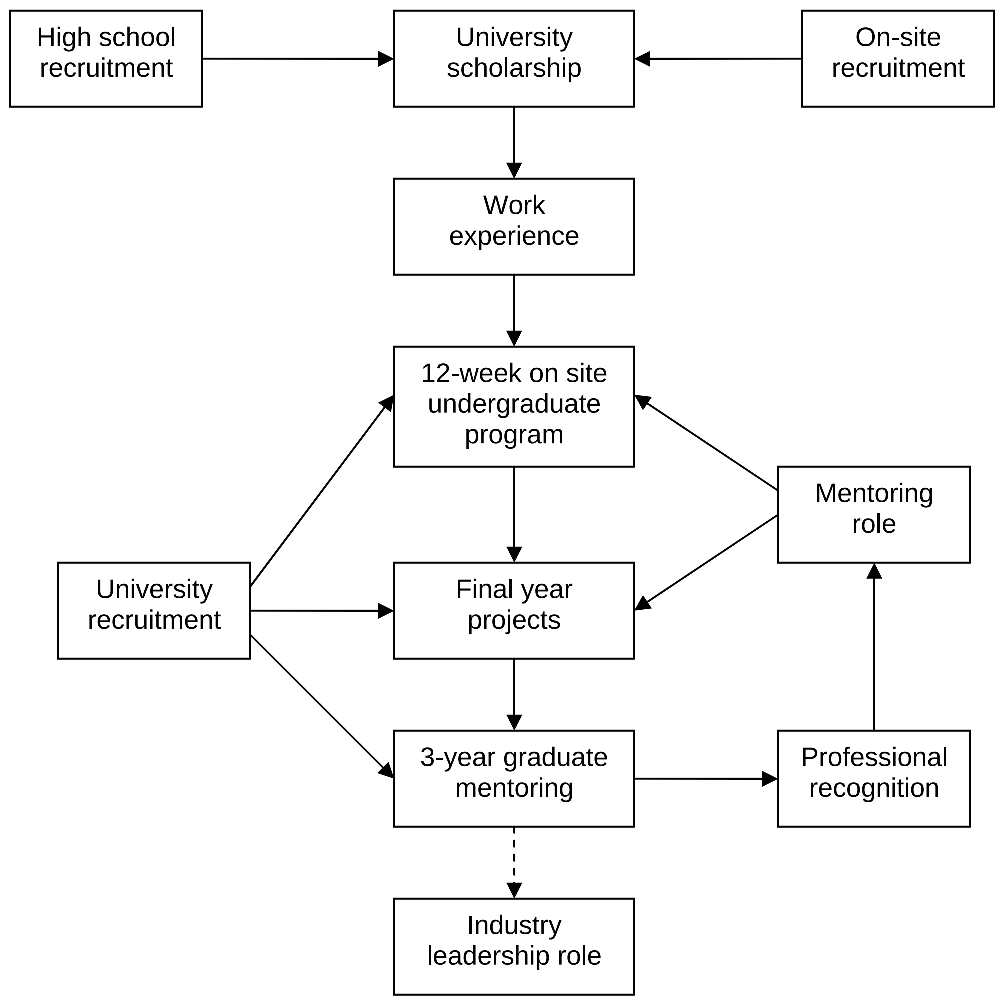
The broad aim of improving industry-science linkages is to increase industry access to a wider body of new scientific and technical knowledge beyond its own capacity to support. However, innovation surveys demonstrate that the main benefit that industry sectors seek from linkages with universities is easier access to a suitably qualified pool of skilled personnel (OECD 2000). Therefore, the key objective of this intervention option was to assist firms in the red meat sector to significantly increase the number of qualified science and technology graduates willing to work in the industry.

Following a review of similar programs in other industries, an existing model was identified in the Australian dairy processing sector. Presentations were made at an industry conference to secure support for the approach, and a key staff member was recruited (from the dairy industry program) to develop the initiative which became known as the *Red Meat Industry Professional Development Program*.

Key components of the intervention are illustrated in Figure 7.5 and include:

- A combination of on-site and external professional mentoring for all graduates and undergraduates
- Comprehensive induction and ongoing training programs
- An intensive 12 week on-site program for undergraduates prior to commencement of final university year
- Students paid while on-site
- Involvement in industry technical and innovation networks
- Direct responsibility for on-site innovation project
- Presentation of project work at industry conferences with awards for excellence based on industry and site ratings (awards also acknowledged by universities)
- Opportunities for secondment to S&T providers (including international placements) for agreed period during 3-year graduate program
- Access to senior MLA program managers for support and knowledge exchange
- Professional recognition at the end of the program (MLA has formed a strategic alliance with Engineers Australia)

Figure 7.5: Professional Development Program



To test acceptance of the model in industry it was determined that an actual pilot of the approach was the most appropriate and this was undertaken through the following activities:

- An information brochure was developed and circulated to industry companies inviting participation
- University departments offering relevant S&T programs in 34 universities throughout Australia were contacted and following agreement to participate, presentations made to faculty staff

- Presentations were made to third and fourth year undergraduates and at career information forums
- The program was advertised nationally
- Program funding mechanisms were secured based on a 50:50 contribution between participating firms and MLA

As can be seen from the following table, industry endorsement for this initiative has been very strong.

Table 7.2: Participation in Professional Development Program

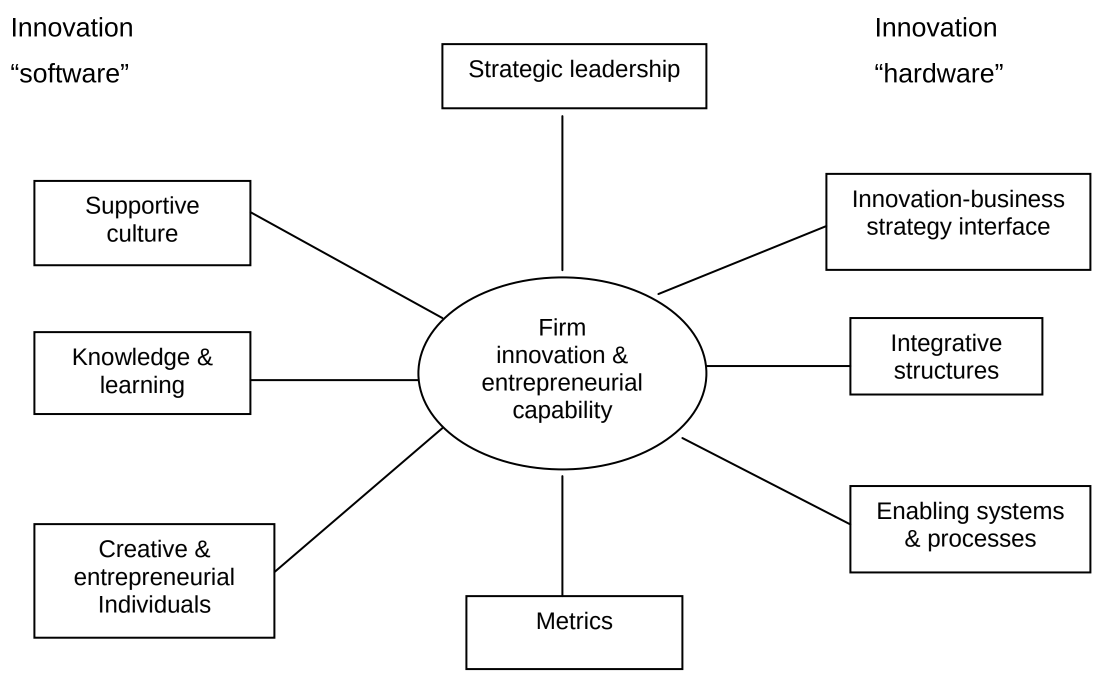
Student/ Graduate Participants	Universities	Firms
2004-05: 19 undergraduates 2005-06: 20 undergraduates 2006: 9 graduates 42 project case studies completed and presented to industry.	NSW: 10 WA: 5 VIC: 7 SA: 2 ACT: 2 TAS: 1 QLD: 7	17 firms with nine engaging more than one student during the two year period.

Based on feedback collected from participants (students, participating firms, universities, mentors) the program has recently undergone a review and will be expanded to capture further benefits from the enhanced industry-university linkages that have been established. There has already been adoption of outcomes of student projects, with firms reporting quantifiable benefits. The 2006-07 program has recently been launched and there is strong support from firms wishing to participate.

7.4.3 Building firm innovation capability (addressing firm capability and adaptive failures)

From the system failure mapping exercise, the category of firm capability failure was identified as a key priority for future intervention by MLA. While a number of initiatives in the past had attempted to address this area (in particular the *Partners in Innovation Program* which involved MLA co-funding innovation projects with individual sites in an attempt to increase awareness and capability in managing innovation), none had been particularly successful. As was discussed in Chapter 5, the following model of firm innovation and entrepreneurial capability was developed for this study based on the literature and analysis of data collected in Cycle 1.

Figure 7.6: Model of firm innovation and entrepreneurial capabilities



Each of the components described in the model are well reported in the literature. However, there appear to be only a few integrated models proposed that have subsequently been applied to research into the design of capability building interventions. One such study was the approach taken by

Cormican and O'Sullivan (2004) in which a best practice model was developed with the aim of facilitating firm capability building in the specific area of product innovation. Similarly, a model of technical innovation capability was developed by Chiesa, Coughlan and Voss (1996) as a basis for designing a technical audit tool to be used by companies in the United Kingdom to improve their technical innovation management processes. For future application within the red meat sector, it was considered that the approaches of these earlier researchers needed to be extended beyond the narrower focus on product and technical innovation to encompass the broader range of innovation and entrepreneurship capability components illustrated in the model.

As intervention in this area would be quite new for MLA, and potentially one which would lead to much greater levels of engagement directly with individual firms, it was considered important to test acceptance of the approach with a number of key industry participants. An introductory workshop was conducted in August 2004 and was attended by 14 industry personnel. Following this, six firms agreed to work with the MLA research team to explore the development of intervention options in this area.

Over the next 18 months, between two and six workshops were conducted at each participating site with specifically established project teams (10-12 participants at each site). At these workshops, the MLA research team presented evolving versions of a proposed intervention approach which included the following elements:

- A series of structured workshops designed to introduce the concept of innovation capability to management and technical staff
- An innovation capability diagnostic process based on an existing on-line survey instrument known as the WAVE™ (Bubner 2001)
- An innovation strategy development process aimed at assisting firms to align innovation projects with broad corporate strategy

- Development of innovation outcome indicators specific to the firm
- Provision of innovation coaching for the CEO and specialist innovation personnel
- Support for the development of a new role within the industry, an Innovation Manager
- The development of an ‘innovation tool kit’ resource
- Direct funding for innovation projects identified as part of the innovation strategy development process

The following quote from the CEO of one of the participating firms illustrates the positive feedback received for this stage of the research:

> *When (our company) was first introduced to this partnership innovations program there was a lot of sceptism (sic) that the program would not provide the sorts of outcomes that would take the business forward. However it is clear that this program has changed the culture and commitment to R&D and innovation within the management team and it is quite profound. I look forward to (our company’s) continued partnership with the MLA and its involvement in the partnership innovations program (CEO, August 2006)*

Based on extensive input from site-based teams, the design of this intervention option is now well advanced. As an indicator of their support, five of the firms have agreed to be actively engaged with MLA in implementing the new approach in the future. In addition, the intervention model has recently been presented at a major industry forum (Raward, AIFST July 2006) and a number of other food companies have expressed interest in participating.

7.4.4 Automation technology strategy (infrastructure, interaction & adaptive failures)

From the interview data collected during Cycle 1, it was apparent that there was significant evidence of system failure in the red meat industry in relation to technology innovation. Given the high cost and high risk of innovation associated with major technology development, the sector was very hesitant about undertaking R&D in this area. Multiple examples of system failure were reported by interviewees including:

- **Infrastructure failures:** lack of alignment between R&D providers and industry; insufficient technology providers and a poor commercialisation history
- **Interaction failures:** limited evidence of collaboration between firms and between firms and technology providers to undertake innovation projects and reduce risk
- **Firm capability failures:** focus on short-term cost-cutting and a failure to understand longer term imperatives for technology innovation; lack of in-house skills to facilitate adoption of new technologies
- **Adaptive failures:** evidence of lock-in to existing technology paradigms and lack of support for capability building in this area

Based on evaluation of the interview data from Cycle 1 and international technology scanning (via internet; visit to trade shows; exchange of information with international S&T providers), the MLA research team developed a new, more comprehensive approach to the development of an integrated automation technology innovation strategy (see Figure 7.7).

Figure 7.7: Automation Technology Innovation Strategy

Strategy Development
- National & international scanning
- Input from international experts (academic and practitioner)
- Detailed process mapping
- Visioning workshops and creation of future scenarios
- Portfolio analysis; risk assessment; ROI analysis

Building Infrastructure
- Identify two new technology providers in Australia & New Zealand and attract to sector (from other industries)
- Secure services of international cobotics expert
- Strategy alignment workshops and re-positioning of existing R&D provider

Industry Engagement
- Visioning workshops with industry R&D committees
- Establishment of industry technology steering committee
- Identify key innovation drivers
- Technology 'tours' by providers to introduce new concepts & tools

Facilitate Interactions
- Establish syndicated innovation projects involving multiple firms
- Facilitate open days and group technology tours (nationally and internationally)
- Support joint international innovation project involving Australian firm, NZ firm and multiple technology providers

Firm Capability
- Appoint experienced project managers and innovation managers on-site
- Develop MLA-firm collaborative innovation strategies to position technology innovation within firms' overall business strategies
- Co-invest in partnership projects on-site
- Implement socio-technical change management initiatives on-site
- Place engineering graduates and undergraduates on-site

Innovation Funding
- Collective industry support from zero to $1 million p.a.
- Commercial innovation partnership agreements > $15 million

As illustrated in Figure 7.7, the more comprehensive approach included the following elements:

- Strategy development (creating new knowledge)
- Building infrastructure (S&T providers; strategy alignment)
- Industry engagement (overcoming adaptive failures)
- Facilitating interaction (between firms; between firms and providers)
- International collaboration
- Firm capability building
- New innovation funding mechanisms

Applying the new intervention approach to the automation technology strategy in the period 2004 to 2006 produced a very significant change. Prior to this approach being implemented, the area of automation technology was perceived to be a major failure for MLA in which virtually no success had been achieved and industry feedback was extremely negative. However, evidence of success following application of the new methodologies include:

- Increase in combined investment by industry and individual commercial partners from zero to > $18 million (with commitments over the next three years secured)
- Successful development and adoption of several new robotic technologies within meat processing firms (robotic y-cut; automated kidney-fat removal; automated six-way cut; automated smallstock primal cut; bladestop)
- Quantified impact in firms following adoption of the new automation technologies including: reduced labour costs; improved OHS; improved yield; reduced turnover; more diverse workforce
- Evidence of positive cultural change in firms implementing new technology based on a socio-technical approach (Axtell et al 2001; Nadin, Waterson & Parker 2001)
- Significant increase in the level of interaction between firms and between firms and technology providers (including international collaboration)

- Broader infrastructure base (new technology commercialisers) to support technology innovation in the future
- Attraction of several mechatronics engineering graduates to the industry
- Positive feedback from industry in relation to the new approach
- Success by MLA in attracting high-calibre engineering staff to work in the program

7.4.5 Evidence of acceptance of the new approach

Based on feedback received at general presentations and the specific input received from the industry project teams established during this phase of the research, the response from industry participants, government representatives, and the MLA board was extremely positive to the proposed new intervention approach. As indicated in Chapter 6, the core purpose of this cycle was to develop an integrated SI-Intervention Framework which would be accepted by industry (and the MLA board) as the basis for MLA's future 5-year *Through Chain Innovation Strategy.*

As several opportunities arose during the cycle for members of the research team to actually test implementation of some of the intervention options, the following data are also presented as early indicators that point to industry acceptance and adoption of the new initiatives:

- The level of investment in MLA's Partnership Program by the meat processing sector doubled in the two year period (2004-2006) from $16 million to $32 million (following a relatively slow growth over the previous five years). The MLA research team credit this accelerated growth to a number of factors including: higher quality projects resulting in faster approval times; wider awareness of the benefits of innovation encouraging more firms to invest; increased level of in-house skills and confidence as firms took advantage of the professional development program; better alignment and interactions between firms and R&D providers. It is noted that a significant proportion of the increased investment came from the six firms participating in the firm innovation capability building initiative.

- Industry investment in the automation technology strategy grew from zero in 2002 to more than $18 million by 2005-06, a clear indication that some of the adaptive failures identified may be starting to resolve.
- Venture capitalists were secured as investors in two new start-ups commercialising innovations in the red meat industry (an industry first for this type of investment). This represents only a very early indicator of a potential to impact on the infrastructure failure identified in relation to finance for innovation. However, the experience has enabled MLA to develop a much greater understanding of the barriers to this type of investment and the requirements for building productive relationships with the VC community. Success in this area is also seen as an early indicator of the emergence of a more entrepreneurial orientation within the industry.
- The Professional Development Program has already attracted participation from 39 students, nine graduates, 17 companies, and 34 universities with a number of graduates offered permanent positions within the industry.
- A strategic R&D alliance was signed between MLA and a counterpart organisation in New Zealand valued at more than $1 million p.a. which provides access to substantial new intellectual property for the red meat industry. This is seen as an early example of the industry now becoming willing to apply concepts of open innovation at a sectoral level, a key dimension to be addressed in the area of interaction failures.
- The automation technology program has provided significant opportunities for individual firms to participate in a range of interaction initiatives through: collaboration with a New Zealand processing company; co-funding a major syndicated R&D program; involvement in a new technology innovation network which includes international study tours, sharing of knowledge and experience, and input into future

industry direction. The willingness of firms to participate collaboratively in this initiative is a first for this industry.

However, not all of the initiatives undertaken during Cycle 2 have achieved this level of success in gaining industry acceptance. Specifically, the intervention options designed to 'engage the regulator' have, as yet, only enjoyed mixed success. During Cycle 2, a number of initiatives were developed to address this area of institutional failure.

One example was the development of science-based recommendations in relation to predictive microbiology and the temperature control of product which is a major food safety issue. This was aimed at reducing the considerable cost impost of existing prescriptive regulations by replacing them with more flexible, outcomes-focused methodologies which maintain equivalence in terms of consumer protection. Within this project, a member of the MLA research team developed a new tool known as the *Refrigeration Index* which has now been widely adopted by industry (resulting in more than $80 million p.a. in cost savings). The tool has also been endorsed by the regulator (AQIS) and has been accepted by the international science community as a major breakthrough. The member of the MLA research team responsible for this initiative has had several papers published in international peer-reviewed journals and has been invited to present at international science conferences.

Unfortunately, the same results could not be achieved in a number of other areas where a similar approach was attempted. One project was in relation to new technology to overcome market access problems in relation to animal welfare. A second was in relation to trialing the application of different water temperatures used in cleaning equipment in an effort to reduce energy costs and alleviate a number of environmental issues. Despite good science in both these instances, the initiatives did not receive support from industry or the regulator and have not been able to be progressed. Based on reflection by the MLA research team, it has been identified that the area of institutional failure is likely to present the team with some of the most difficult hurdles to overcome as:

- The areas impacted by institutional failures generally relate to major issues of trade and market access which can impact on the whole industry and cause significant economic loss. Not surprisingly, there is greater evidence of risk-adverse behaviours in these areas.
- The internal culture of the regulator has been built up over many decades and will not be likely to change in a relatively short period of time.
- The knowledge base and capability within the regulator has been significantly challenged in recent years due to government cost-cutting. This will need to be addressed before they can effectively participate in some of the initiatives being proposed.
- The area of regulation attracts widespread political attention within the industry. Because of this, the MLA research team does not have a clear mandate to operate in this area in isolation from many other actors within the system. This adds considerable complexity to the design of intervention strategies.

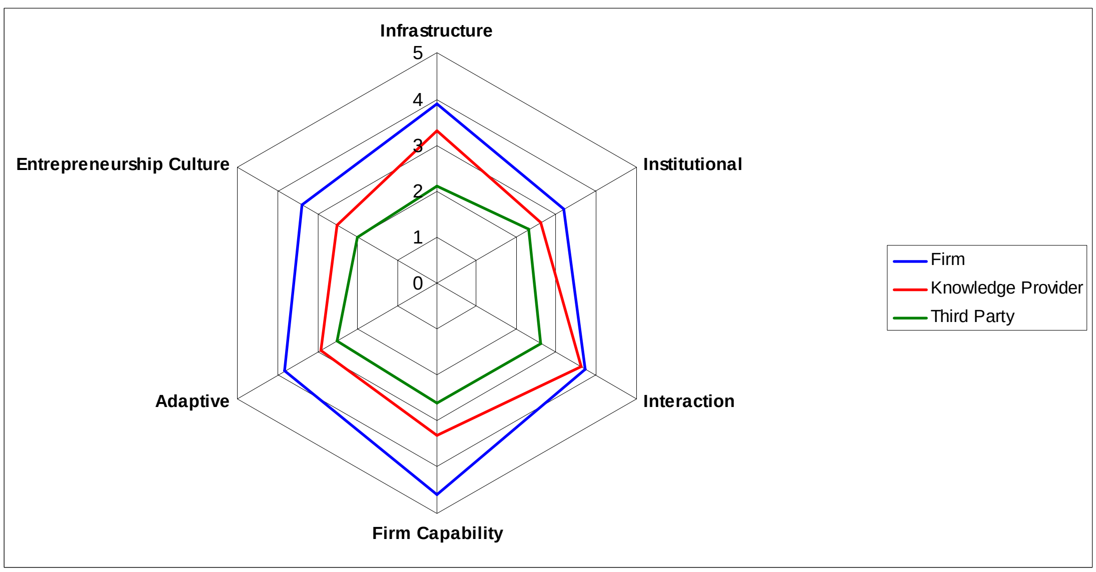
Despite these issues, the MLA research team believes that addressing the area of institutional failures should remain a priority for MLA. However, it is recognised that the design of intervention options will require further effort and consideration.

7.5 Potential for MLA to Impact

An important consideration in determining targets for intervention is that there must be a reasonable expectation that the proposed interventions are likely to have an impact. At the conclusion of this stage of the study, the MLA research team undertook a rating of the potential for MLA to have an impact in relation to the various intervention options based on their experiences and the feedback from industry participants received during Cycle 2.

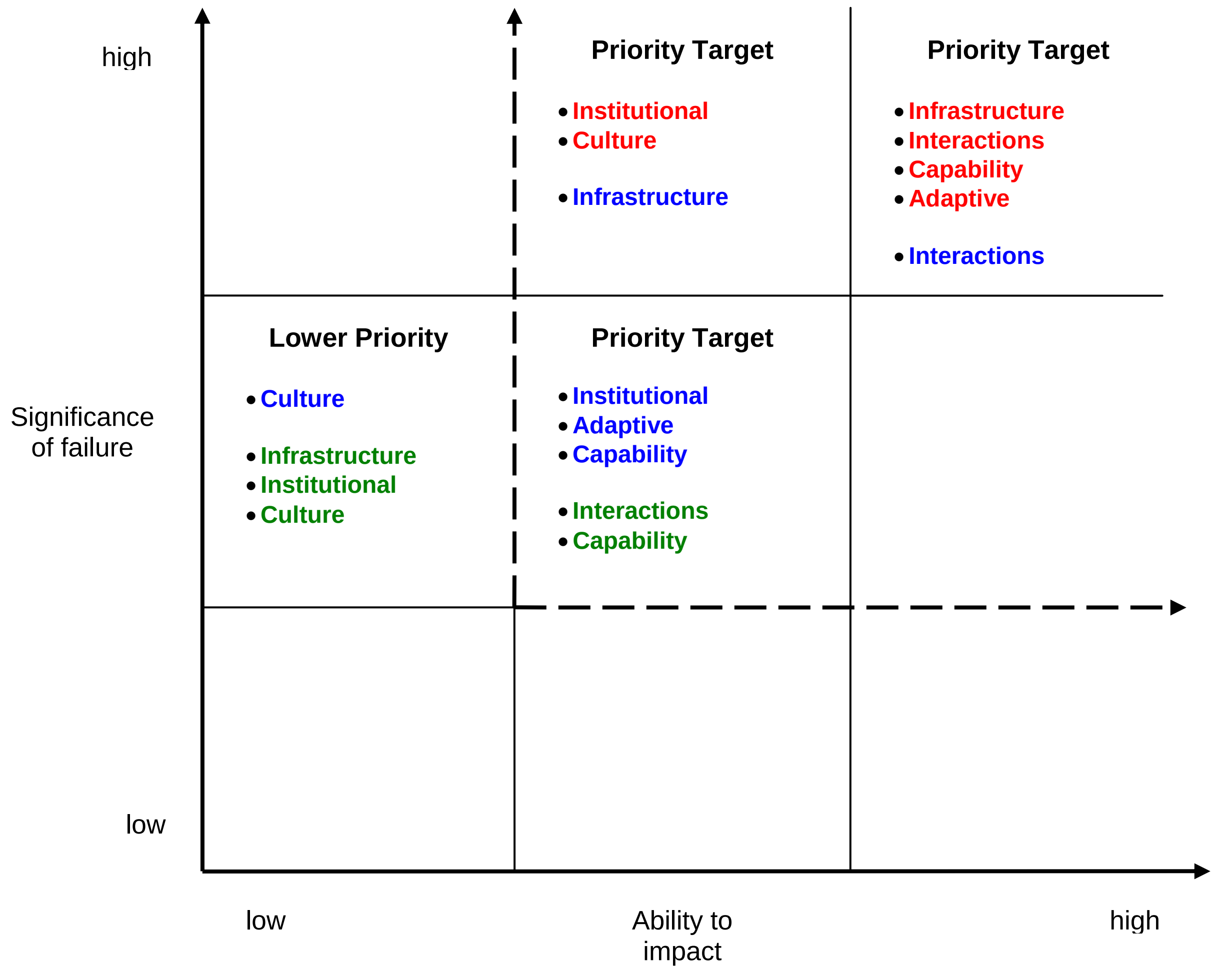
To rate the potential for MLA to impact, the same process was applied as that used for determining the degree of impact on the effectiveness of the red meat industry innovation system of each of the system failure dimensions by each category of actor (see Section 7.3). In this phase of the mapping exercise, a rating of ‘1’ indicated ‘no ability to impact at all’ through to ‘5’ indicating ‘ability to impact: transformational’. The following Figure 7.8 summarises the outcomes of this rating exercise.

Figure 7.8: Potential for MLA to impact



When combined with the degree of impact on the overall effectiveness of the innovation system of individual failure categories (see Figure 7.2) the following priority matrix (Figure 7.9) was developed as the basis for determining the most important areas for developing specific intervention options for inclusion in MLA’s future innovation strategies.

Figure 7.9: Intervention priority matrix



Code

Firms/value chains
Knowledge providers
Third parties

Based on this matrix, the following options were identified as the key targets for future interventions by MLA:

- Building firm innovation and entrepreneurship culture and capabilities
- Developing key firm and provider infrastructure components

- Facilitating interactions between firms; between segments of the value chain segments; and between firms and external knowledge providers such as universities
- Implementing strategies to overcome adaptive failures in firms and providers
- Implementing initiatives to improve the institutional environment for firms in areas where MLA can make an impact

As will be discussed in the following section, these intervention priorities have been incorporated into a new integrated intervention framework that is proposed as the basis for MLA's future 5-year innovation strategy. It is noted that in addition to the new intervention targets, MLA's future strategy would continue to focus on the core role of building the industry's knowledge base via investment in a market-driven R&D portfolio.

In determining the appropriate scope of interventions for MLA, it is important to note that MLA occupies a relatively unique position in terms of policy implementation through straddling both the public and private spheres. MLA is an industry owned company which attracts commercial investment but also has access to substantial Federal Government funds via a Deed of Agreement. As such, MLA is identified as a key policy instrument in the government's innovation agenda. This role enables MLA to perform an important integration and transition function which creates flexibility and the agility to respond quickly as the industry's innovation system evolves. As noted by Edquist et al (2004), innovation systems are not static. It is considered that the ability to rapidly adapt intervention strategies to meet changing sectoral system requirements has the potential to confer greater competitive advantage compared to the less responsive traditional policy instruments that currently characterise most national innovation systems. As will be discussed in Chapter 8, it is proposed that the model developed in this study provides valuable insights and benefits which could usefully be replicated and tested in other sectors.

7.6 An Integrated SI-Intervention Framework

The core purpose of this research study was to design an integrated innovation intervention strategy which would assist the Australian red meat sector to improve its overall global competitiveness. As noted in the earlier discussions, intervention strategies must be comprehensive, efficient and cost-effective and they must be focused on the broad range of areas where problems are having the greatest impact but also in areas where interventions are most likely to succeed (Edquist et al 2004). In addition, clear impact objectives must be able to be articulated and measured. Woolthuis, Lankhuizen and Gilsing (2005) note that problems in the innovation system generally relate to complex issues affecting many actors. Solutions are therefore unlikely to be found in narrow, one-dimensional approaches.

From the insights derived from undertaking this research study (reflection on past practice; literature review; data analyses; and reflection undertaken during the two major research cycles) the following 10 key principles for the design of an integrated SI-Intervention Framework are proposed:

Principle #1: The overall purpose of the innovation system should be defined (Edquist et al 2004; Lundvall & Borras 1999; OECD 2000).

Principle #2: The intervention framework must be based on a comprehensive understanding of the sector's innovation and entrepreneurship system (see conceptual framework in Chapter 5).

Principle #3: The intervention strategy must address areas where significant problems have been identified within the system (see system failure analytical framework developed for this study in Chapter 6).

Principle #4: The intervention strategy should be based on a comprehensive approach to change which provides multiple options at the whole systems level rather than a piecemeal approach comprised of *ad hoc*, narrowly-based initiatives (Woolthuis, Lankhuizen and Gilsing 2005).

Principle #5: Industry engagement and participation in identifying intervention options is an important design criterion (see action research cycles undertaken in this study).

Principle #6: There must be a reasonable expectation that the proposed interventions are likely to have an impact (see assessment in Section 7.5).

Principle #7: Clear objectives and measures for the intervention strategies should be articulated in order to facilitate ongoing review and reframing of the strategy (see Section 6.3 for a discussion of qualitative and quantitative indicators).

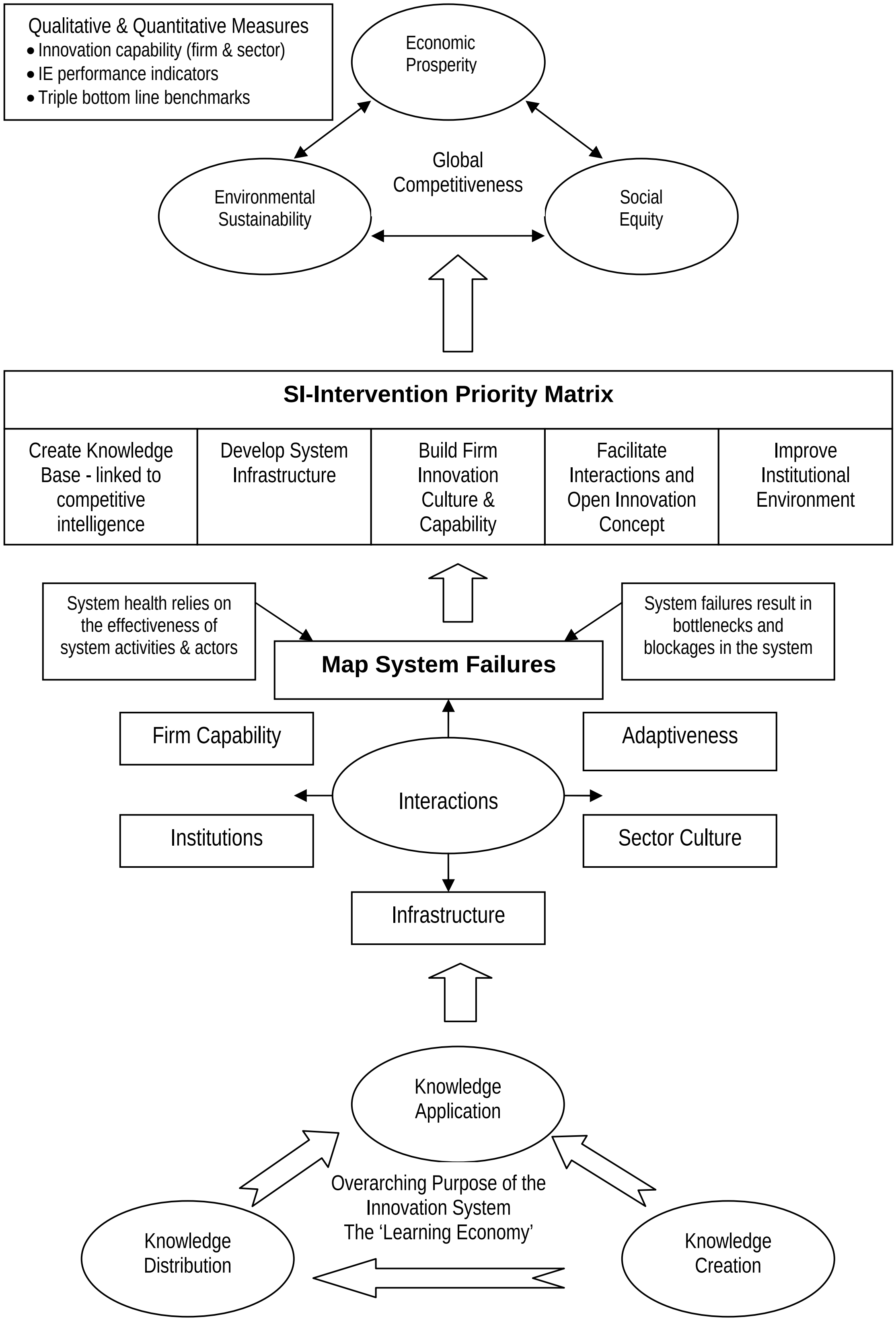
Principle #8: A holistic socio-technical perspective which encompasses people, technology and the organisation should be incorporated into the overall design of any intervention (based on insights from previous attempts at change and discussed in Chapter 2).

Principle #9: A multi-level approach should be adopted which includes interventions focused on: developing people; building firm capability; and intervening at the overall sector level (see Figure 7.4).

Principle #10: Capabilities of the intervention agency must be aligned to the complexities of the innovation system in order to meet changing industry requirements (Hofer & Polt 1998; Scott-Kemmis et al 2005; Smith, K. 1998).

Based on these principles, a new integrated innovation intervention framework is proposed for application within the red meat sector (see Figure 7.10).

Figure 7.10: Integrated SI-Intervention Framework



As can be seen in the diagram, the overarching purpose of the sectoral innovation system is defined as encompassing: knowledge creation; knowledge distribution; and knowledge application with the core objective of increasing the sector's global competitiveness. Measures of impact in relation to the effectiveness of the innovation system in achieving this objective are presented as a hierarchy of qualitative and quantitative indicators ranging from:

Innovation capability measures: at both the level of the firm (utilising innovation capability diagnostic tools) and the sector level (a sectoral diagnostic based on the system failure analytical model)

Innovation & entrepreneurship performance indicators: based on defined industry priorities (which may vary over time) and including a range of macro, meso and micro level indicators such as: commercialisation and adoption of R&D; R&D expenditure; successful change management initiatives; cost savings from R&D projects; launch of new products; reduced compliance costs; entry to new domains; new business models; and industry transformation.

Triple bottom line benchmarks: in the core areas that contribute to long term global competitiveness including: economic prosperity and profitability; environmental sustainability; social equity and meeting community expectations.

As indicated in the diagram and discussed in detail in this chapter, interventions can then be developed which address specific areas of system failure in order to build capability within the system.

7.7 Building Internal Capability Within MLA

As was discussed briefly in the opening chapter, the organisational context for this research study was a specific division of MLA responsible for implementing a whole-of-industry innovation program of which I am the general manager. In undertaking this study, I formed a research team comprised additionally of a group of seven senior MLA innovation managers from my division. At commencement of the study in early 2002, the division employed a total of 12 professional staff who were responsible for managing a portfolio of innovation programs with a total budget of approximately $23 million. By mid 2006 when this research study was completed, the number of employees in the division had grown to 26 with an active portfolio in excess of $82 million.

Action research, by its very nature and purpose to improve practice, is conducted within a real world setting. This presents action researchers with specific challenges and constraints, but also with unique opportunities to understand complex social phenomenon and to explore and understand the new competencies that will be required to embed change into an organisation. This study was undertaken in a real world setting and therefore had to be conducted within the constraints of: existing priorities; existing skill sets (which were modified and enhanced during the course of the research); existing budgets (which grew rapidly as a result of the research); and with existing expectations from stakeholders regarding what the team should be focusing on (which often slowed the research). However, at the same time, the real world context also ensured that the team who would subsequently be responsible for implementing the outcomes of the research was provided with opportunities to learn during the research phase. This also assisted me to better understand the competencies required of an innovation intervention agency implementing the more complex innovation systems approach.

As was the case in designing the intervention options that were targeted at the industry sector, the MLA research team also undertook an analysis of needs in relation to MLA's current capabilities and followed with an extensive development process where gaps were identified. In broad terms, the following five areas were identified by the research team as requiring modification or development internally within MLA:

- MLA would need to develop methodologies and capabilities to better understand the external environment in which innovation programs were seeking to impact
- Program managers would require tools to assist them to conceptualise their programs within a broader innovation systems context as compared with the much narrower perspective of seeing innovation programs purely as a vehicle to create new knowledge through investments in R&D
- New approaches to measuring the ‘health’ of the sectoral innovation system would need to be developed, as well as performance indicators to assess the impact of the new approach
- Internal capabilities would need to be developed to implement the new innovation intervention service model
- More flexible organisational structures and processes would be required to assist program managers to deal with the complexity of the new innovation systems approach

A number of specific approaches related to building MLA internal capabilities were subsequently incorporated into the intervention model (see Figure 7.4) and are described briefly in the following sections. Where appropriate, the new approaches were trialed for acceptance internally within MLA as it was clear that implementation in the future would require widespread acceptance of MLA program management staff.

7.7.1 Competitive intelligence (CI) capability

Fundamental to the development of innovation strategies (at both industry and firm level) is the need to understand and capitalise on opportunities and threats posed by developments in the external environment (or ‘markets’ as described in the conceptual framework developed for this study). The research team identified that MLA collects and collates a significant amount of information concerning the external environment. In relation to the development of innovation strategies the team considered the approach to be fragmented and *ad hoc*. Based on a review of the literature, it was identified that an approach termed *competitive intelligence* would be the most appropriate to meet MLA's needs in this area in the future (Fleisher & Bensoussan 2003). Fleisher and Bensoussan (2003, p.6) define competitive intelligence as, "a systematic process or cycle for collecting and analysing information about competitors' activities, one's own business environment and business trends to further one's own organisational goals." With the assistance of an external expert, the MLA research team undertook a review of MLA's competitive intelligence capabilities. Data were collected based on ten face-to-face interviews with a group of senior MLA managers undertaken by the consultant. The purpose of the review was to explore the following questions:

- What are the sources of information that MLA currently has available – and what additional data collection/analyses should be implemented?
- What strategic thinking/CI tools should be applied to 'value add' the information to transform it into intelligence/knowledge and how can these skills be developed in-house to an appropriate level?
- How can MLA integrate this value-added intelligence into the development of innovation strategies and create stronger linkages with marketing strategies?

Following analysis of the interview data, the research team developed a suite of recommendations and a CI-framework for further development (see Box 7.1).

Box 7.1: Competitive intelligence framework

Consumers – trends; paradoxes eg bio-innovation
Customers – who will they be; what will they look/behave like eg global retailers; food service
Competitors – who are they; what are their innovation strategies; are we trying to beat them at their own game and/or find different bases for competitive advantage
Community – regulators; market access; emerging community concerns eg environment; animal welfare
Technological trajectories – scanning; convergence; where will the opportunities come from
Industry evolution & trends – what will it look like in the future eg livestock; value chains; rationalisation
Social trends – changing demographics; labour force; marketing trends

These recommendations have now been adopted by MLA as a *Critical Success Factor* in 2006-07, and a cross-business project team has been established to implement the recommendations. It is anticipated that in the future, this approach will be embedded in MLA strategies and programs as indicated in the SI-intervention priority matrix illustrated in Figure 7.10.

7.7.2 Program Excellence

Following completion of Cycle 1, it became obvious to the MLA research team that a fundamentally new approach to the conceptualisation of an 'MLA innovation program' was required. Prior to commencement of this research study, MLA innovation programs could be characterised as primarily a collection of R&D projects aimed at addressing an identified industry need for new knowledge. Program strategy depended predominantly on the ability of MLA program managers to design R&D projects and source external R&D providers to create the new knowledge. Based on the significantly more complex conceptual framework developed in Cycle 1 (and described in Chapter 5), it was obvious that a new model would be required to guide program managers in the future. The research team undertook a review of existing program models and developed a new systems-based approach titled *Program Excellence* (MLA September 2004). Underpinning the new approach was the concept of the innovation cycle (based on an action research methodology) which was represented as a series of interventions and responses, or actions and results (see Figure 7.11). Based on this model, the actions or processes undertaken by a program were expanded to include:

- Strategy development: based on scanning including: competitor analysis; scenarios and futures planning; industry consultation; international alliances; market and consumer research; links to government policy makers; leading edge planning techniques including portfolio and cost-benefit analysis; multiple funding mechanisms and business development.
- Delivery of program outcomes via: best practice innovation processes; detailed program implementation plans; project management systems; accelerated product and technology development tools; innovation 'value-chain' process model including links to suppliers.
- Development of innovation capability within industry including: firm and value-chain capability; innovation coaching; knowledge management; application of action research methodologies; innovation partnerships and development of collaborative innovation strategies.
- Evaluation of program achievements such as: delivery of industry impact via adoption and commercialisation services; dissemination and communication; change management; demonstration projects; outcomes reporting; new program impact evaluation methodologies.

The reactions or outcomes of the program were seen as:

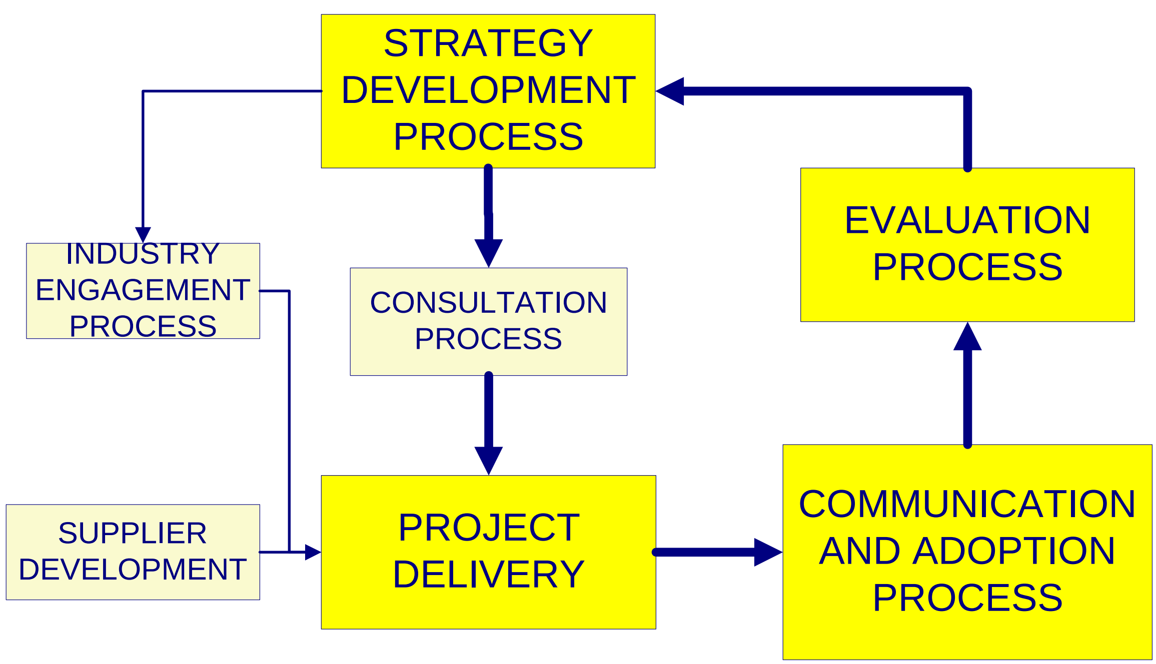
- R&D investment by stakeholders
- Adoption of innovations by firms or value chains
- Effective implementation (diffusion) broadly within the sector
- Quantifiable impact

Figure 7.11: Innovation cycle

Source: Program Management at MLA 2004

To support implementation of the Program Excellence framework, a new model of program management was also developed (see Figure 7.12).

Figure 7.12: Program management tasks



Source: Program Management at MLA 2004

The new program management model was based on the constructs underpinning innovation systems theory. Specifically it addressed:

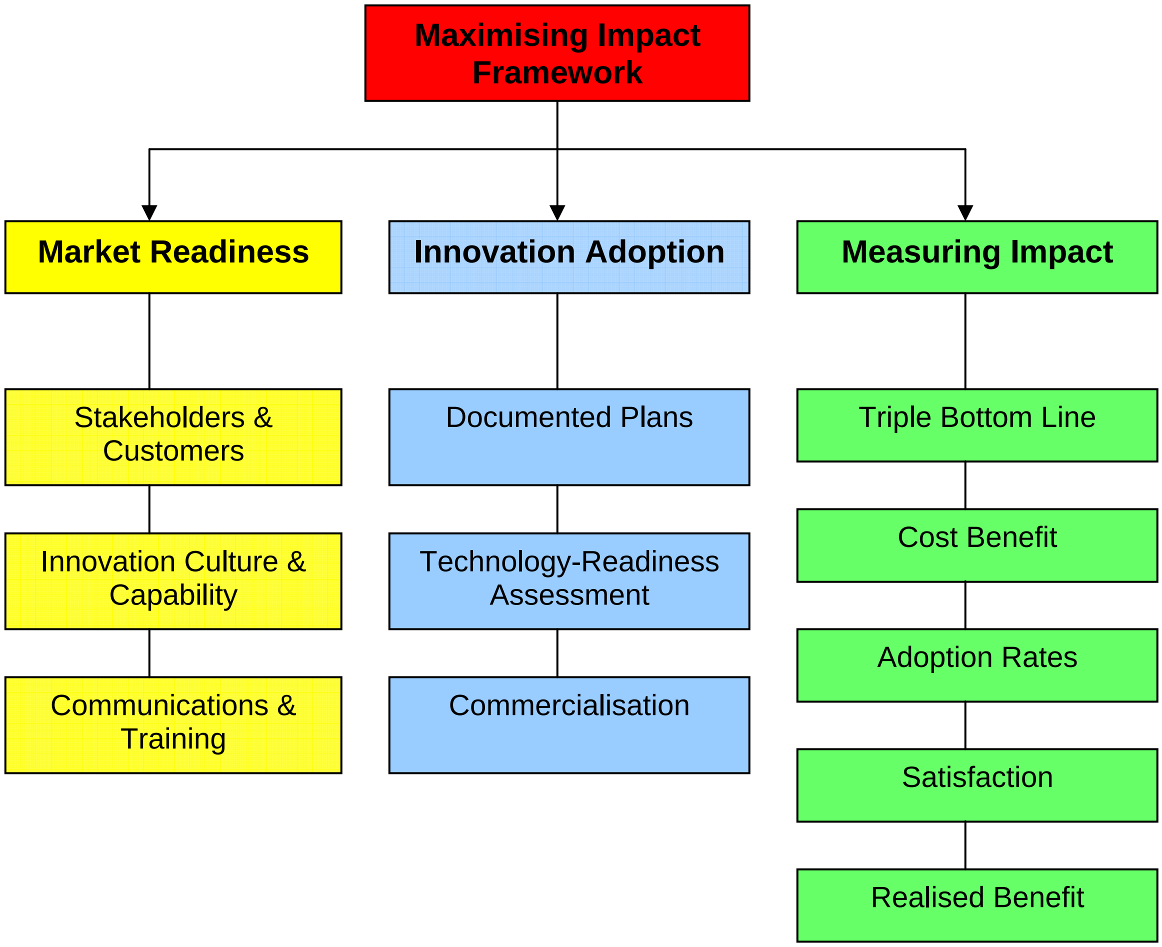
- Key system elements and processes such as the impact of markets in the strategy development process
- Science and technology resource base and a supplier development initiative
- Distribution of new knowledge via interactions between actors through enhanced communication and adoption processes
- The impact of sector culture and firm capability and the importance of industry engagement processes

The program implementation model embodied in the new framework (the 'innovation cycle') was based on an action research approach which is acknowledged in the literature as providing a strong theoretical and methodological grounding for dealing with complex, non-linear systems (Phelps & Hase 2002). The Program Excellence framework now forms the basis of innovation program design and evaluation at MLA and also the evaluation of program manager performance.

7.7.3 Maximising Impact Framework

Fundamental to achieving impact from the creation of new knowledge are the processes that ensure knowledge is distributed in a timely manner and that effective commercialisation strategies are in place. Based on the innovation cycle developed within the Program Excellence framework, the research team also identified the need to build MLA's capability in relation to knowledge dissemination and facilitating innovation adoption. The '*Maximising Impact Framework'* was developed and is depicted in Figure 7.13.

Figure 7.13: Maximising Impact Framework



Source: MLA submission to inquiry into pathways to technological innovation May 2005

As can be seen, this framework involves a three-pronged strategy that is progressively implemented during the life of an innovation cycle as follows:

- **Market readiness:** a series of interventions which ensure that the industry target markets for innovations are advised of the opportunities in a timely manner and are provided with support to build their capability to adopt (includes the firm innovation capability building initiative described in Section 7.4.3).
- **Innovation adoption:** a disciplined approach applied by MLA to planning and implementing adoption and commercialisation strategies which

includes building infrastructure capabilities in the science and technology infrastructure base.

- **Measuring impact:** a range of new methodologies developed to measure the effectiveness of MLA programs which includes the qualitative and quantitative indicators referred to in Section 7.6.

The Maximising Impact Framework is underpinned by the theoretical components of the system failure analytical model discussed in Chapter 6 in relation to: firm innovation capability; infrastructure components in relation to science and technology providers; and interaction between firms, and between firms and external knowledge providers. The approach has been fully embraced by MLA and was included in a submission to the Commonwealth government's *Inquiry into pathways to technological innovation* (MLA May 2005).

7.7.4 Management model based on creativity and leadership

Finally, in response to the increased level of complexity that program managers will be required to deal with in the future, it was determined that new models of management and leadership would also be required. The research team undertook a series of internal reviews which resulted in the design and implementation of a new leadership paradigm for the division referred to as '*A New Model for Leadership and Creativity'* (Raward 2003; revised 2005*).*

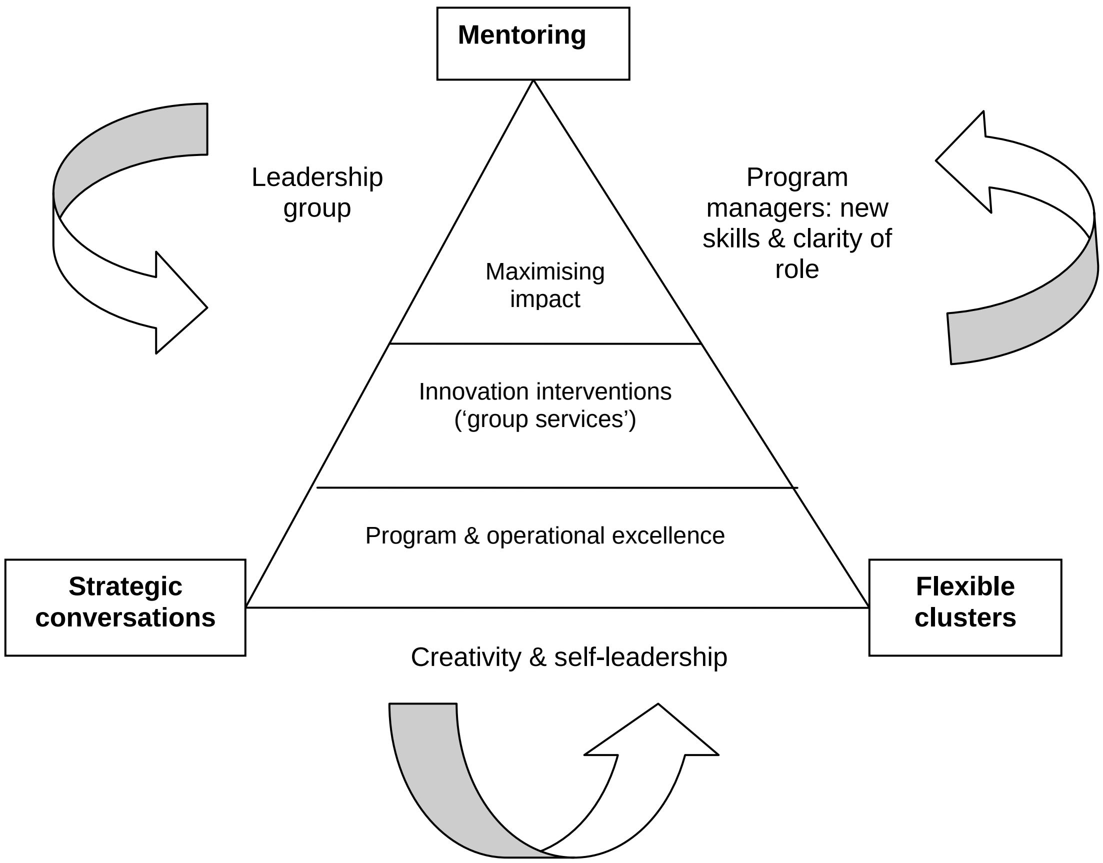
The core components of the new leadership model include:

- Enhancing innovation and creativity within the division via extensive training and skills development initiatives
- Introducing new skill sets and positions into the division to complement existing program manager roles. A new section within the division known as 'Group Services' has been formed.

- Assisting program managers to understand and deal with complexity via a new flexible mentoring model which replaced the previous hierarchical structure
- Introducing a range of action research approaches to the implementation of innovation programs to enable program managers to respond to unpredictable and unexpected outcomes
- Building individual strengths within a more supportive team environment and introducing the concept of ‘strategic conversations’ as a basis for shared reflection and learning (based on work by Bennett & Brown 1995)
- Ensuring clarity of goals and individual accountabilities via new performance management and competency assessment tools
- Growing program manager leadership capabilities while maintaining their access to a pool of collective wisdom and experience (the mentoring group which is known as the ‘Leadership Group’)

The division was restructured around three organisational concepts as illustrated in Figure 7.14. The model was based on the belief that the MLA innovation division already possessed the capacity to adapt to the changes likely to be required by the new innovation services model as it evolved. However, to ‘unlock’ this capacity required team members to be exposed to new ways of thinking and working, and they would need to develop new reflective skills to uncover their learning (Kofman & Senge 1993).

Figure 7.14: New divisional structure and management processes



Source: Raward (MLA) 2003; 2005

It was determined that the way in which the MLA innovation division will need to operate in the future should be based on an understanding of the fundamentals of complexity theory which acknowledges that when change in complex social systems is being attempted, results are often uncertain and unpredictable (Eve, Horsfall & Lee 1997). To cope with this level of complexity, program managers must embrace new (to them) concepts of systems theory, change management and action research. At the same time, the parent organisation (in this case the MLA innovation division) will also need to develop a flexible and responsive support infrastructure as it is possible that program managers will respond to the new levels of complexity in highly unpredictable ways themselves. A condition of 'complexity fatigue' has in fact been identified in the program managers engaged in this research study.

7.8 Summary

The integrated *SI-Intervention Framework* (Figure 7.10) described in this chapter represents the culmination of the research study. To arrive at the final model, a methodology was developed to evaluate the potential effectiveness of the red meat sector's innovation system. The methodology was based on the concept of system failures and underpinned by a comprehensive understanding of the sector's innovation and entrepreneurship system. A 'map' of the sector's innovation system was constructed by applying evaluation data from Cycle 1 to an analytical model comprised of six categories of system failure. Analysis of the potential impact of system failures on sector performance led to the development of a range of intervention options aimed at building sector innovation capability and ultimately improving sector global competitiveness. A series of intervention projects were tested for acceptance and potential impact via engagement with industry participants. Evidence of support and/or impact was based on:

- Positive feedback from participants
- Agreement by industry to future participation
- Actual adoption and impact

Finally, the intervention model was further refined to incorporate an intervention priority matrix which was determined by the capacity of the intervention agency (in this case MLA) to make an impact. As this new SI-Intervention Framework represents a substantially expanded role for MLA, it was also necessary to develop and trial a range of internal capability building initiatives during the study.

CHAPTER 8

CONCLUDING THE STUDY: A PERSONAL REFLECTION

Finding an appropriate point at which to conclude this thesis has been challenging as ‘conclusion’ implies that a point of finality or certainty has been arrived at. It will be clear to the reader that this is not the case and, as noted by Phelps (2002, p.198), “the notion of conclusion is, in itself, incongruous with the nature of action research”.

This research study was borne out of my strongly held belief that there existed a significant opportunity for MLA to improve the long term competitiveness and sustainability of the red meat industry. This seemed to depend on successfully building innovation capabilities within firms and facilitating the emergence of a much stronger culture of innovation and entrepreneurship across the industry. Underpinning my belief was a level of frustration at the relatively slow progress being achieved through application of ‘best practice’ R&D management (the dominant paradigm in the early years of MLA). In addition, I had concerns regarding the long term viability of the industry if it was unable to adapt to the challenges of a rapidly changing and complex environment.

At the commencement of this study I was optimistic enough to believe that MLA was in a unique position to make a difference. As an organisation that straddles both the government and industry spheres, MLA has a clear mandate to operate in the innovation and entrepreneurship domain. The company possesses a level of resources and capability that positions it to adopt a strong leadership position in this regard. Due to my previous experiences as a change management practitioner in the industry, I also knew that innovation and change are perceived as being difficult, high risk, and often beset by many setbacks and failures.

I was therefore realistic about the chances of bringing about a major transformation in an industry that is characterised by deeply entrenched traditional views and which has enjoyed considerable commercial success by focusing on what has worked in the past. When I commenced this study in 2002, I set myself a four year timeframe for 'completion'. However, I realised that ultimately this thesis would simply represent a 'snapshot' of a particular phase in the evolution of MLA's journey of 'leading innovation and entrepreneurship in the Australian red meat industry'.

This chapter is therefore not presented as a conclusion in the traditional sense, but rather as a synthesis of the point at which MLA has arrived so far. I am confident that the action research methodology is now strongly embedded in MLA's *modus operandi* and I anticipate that the processes of *planning, action, learning* and *reflection* will continue.

In these final sections I will endeavour to provide the reader with a sense of 'closure' by:

- Revisiting the central research questions that this study has set out to address and postulate whether meaningful insights have been achieved.
- Identifying a number of areas in which, I propose, the study has made a contribution: to knowledge as a result of the learning achieved; to theoretical methods which may be of value to researchers that follow; and to improved practice both for MLA and potentially more broadly within the food and agricultural innovation systems policy arena.
- Suggesting areas for future research and implementation of the outcomes of the study.

8.1 Revisiting the Central Research Questions

As indicated in the opening chapter, in 2002 I was concerned that MLA's approach to implementing innovation strategy was predominantly *ad hoc* and fragmented as we struggled to rebuild relationships following a period of highly politicised restructuring. It was obvious that the industry culture was not generally supportive of innovation and that there was a lack of innovation skills within the industry. Similarly, the innovation infrastructure in relation to alignment of R&D providers and the availability of adequate commercialisation skills was also clearly inadequate. I believed that there was an opportunity for MLA to respond to these concerns by developing:

- A better understanding of the environment in which the red meat industry was operating and of how the innovation system could be supported to deliver greater impact
- A model of firm innovation capability that would assist MLA to more effectively deliver change management and innovation services
- A whole-of-industry innovation strategy that would capture opportunities to improve industry competitiveness and sustainability and would ensure the industry was equipped to face the challenges of a rapidly changing competitive environment
- A range of theoretically robust methodologies that would assist MLA to enhance internal capabilities in order to more effectively lead innovation and entrepreneurship in the red meat industry

Based on these thematic concerns and a preliminary review of the innovation literature I developed an early version of a conceptual framework. I defined the central research question to be addressed by the study as follows:

> **How should MLA design and deliver interventions that will significantly enhance the innovation capabilities of the Australian**

red meat industry in order to sustain competitive advantage in a rapidly changing environment?

To support exploration of this research question, I added the following three supplementary research questions to the task:

How can the concept of firm innovation capability be expressed in the context of the red meat industry?

What are the key contextual issues impacting on the level and success of innovation initiatives in the red meat industry?

What skills, strategies and structures will MLA require to deliver the new innovation intervention services?

Following a detailed review of the historical context in which innovation had been undertaken in the industry and a reflection on past attempts at change, I identified that the collaborative and participatory approach embodied in action research methodologies would be the most appropriate to the development of MLA's proposed intervention framework.

It will be recalled that the research study was conducted over the period 2002-2006 and consisted of two major research cycles (at the macro level) with multiple 'cycles within cycles' (at the micro level of individual activities and interventions) embedded within the overall research design. Cycle 1 consisted of a detailed stakeholder analysis with industry knowledge and participation captured via 28 in-depth interviews using a convergent interviewing methodology (Dick 1998). An extended review of the literature in the areas of *innovation systems theory* and *strategic entrepreneurship* was combined with a systematic iterative triangulation methodology adapted from the work of Lewis (1998). This resulted in a substantially revised conceptual framework of the sector's innovation and entrepreneurship system and an associated model of firm innovation and entrepreneurial capability. The outcomes of Cycle 1 served to address the first two supplementary research questions and provided a strong theoretical basis upon which the second major research cycle could be developed.

During the first research cycle, the foundations of the study's participatory approach were also established with the formation of the MLA research team. My close relationship with the research team permitted me to observe first hand the demands that the new approaches being developed in this study would have on the skills and capabilities required by MLA. This provided me with an initial basis upon which to address the third supplementary research question.

During the second major research cycle, I identified two emerging areas in the literature: firstly in relation to the concept of *mapping the effectiveness of an innovation system*; and secondly the concept of *system failures* and its application to the design of innovation policy and interventions. Building on the work of previous researchers (Chaminade & Edquist 2005; Woolthuis, Lankhuizen & Gilsing 2005) I developed an analytical framework based on six areas of potential system failure. In collaboration with the MLA research team, a mapping exercise was undertaken from which I identified that system failure is evident in the red meat industry's innovation system. Based on this new methodology, we progressively constructed a new *SI-Intervention Framework* and developed a suite of intervention projects. These interventions were tested for acceptance and potential impact via multiple engagements with industry participants.

Building on the learning from this action phase of the cycle, I subsequently developed a methodology for applying the framework which is based on 10 key design principles. It is proposed that the framework (see figure 7.10) demonstrates how interventions, which are based on identified system failures, will enhance the effectiveness of the relationship between the core purpose of the innovation system and the achievement of global competitiveness.

Finally, a number of specific activities undertaken in Cycle 2 also sought to address the third supplementary research question of identifying the skills, strategies and structures that MLA will require to deliver the new innovation intervention services. Following a review by the MLA research team, a number of priorities were identified for building MLA capability to deliver the new approach and these are described in Chapter 7. Essentially it was determined that MLA will need to develop a flexible and responsive internal infrastructure which acknowledges that when change in complex social systems is being attempted, then results may be uncertain and unpredictable.

Following a period of reflection at the end of the second research cycle, I realised that I had reached a point where I could reasonably complete this thesis. The new SI-Intervention Framework explicitly addresses the principal research question of how MLA should design an integrated innovation intervention strategy to assist the red meat sector to improve its overall global competitiveness. I had also developed an understanding of the challenges that MLA would face in implementing the new approach. Together with the MLA research team we had designed and implemented a suite of capability building initiatives that we believed equipped MLA with the skills, strategies and structures required to support delivery of the new approach. In addition, the conceptual models developed at the conclusion of the first research cycle provided a basis for understanding the key contextual issues impacting on the sector's innovation system and of the components that comprise innovation capability at the level of the firm.

In revisiting the central research questions I therefore propose that meaningful insights have been achieved and that the findings of this study will provide MLA with robust and defendable models and methodologies upon which to develop future intervention strategies.

8.2 Contributions to Knowledge

As is the case with the majority of action research projects, this study was clearly undertaken with a dual purpose: action to improve practice in the workplace; and research as a contribution to learning and the development of new insights. I propose that the study has achieved a degree of success in both of these areas and the following discussion is presented in support of this claim.

8.2.1 Convergence of innovation and entrepreneurship literature

This thesis has identified a growing body of literature (both theoretical and empirical) that provides evidence of the nature and importance of both innovation and entrepreneurship to the long term competitiveness and sustainability of firms and whole industry sectors (Bryant 1998; Chandler, Keller & Lyon 2000; Dodgson & Bessant 1996; Hamel 2002; Lee & Peterson 2000; Lin 2001; Lumpkin & Dess 1996; Zahra, Kuratko & Jennings 1999). However, there is also considerable evidence in the literature to suggest that both scholars and practitioners alike have found the understanding of innovation and entrepreneurship to be problematic. Thus there remain significant levels of concern among researchers regarding the efficacy and value of much of the work to date (Hindle 2002; Van de Ven et al 1999; Wolfe 1994).

From the discussion provided in this thesis, it is apparent that there are many areas of potential overlap in the study of innovation and the study of entrepreneurship. Despite this, the benefits of convergence in these seemingly closely related fields have largely been ignored in the literature and there is almost no evidence of cross-referencing in the two bodies of work. Brazeal and Herbert (1999) and Covin and Miles (1999) identified that the study of the two fields would benefit from higher levels of convergence.

Based on a comparative review of the literature from both domains (see Chapter 5), in this study I explicitly linked the concepts of innovation and entrepreneurship culminating in the development of a conceptual framework of a *Sectoral Innovation and Entrepreneurship System* (Figure 5.5) and a supporting model of *Firm Innovation and Entrepreneurial Capabilities* (Figure 5.3). The various components included in the framework and the models are well supported by the literature. However, there appear to be only a few integrated models that have been reported specifically for the purpose of designing capability building interventions. The integrated and comprehensive models I have developed in this study incorporate multiple elements and concepts from diverse perspectives in a novel way. I propose that this approach provides a more solid basis for analysing a sector's innovation system and represents an advance on the narrower perspectives that characterise current innovation policies.

As noted by Hindle (2002), it is only when a firm's innovation capability is effectively deployed via the transformational processes embodied in the concept of corporate entrepreneurship that true value creation and competitiveness are achieved. At the industry level this study has also demonstrated that the theoretical concepts embodied in the innovation systems literature (Malerba 2002, 2004) include many areas of potential overlap with those espoused in the strategic entrepreneurship domain (Johnson & Van de Ven 2002; Lee & Paterson 2000; Shane & Venkataram 2000). At the level of the industry sector, this study has proposed that the over-riding sector culture will determine the degree to which firms in the industry exhibit an entrepreneurial orientation. This in turn will impact on how problems and opportunities arising from challenges in the external environment are perceived by the sector, and on how innovation options are developed within the sector's innovation strategy. At the sector level, it is the level of entrepreneurial orientation within firms combined with the adoption of innovation options that ultimately determine the degree to which the sector will be able to transform itself to achieve the desired level of global competitiveness.

By converging the two fields of innovation and entrepreneurship into a single conceptual framework, I submit that the approaches developed in this study will assist future researchers to develop a more comprehensive understanding of the elements within a sectoral innovation system that must be addressed. This approach will be of particular relevance to practitioners attempting to intervene and change system dynamics and improve competitive performance. The value of this research study was reinforced when the outcomes were presented to more than 60 innovation practitioners in the food industry and they acknowledged that the models developed offer a tangible contribution to the field.

8.2.2 New theoretical and analytical models

There have been significant advances in recent years in the development of the new systems approach to the study of innovation and entrepreneurship. However, in this study I identified that there is very little theoretical or practical information to inform policy development or intervention strategies in this area (Edquist et al 2004; Hindle 2002; Metcalfe 1995; Scott-Kemmis et al 2005; Smith, K. 1998). As noted by Edquist et al (2004, p.427), "From a policy viewpoint the results are disappointing. No simple and obvious formula for reliably achieving success in promoting or fostering innovation has emerged." Smith (Smith, K. 1998) believes that the task of conceptualising the appropriate rationales for policy intervention is an important one for consideration by researchers.

There are areas in the literature which have emerged in recent years which attempt to address these concerns: firstly in relation to the concept of ‘mapping’ the effectiveness of an innovation system; and secondly the concept of system failures and its application to the design of innovation policy and interventions. However it has been acknowledged that these areas are also still in their infancy and there are significant opportunities for researchers to develop new concepts and theoretical perspectives.

As noted in a recent innovation mapping study undertaken in Australia (Commonwealth of Australia 2003, p.41), “There is no definitive consensus on the details of the map, and probably no general agreement on methods.” The Commonwealth study proposed that there is an opportunity for future research to be undertaken to extend the mapping methodology to become the basis for developing policy and interventions. Similarly, Woolthuis, Lanzhuizen and Gilsing (2005, p.618) note that, “The current (innovation systems) approach still under-exploits its potential to provide practical guidelines and/or rationales for policy makers”. In their conclusion, these researchers identified that there remain significant opportunities to improve and extend the approach through further study. Specifically, research could be undertaken to test the application in practice as a tool to analyse system failure and to design and evaluate intervention measures.

Thus, this thesis makes a contribution to the field in a number of areas. Firstly, I have proposed a new system failure analytical framework which is comprised of six categories of innovation system failure with a further typology of 24 dimensions within these categories. The analytical framework is closely aligned to and builds on the work of previous researchers (Chaminade & Edquist 2005; Woolthuis, Lanzhuizen & Gilsing 2005) and includes additional elements derived from the evaluation of results from this study.

Secondly, a preliminary methodology for determining evidence of system failure has also been developed in this study. In the literature review only one article could be located that explicitly discussed using qualitative data to evaluate success of innovation interventions based on system failure (Woolthuis, Lankhuizen & Gilsing 2005). None could be located that specifically developed system failure indicators as a methodology to 'map' a sectoral innovation system for the purpose of designing intervention strategies. The preliminary approach taken in this study therefore represents a new area of research, and is one which several researchers have suggested should be pursued (Scott-Kemmis et al 2005; Smith, K. 1998; Woolthuis, Lankhuizen & Gilsing 2005).

Finally, a structured six-step methodology to developing an integrated intervention strategy is proposed based on the application of innovation systems theory and the concept of system failure (see Section 6.4). The study culminates in the application of this new approach to the innovation system which underpins the Australian red meat sector. By applying 10 key design principles, a new integrated *SI-Intervention Framework* (see Figure 7.10) was developed. As noted previously, this outcome directly addresses the central research question that was the basis of the study. It is noted that during the study the new framework was tested for acceptance and potential impact via engagement with industry participants in a series of intervention projects. In addition, an internal capability building strategy was also implemented within MLA in order to address the concerns of previous researchers such as Scott-Kemmis et al (2005, p.27) who stated, "The development and maintenance of competencies in these organisations (policy and intervention bodies) is as important as the competencies of firms."

In summary, I propose that this study has developed a number of new theoretical and analytical models/methodologies which build on and extend the work of previous researchers. The specific contribution is in the area of applying the concept of system failure to inform the design of innovation policy and intervention strategies. This contribution directly addresses a number of concerns and opportunities that have been raised in the literature. I acknowledge that the models and concepts proposed are at a preliminary and exploratory stage of development and that there is a significant amount of further research required (see Section 8.4).

8.3 Evidence of Improved Practice

In order to address the purpose of improving practice, this study was characterised by a strong focus on collaborative and participatory approaches. This was achieved through the formation of a seven-member MLA research team (with members participating directly in the study as co-researchers) and the creation of opportunities for input and engagement by industry participants. As was discussed in previous chapters, the focus on participation and action embodied in the action research paradigm has been found to be particularly useful when a study is seeking innovation, change, growth and transformation of organisations and their leaders/managers (Wilson-Evered & Hartel 2001). Similarly, in determining the quality of action research it has been argued that, “Credibility, validity and reliability in action research are measured by the willingness of local stakeholders to act on the results of the action research” (Greenwood & Levin 2000, p.96).

The objective in this study was to improve practice in several key areas and I considered that this could be evidenced in a number of ways including:

- Adoption of the new approach by MLA
- Enhanced capability of the MLA innovation team to deliver the new approach, thus increasing the likelihood that the change will be sustainable following completion of the study
- Willingness of industry participants to accept the new approach with evidence of: early adoption; impact arising from preliminary trials of the

new intervention initiatives; and/or agreement by industry partners to engage in the intervention initiatives in the future.

While the impact of innovation and change programs may take several years to manifest, I suggest that there is substantial evidence of improved practice and adoption of the outcomes of the study. As this has been discussed in some detail in preceding chapters I will provide only a brief summary here.

8.3.1 Adoption of the Innovation Strategy Framework

Since completion of the study, the new SI-Intervention Framework has been submitted for consideration by the MLA Board within the company's new 5 year *Through Chain Innovation Strategy* scheduled to commence in July 2007. Based on the outcomes of this study, it was recommended that the priorities for MLA's future innovation intervention strategies include a focus on the following five key areas:

- Building the industry knowledge base through investment in a balanced portfolio of R&D which incorporates the whole industry value chain and which is based on a sophisticated competitive intelligence capability
- Implementing interventions in the sector innovation system which develop core industry infrastructure components in relation to: science & technology provider capability and alignment; developing a pool of skilled technical personnel willing to work in the industry; exploring new options for financing innovation; and ensuring adequate physical R&D infrastructure
- Building innovation culture and capability particularly within firms and value chains by offering a range of new innovation intervention services
- Facilitating the emergence of an open innovation culture by encouraging and supporting interactions: between firms; between segments along the value chain; between firms and knowledge providers; and between this industry and international collaborators

- Improving the institutional environment in areas where MLA can make an impact to reduce gaps in the competitive advantage of this industry in relation to its competitors

Following a Board strategy planning day in August 2006, the new approach has been endorsed for further development including population of the 5-year corporate plan with specific projects and interventions in the above categories.

8.3.2 Building internal MLA capability

In addition to the interventions aimed at enhancing industry innovation capability, the study has also highlighted the need for intervention agencies such as MLA to themselves build internal capabilities to assist them to implement these new approaches. This is consistent with the findings of earlier research studies (Hofer & Polt 1998; Scott-Kemmis et al 2005; Smith, K. 1998) which note that the types and scope of analyses are much more complex and difficult when applying the innovation systems approach. These researchers identified an imperative for policy bodies and intervention agencies to continually evolve their own knowledge and competence base.

As was discussed in Section 7.7, the MLA research team undertook an extensive analysis of the MLA capabilities required to implement the new approach. The outcomes of this analysis were followed with a range of development processes where gaps were identified. The following initiatives have now been adopted by MLA and there is early evidence of acceptance by members of the innovation division and manifestation of improved practice including:

- Incorporation of a new *Competitive Intelligence Capability* as a company-wide critical success factor in 2006-07
- Adoption of new approaches to the design and delivery of innovation programs known as *Program Excellence* and the *Maximising Impact*

Framework (both of which are based on the conceptual frameworks developed within this study)

- Implementation of a new divisional management model aimed at supporting program managers as they deal with the complexity of delivering the new approach

8.3.3 Acceptance by industry participants

Section 7.4.5 discusses in detail the evidence of improved practice more broadly within industry that has arisen as result of this study and which includes:

- Substantially increased investment in MLA innovation programs
- Multiple examples of improved interactions between firms and between firms and R&D providers
- Adoption by firms of new high risk innovation outcomes in areas such as automation technology with quantifiable benefits achieved
- Evidence of positive cultural change in firms implementing new technology based on a socio-technical approach
- Willingness by the financial sector to invest in the sector's innovation initiatives
- Ability to attract a substantial number of highly skilled undergraduates and new graduates to the industry for the first time

The following quotes from individuals involved in the study are provided as an illustration of the changes that have occurred:

> *When (our company) was first introduced to this partnership innovations program there was a lot of sceptism (sic) that the program would not provide the sorts of outcomes that would take the business forward. However it is clear that this program has changed the culture and commitment to R&D and innovation within the management team and it is quite profound. I look forward to (our company's) continued partnership with the MLA and its involvement in*

the partnership innovations program (CEO, processing company, August 2006).

The innovation model within the MLA Donor Company, through leadership and commitment from Christine Raward (note this is the previous name of the researcher)*, General Manager Client and Innovation Services at MLA, has allowed significant leverage of R&D resources and industry knowledge and skills. The model has allowed companies in the meat processing sector, and research providers, to increase their commercialisation and project management capabilities. Recognition of the importance and impact from this innovation model is illustrated through its adoption by the National Food Industry Strategy of the Commonwealth Government in its innovation program for the Australian food industry and particularly as relating to the needs of small and medium sized enterprises.* (MLA Board director, September 2006).

8.4 Implications for Further Research

This thesis has developed and subsequently applied a new structured approach to the development of an integrated innovation intervention strategy based on innovation systems theory and the concept of system failure. It will be recalled from the discussion in Chapter 6 that the methodology proposed involves six steps as follows:

1. Develop an appropriate conceptual framework that identifies the key elements in the sectoral innovation system being studied
2. Analyse the system to identify stresses and failures in the innovation system
3. Design intervention instruments and projects to address system failures
4. Undertake acceptance-testing of the proposed interventions to determine potential for impact

5. Develop an integrated intervention framework based on identified system failures and the potential for impact
6. Design broad comparative and longitudinal studies (across sectors; within sectors across countries; and within sectors historically) to track implementation; to determine overall effectiveness; and to refine strategies and approaches.

In this study, the methodology has been applied to the red meat industry in relation to the first five of these steps. Specific opportunities clearly exist to undertake further research to complete application of the approach in relation to the final step. This would include comparative and longitudinal studies of the effectiveness of MLA's interventions in the red meat industry over the next five years.

As was discussed in Chapter 6 (Section 6.3), there are also opportunities to further develop methodologies to determine evidence of system failure. Such methodologies would include quantitative and qualitative data related to both positive and negative indicators (i.e. system 'health' and system 'failure' indicators). It is proposed that, based on the models and approaches developed in this study, a more sophisticated innovation systems 'diagnostic' tool could be developed. Of particular interest is the potential to use such a tool to identify specific areas of competitive advantage based on the 'health' of a sector's innovation system. There would also be opportunities to benchmark innovation systems with competitors' systems as a basis for designing interventions to overcome identified gaps.

This study is focused on a single case and therefore does not purport to offer generalisations regarding the usefulness of the models and methodologies outside this single case. However, based on the positive feedback received from more than 60 experienced practitioners from the broader food industry, I propose that there is the potential to explore the application of the approaches developed in this study to these other sectors. This opportunity has been discussed with the National Food Industry Strategy and a pilot of the methodology has already commenced.

Finally, the literature review identified that the new approaches offered by innovation systems theory and the concept of system failure provide innovation policy researchers with a desirable alternative to the current economic policy paradigms which are based on the less useful concept of ‘market failure’. I propose that the advances made in this study would provide a useful basis upon which to undertake such research and that the Rural R&D Corporation model (which underpins MLA’s role) lends itself to further exploration in this regard. Given the Commonwealth government’s desire to maximise returns from their substantial investment in agricultural R&D and the proposed review of the RRDC model in 2010, I would suggest that there is an ideal opportunity to support further research in this area.

8.5 Conclusions

In concluding this thesis it has become apparent to me that my own journey has really just begun. In this final chapter I have discussed those areas where I believe the study has made a contribution both to the general research community and to my own organisation and fellow team members in particular. In broad terms, the value of the study will ultimately be determined by the specifics of future research contexts and can only be evaluated to the extent that it seems accurate, appropriate and authentic from the reader’s own perspective. Indisputably however, I can attest to the immeasurable value that undertaking this study has contributed to my own growth and learning. As a leader, as an innovation practitioner, and as a creative and reflective thinker I know I am now far better equipped to make a difference to the innovation and entrepreneurship journey of others.

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Appendix 1: Invitation to participate

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Attachment: Study Outline

STUDY TITLE: "Building innovation culture and capability in the Australian red meat industry"

RESEARCHER: Christine Raward
General Manager, MLA
Doctoral candidate, Southern Cross University

BACKGROUND:

The objective of this study is to develop an in-depth understanding of innovation in the Australian re meat industry. As an outcome, I hope to identify strategies that will impact on the innovation culture of the industry as a whole and, in particular, to determine what sort of interventions will lead to improvements in the innovation capability of individual organizations.

I believe this is a very important study as:

1. The red meat industry is a major contributor to the Australian economy
2. Innovation culture and capability are thought to be critical factors in determining sustainable competitive advantage

The study is planned in two main stages, although this is flexible and may change as the work progresses. The first stage is mainly about collecting information from a variety of reports and from interviews with a cross-section of people. At this stage, I plan to interview 25-30 people from individual companies, industry bodies, government and research/technology suppliers. I welcome your thoughts on who else it would be important for me to interview.

When the information collected in Stage One has been analysed, a pilot study will be undertaken in Stage Two to trial different forms of intervention and support that are aimed at improving innovation in the industry.

November 2002

Appendix 2: Interview protocol (prepared for interviewer's use only)

1. Review purpose of study
2. Note that all data will be analysed in a general way and will be completely anonymous. Details of the interview will remain confidential.
3. I am happy to provide feedback regarding progress of the study.
4. Is there anything else about the project before we begin?
5. Record individual's details.

Opening Question & General Prompt Questions:

1. Let's start with your general thoughts on innovation and how important it is for the red meat industry in Australia.

Note: After this initial question, subsequent questions depend on the participant's response. The following probe questions are to be used as a guide only. In later interviews, specific questions may be included for confirmation/disconfirmation purposes. More detailed probe questions have been prepared for discussions with representatives from meat processing companies – a key target of this research.

2. How do you think innovation impacts on the industry's competitive advantage and overall performance – how do we rate compared with the competition?

3. What are the most important areas for innovation?

4. What do you think are the specific threats/opportunities facing the industry in the next 5-10 years – how well is the industry equipped to handle these challenges – how important will the ability to innovate be?

5. From your experience and knowledge of the industry – how innovative is the industry – where does innovation occur – do you have any examples – how would you measure

innovation performance (at industry level; at company level)?

6. What do you think are the key issues in the external environment that are either helping or hindering innovation?

7. What factors internal to companies do you thin impact on their ability to innovate – do they have the necessary skills?

8. What do you think companies need to do to become more innovative?

9. What role does government (departments, regulators, agencies such as NFIS) play in assisting or inhibiting innovation – how could it be improved?

10. What role do you think industry bodies such as MLA, AMIC, Peak Councils play in assisting or inhibiting innovation – how could this be improved – do they have the right skills and resources?

11. What additional support/resources/infrastructure should be developed (by whom) to help build industry innovation culture and capability?

12. Is there anything else you would like to add – who else should I interview for this study?

Appendix 3: Additional probe questions which may be used when interviewing representatives from meat processing companies

1. What do you understand about the process/concept of innovation?

2. How important is innovation for you business in achieving competitive advantage?

3. How important do you think innovation is for the survival of the industry?

4. What do you understand about your competitors use of innovation – give examples?

5. How do you think the red meat industry rates in terms of innovativeness compared with other red meat countries – other proteins?

6. How important is innovation in helping you to meet your customer's requirements?

7. Is there anything in the external environment that is hindering your company's innovation efforts?

8. How valuable are government initiatives in assisting you to be more innovative – give examples?

9. What things inside your company help/hinder you to be more innovative?

10. In what areas of your business have you been the most innovative – give examples?

11. What areas of your business are the most important for innovation – in what areas would you like to be more innovative?

12. What skills does your company need to be innovative – do you have these skills – how did/would you improve them?

13. What influence do your suppliers have on innovation?

14. Where do you get assistance from in relation to innovation?

15. What positive results do you expect from good innovation management – how do/would you measure your performance in this area – what indicators do you use?

16. Do you have any formal or structured innovation program/processes – give examples such as strategy; specific plans; commitment of people and finances; processes for capturing new ideas; project management; product development; training programs.

17. Do you have any links with external networks that help foster innovation?

18. What sort of company culture do you think fosters innovation – how does yours rate?

19. Give examples of significant changes you have undertaken in the last 2 years in areas such as technology; systems; structures; products; markets, overall business strategy. How successful were these changes – what worked and what didn't – what would you do differently?

20. How does your organisation cope with change?

21. Are you planning any significant changes in the future – how will you plan and implement these changes?

22. How significant is change in your external environment in relation to customers, technology, competitors, industry structures, government policy, regulation – how do you find out about change?

23. How confident are you that your company can cope with these changes?

24. Are you aware of the latest technology development in this industry – how do you keep up-to-date?

25. Do you or your staff attend innovation related conferences – regularly visit trade shows – talk to customers and suppliers – other companies and industries – do you get many new ideas from these activities?

26. What are your company's priorities for delivering business strategy – what role does innovation play?

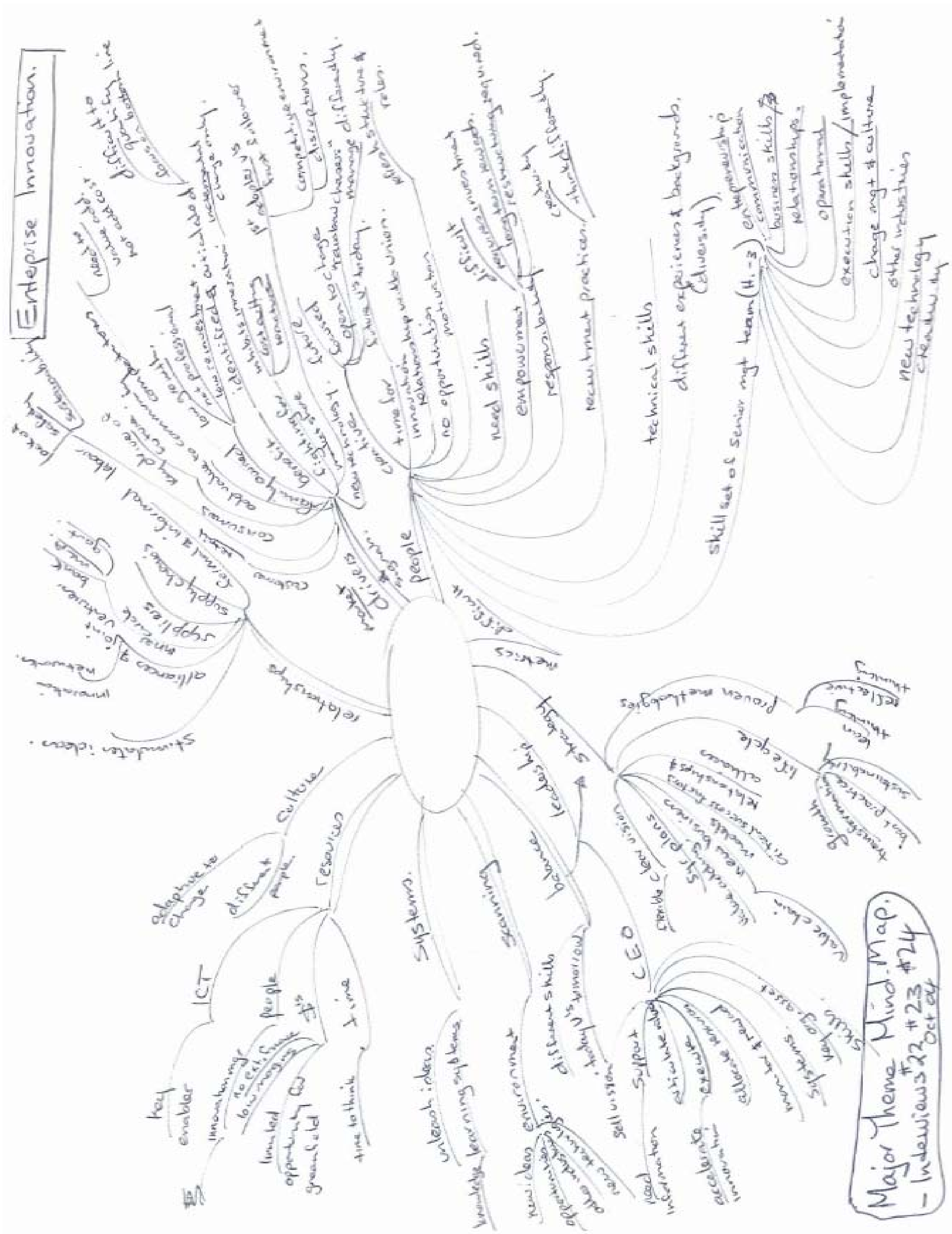
27. Has your company had any involvement in MLA R&D/innovation programs – what was the result?

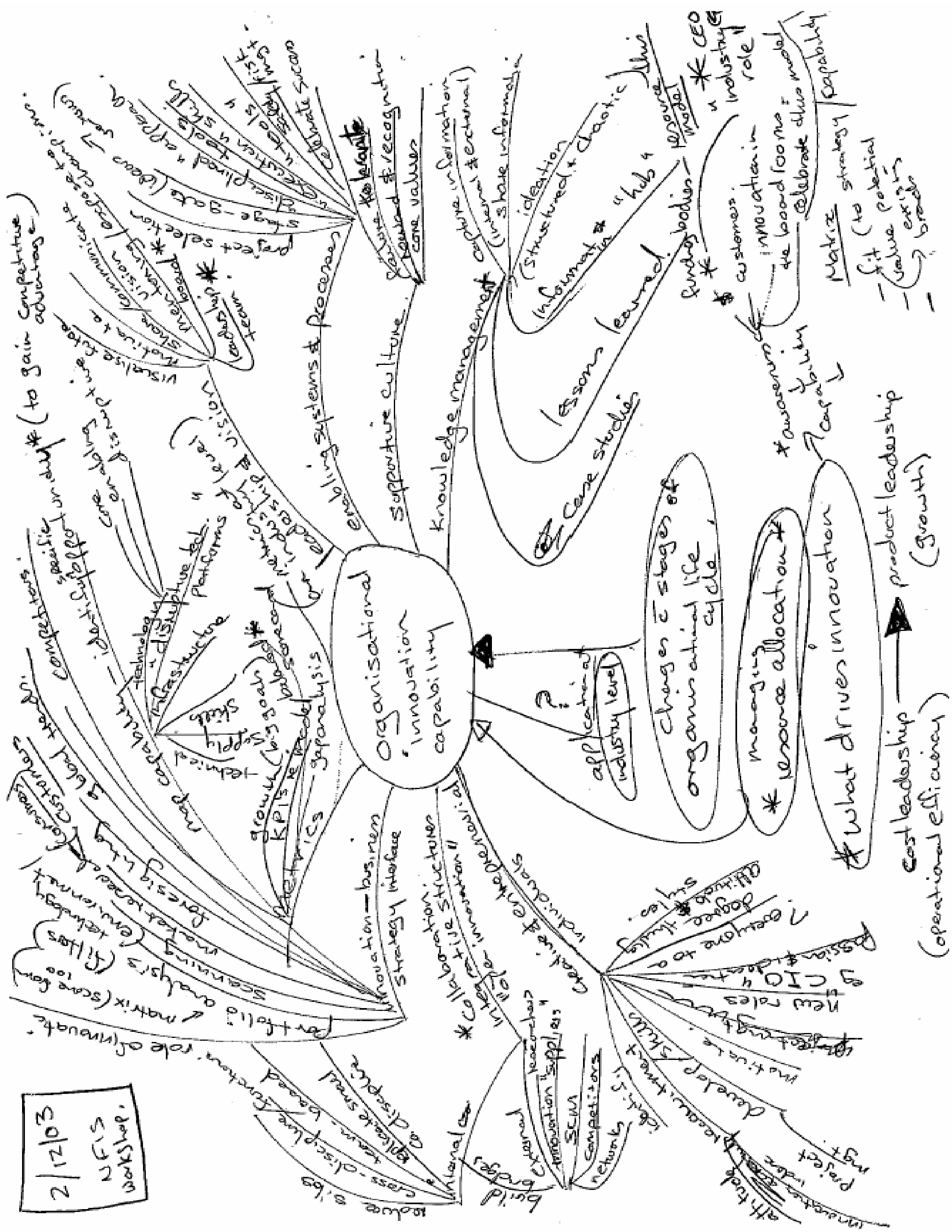
28. What additional assistance would you like form MLA?

29. What do you think is MLA's role in facilitating innovation capability building in meat processing companies?

30. How can MLA improve its services to your company?

Appendix 4: Examples of mind map prepared in data analysis phase




Organisational innovation capability
What drives innovation
Cost leadership
(operational efficiency)
product leadership
(growth)
managing resource allocation
lessons learned
Case studies
knowledge management
supportive culture
2/12/03
NFIS workshop.

Appendix 5: Structured data collection from MLA research set – System Failures (note actual responses from one member in red)

UNDERSTANDING "FAILURES" IN THE RED MEAT INDUSTRY'S INNOVATION SYSTEM

As you know, I have been undertaking research with the objective of developing a more robust approach to the provision of innovation intervention services by Meat & Livestock Australia (and CIS in particular). The focus of the study is the red meat processing sector (within a broader value chain model) and the overall objective is to enhance the contribution of the industry's innovation strategy to increasing the sector's global competitiveness. The underlying hypothesis is that there are a number of "failures" in the industry's innovation system (both in relation to the capability of firms plus problems/issues in the broader environment impacting on firms) and that these "failures" undermine the effectiveness and potential impact of our *Through Chain Innovation Strategy* (eg. by reducing industry's willingness to invest in innovation; by reducing the success rate of R&D projects; by limiting the level of adoption etc). The key research steps that I have undertaken include:

1. Developing a conceptual framework for understanding the sector's innovation and entrepreneurship system (based on the literature and an analysis of data from in-depth interviews). A diagram representing this conceptual framework is attached.
2. Applying an analytical approach to identifying "system failures" as an alternative policy instrument to the current paradigm of "market failure" as the basis for designing intervention strategies. I am asking for your input into this component.
3. Based on the concept of system failures, proposing an integrated innovation services intervention framework. I will present this at our August team meeting.

4. Determining appropriate outcome measures for evaluating the new approach. Will discuss in August.
5. Piloting a number of the proposed interventions (at both firm and sector level). Will discuss in August.

The following table summarises a number of possible “system failures” based on ideas I have developed from a review of the innovation and entrepreneurship literature. I have not been able to find a structured analytical tool to apply these concepts to undertaking a “diagnostic” of the “health” of a specific sector’s innovation system – so that is what I an trying to develop. Eventually, I plan to develop a more structured diagnostic tool (which may be similar to the firm innovation capability diagnostic instrument I have developed in collaboration with an external expert in this area). You will see there are 6 categories of possible “system failures”. In each category I have given a brief description of the areas of focus; suggested some types of evidence that could be used to identify failures in a particular sector’s innovation system; and then summarized the findings from my in-depth interviews with industry personnel that would suggest there may be “failures” of this type in the red meat industry. I would greatly appreciate your input as follows:

1. In the section marked “CIS Program Manager”, and from your own experience, add any “evidence” you think qualifies as an example of “system failure” in each category – please provide brief comments so I know what you are talking about. This will be qualitative evidence as it will be your own thoughts, perceptions and interpretations.
2. If you can think of any hard quantitative evidence (eg reports; surveys etc) that we could also use – please give brief reference.

It would be great if I could have your feedback by 14 July. I know we are all busy so just your quick first thoughts are all I need at this stage (should take about 1 hour). If you would like more detailed reading, I can send you an extract from my thesis. I am confident that the approach will help us to become much more effective and focused in the future and I look forward to sharing my thoughts in more detail with you a bit later in the year.

Many thanks

Christine

1. INFRASTRUCTURE FAILURES	
Areas of focus: Inadequate knowledge and resource base in areas including: • Science & technology (S&T) • Pool of skilled labour • Finance for innovation • Industry knowledge of markets and technology opportunities • Innovation & entrepreneurship education and training Failures in this area result in the sector being perceived as either disadvantaged or lagging compared with competitors	**Types of evidence:** • S&T capability geared to industry needs • Critical mass of S&T infrastructure • Access to knowledge brokers with appropriate expertise • Competitive intelligence capability developed and deployed • Industry positioning compared with competitors • Skilled technology commercialisers • Adequate physical R&D infrastructure • Ability of firms to attract technical staff • Retention of skilled operators • Adequacy of training & educational services • Perception of industry by finance sector • Access to R&D grants • Availability of venture capital and other forms of start-up capital • Adequacy of ICT infrastructure
Meat industry – empirical evidence (from in-depth interviews): • Lack of industry awareness of threats and opportunities in global environment • Industry lagging competitors such as NZ and Brazil in infrastructure capabilities • Lack of exposure to formal education and training of many managers • Lack of alignment between R&D providers and industry • Insufficient technology provider and poor commercialisation history • Difficulty attracting and retaining skilled managerial and technical staff • Lack of diversity in workforce • Insufficient physical R&D infrastructure • Insufficient education and training providers with industry knowledge and content • Lack of access to risk capital due to perceived volatility of industry • Low margins resulting in low levels of investment in innovation • Uptake of ICT has been relatively slow with infrastructure problems in rural areas	
CIS Program Managers: • **Processors capital write down values for existing infrastructure are very low due to age of buildings and equipment enabling them to maintain profitable**	

reporting. • **Plants are generally running well below their maximum production levels for the last couple of years due to stock shortages and the processing industries over capacity resulting in underutilization of exist capital infrastructure and makes it difficult to justify new investment.** • **Large number of processing plants are family owned and have tended to be conservative and "traditional" in there investment strategy. Tend not to borrow heavily in order to drought proof.**
Quantitative evidence:

2. INSTITUTIONAL FAILURES	
Areas of focus: Analysis of how the following are impacting on the capacity of firms to be innovative: • Legal & regulatory impost • Industrial relations • Patterns of appropriation (eg. I.P.) • Competition policy	**Types of evidence:** • Acceptance from regulators • Perceived role of regulators • Balance between consumer protection and operational flexibility • Level of management-employee trust in workplaces – industrial disputes • Incentives and rewards for innovative and entrepreneurial companies eg tax concessions • Entry and survival of new firms • Capacity of firms to capture benefits from innovation • Basis of competition
Meat industry – empirical evidence: • Regulators perceived as creating barriers to innovation by resisting change and being too slow to adapt to new technologies • Over regulated which creates confusion and inefficiencies • Regulations are not science-based and not aligned with commercial realities • Regulators are locked into an historical paradigm of representing the customer not serving the industry • Competitors such as NZ have a much more productive relationship with regulators	

- Too many industry bodies with high levels of paternalism; a focus on crisis-management; dysfunctional behaviours; misuse of power; highly political
- Socialised approach to R&D funding provides disincentives to innovative companies
- Lack of objective understanding of impact of institutional barriers to innovation
- Narrow base of competition with livestock purchasing muscle used to exclude new entrants

CIS Program Managers:

- **Smart trace cold chain traceability.. mainly entrepreneurial companies see competitive advantages. System benefits industry in providing consumer confidence and regularity environment can be leveraged to the adopters advantage.**

Quantitative evidence:

Reluctance of processor to challenge regulatory standard due to market access issues. 82c water project.

3. INTERACTION (CO-EVOLUTION) FAILURES

Areas of focus:	Types of evidence:
Analysis of level and quality of interactions in areas including: • Public-private partnerships • Co-innovation along value chains • Networks and collaboration • Knowledge exchange between actors	• Access to knowledge • Awareness of knowledge by firms • Level of trust and respect between firms and R&D providers • Collaborative R&D projects • Interaction by firms with sophisticated users/customers • Effective user-producer interface in technology development • Effective value chain innovation • Evidence of participation by firms in innovation networks and application of open innovation processes

Meat industry – empirical evidence:

- Only limited evidence of public-private partnerships between firms and R&D

providers or educational institutions (latter improved in recent years) • Need for better linkages between researchers and industry • Fragmented industry structures with little integration or collaboration along the value chain • Poor information flow between value chain members • Lack of trust and low levels of co-operation between firms • Lack of innovation in value chain thinking resulting in lack of coherence in innovation and marketing strategies • Industry is behind competitors such as chicken in implementing value chain innovation • Relationships between processing companies and livestock suppliers often based on adversarial behaviour patterns • Dominant customer base in US manufacturing beef market does not encourage sophisticated innovation interface between firms and customers • Dominance of major domestic supermarkets may inhibit innovation due to narrow focus on cost-cutting and disproportionate sharing of benefits from innovation
CIS Program Managers: • Competitive nature of industry and general distrust of one another inhibits cooperative scope of R&D. • R&D outcome wanted on a exclusive basis or done on a inhouse basis. • Lack of trust in the supply chain. Although there are some exceptions such as CRF and ACC
Quantitative evidence:

4. FIRM CAPABILITY FAILURES	
Areas of focus: • Innovation leadership & strategy execution • Culture & systems • Knowledge, learning & creativity • Entrepreneurial capacity (mindset and skills)	**Types of evidence:** • Innovation capability benchmarks • Successful launch of new products • Successful entry to new markets • Cost competitiveness • Adoption of new technologies and business models • Ability to attract new people with new skills • Ability to foster creativity, innovation and risk taking • Evidence of entrepreneurial behavior and

<table>
<tr><td></td><td>implementation of growth strategies
• Evidence of excellence in environmental and social sustainability</td></tr>
<tr><td colspan="2">Meat industry – empirical evidence:
• Owner-operated businesses generally seen to exhibit low levels of innovation and are often not growth-oriented
• Industry firms are dominated by a focus on narrow commodity-based strategies
• Many firms exhibit complacency and resistance to change
• Many firms rely on innovations to filter into the Australian market from overseas which is seen to expose the industry to threat from fast moving competitors such as Brazil
• Competitors such as NZ are seen as superior in their capacity to adopt new ideas and technologies
• Many CEO's rely on approaches that have worked in the past and seem reluctant to embrace new ideas. They are hampered by a general lack of formal training and education and a lack of exposure to diverse industries and experiences
• Firms have significant difficulty in attracting and retaining skilled managerial and technical staff
• General lack of support for creative individuals</td></tr>
<tr><td colspan="2">CIS Program Managers:
• Many processor owners are entrepreneurial (in the more traditional sense) as they start their business or taken over existing business at considerable risk. However investment in new R&D concepts and forward planning is not well managed.</td></tr>
<tr><td colspan="2">Quantitative evidence:
Adoption of robotics eg T&R (focus on takeovers and interesting in securing stock supply.</td></tr>
<tr><td colspan="2">5. ADAPTIVE FAILURES</td></tr>
<tr><td>Areas of focus:

a) Transition failures:
Transition failures caused by technological shocks and failure of firms to adapt – characterised by reactive rather than proactive responses.</td><td>Types of evidence:

• Slow to respond to changing market requirements or opportunities
• Loss of market share
• Evidence of redundancy in skills and capabilities
• No support for R&D providers to build</td></tr>
</table>

	capability in new areas • New technology adoption by competitors but not by sector
b) Lock-in failures: Lock-in failures caused by over zealous commitment to current technology.	• Tight control of investment in technological innovation – creating barriers • High capital investment in current technology • Narrow technical skill base

Meat industry – empirical evidence:

- Evidence of misuse of power by industry representatives (on committees) seeking to maintain status quo and smothering unacceptable new ideas
- Large companies who have succeeded with old commodity focus appear unwilling to accept changing environment
- High levels of complacency with status quo …"we sell all the meat we produce, we're pretty right"
- Industry not prepared to support capability building in R&D providers
- Many CEO's not willing to move outside their comfort zone
- Evidence of loss of market share to competition in both domestic and export markets
- Adoption of new integrated value chain business models by competitors such as chicken but not evident in meat industry to any degree
- Focus on reactive, short-term problem solving rather than long term innovation strategy
- Reliance on follower strategy rather than leading technological innovation
- Lack of broad professionally educated skill base in most firms resulting in inability to implement technological innovation in areas such as automation

CIS Program Managers:

- **Limited incentive for industry to adopt maximum efficiencies gained by R&D innovation due to limited customer tolerance to meat cut specification changes. IE improved labor savings via automation can result in variations to traditional meat cuts.**
- **Attitude of processors that they currently sell all their product so "she'll be right" …I am making a buck ….status quo**

Quantitative evidence:

6. ENTREPRENEURSHIP CULTURE FAILURES

Areas of focus:	**Types of evidence:**
• Entrepreneurial orientation • Industry culture	• Support for innovative & entrepreneurial firms • Evidence of innovative & entrepreneurial individuals • Acceptance of legitimacy of entrepreneurship • Degree of entrepreneurial orientation – eg. tolerance for mistakes; risk taking • Levels of participation in new venture creation and high growth strategies

Meat industry – empirical evidence:

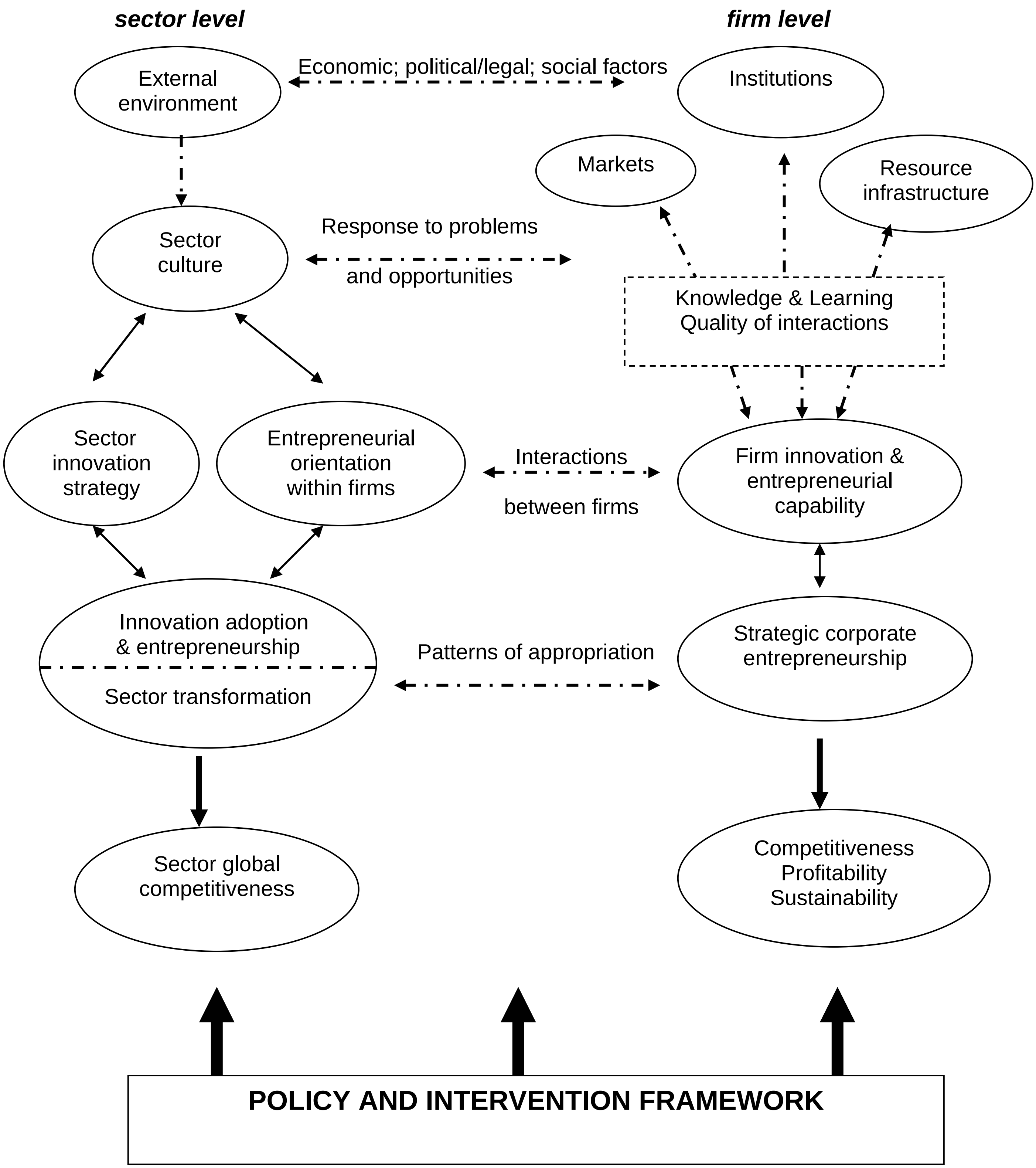
- Industry seen as exhibiting relatively low levels of innovativeness
- Negative attitudes towards risks associated with innovation
- Some segments of the industry are not growth oriented and display low levels of reinvestment in the business
- Risk adverse culture due to past R&D failures
- Most companies not willing to be the first to try anything new as this is perceived to be too risky
- Firms are not tolerant of failure
- A need identified to attract more creative and entrepreneurial people to the industry
- Industry culture is dominated by suspicion, lack of trust and a mistrust of innovators

CIS Program Managers:

- **Low profitability = low R&D investment allocation which in turn tends to lead process to low risk innovation strategy.**
- **Luck of tolerance of R&D failure**
- **Successful innovation entrepreneurship is characterised by the ability to;**
    - ❖ **Vision the benefits gained**
    - ❖ **Can accept high risk**
    - ❖ **Don’t think Failure**
    - ❖ **Drive change management internally and externally**

Quantitative evidence:

Sectoral Innovation & Entrepreneurship System



Appendix 6: Template used to collect data from MLA research team on Impact of System Failures and Ability of MLA to Impact

Impact of System Failures

Infrastructure failures

Infrastructure activities (missing or ineffective)	**Actors** (missing or ineffective)		
	Firms/value chains	**Knowledge providers**	**Third parties**
Creation of knowledge • Industry not aware of R&D outcomes *(MLA/AMPC report 2004)*			
Score: impact on effectiveness of SI			
Science & technology • Lack of alignment between industry and R&D providers *(interviews)* • Insufficient technology providers and poor commercialisation history *(interviews)*			
Score: impact on effectiveness of SI			
Pool of skilled labour • Lack of exposure to formal education and training of many managers *(interviews; MRC Report: Andrewatha 1995)* • Difficulty attracting and retaining skilled staff *(interviews; MLA Report: Abba 2004)* • Lack of diversity in workforce *(interviews)*			
Score: impact on effectiveness of SI			
Education & training • Insufficient education and training providers with relevant industry knowledge (interviews; *MLA Review: MINTRAC 2006)*			
Score: impact on effectiveness of SI			
Competitive intelligence • Lack of industry awareness of threats and opportunities in global environment *(interviews)* • Industry lagging competitors such as NZ and Brazil in infrastructure *(interviews)* • Lack of benchmarking data on industry performance *(interviews)*			
Score: impact on effectiveness of SI			
Finance for innovation • Lack of access to risk capital due to perceived volatility of industry *(interviews)* • Low margins resulting in low levels of investment in innovation *(interviews)*			
Score: impact on effectiveness of SI			
Physical infrastructure eg ICT • Insufficient physical R&D infrastructure *(interviews; MLA Report: KPMG 2000)* • Uptake of ICT has been relatively slow in red meat industry *(interviews; MLA/QLD government Report: QeMeat 2001)*			
Score: impact on effectiveness of SI			
TOTAL			

Institutional failures

Institutional activities (missing or ineffective)	**Actors** (missing or ineffective) **Firms/value chains**	**Knowledge providers**	**Third parties**
Legal & regulatory • Competitors such as NZ have a more productive relationship with regulators (interviews; *MLA Report: TAP 2000)* • Regulators are locked into an historical paradigm of representing the customer not serving the industry *(interviews)* • Regulators perceived as creating barriers to innovation by resisting change and being too slow to adapt to new technologies *(interviews)* • Over regulated which creates confusion and inefficiencies *(interviews)* • Regulations are not science-based and not aligned with commercial realities *(interviews)* • General industry lack of objective understanding of impact of institutional barriers to innovation *(interviews)*			
Score: impact on effectiveness of SI			
Industrial relations • No issues recorded			
Score: impact on effectiveness of SI			
"Rules" regarding R&D • Socialised approach to R&D funding provides disincentives to innovative companies *(interviews)* • Too many industry bodies with focusing on crisis-management rather than longer term industry innovation strategy *(interviews)*			
Score: impact on effectiveness of SI			
Patterns of appropriation • Domestic supermarkets have too much power and inhibit innovation as they claim all the benefits *(interviews)*			
Score: impact on effectiveness of SI			
TOTAL			

Interaction failures

Interaction activities (missing or ineffective)	Actors (missing or ineffective)		
	Firms/value chains	**Knowledge providers**	**Third parties**
Distribution of knowledge			
Score: impact on effectiveness of SI			
Industry-science linkages • Limited evidence of public-private partnerships compared with counterparts in USA and Europe *(MLA Report: MINTRAC study tour 2006)* • Need for better linkages between researchers and industry *(interviews)*			
Score: impact on effectiveness of SI			
Co-innovation along value chain • Fragmented industry structures with little collaboration along the value chain *(interviews)* • Poor information flow between value chain members *(interviews)* • Industry is behind competitors such as chicken in implementing value chain innovation *(interviews; MLA report: KPMG 2000)* • Relationships along the value chain based on adversarial behaviours *(interviews)* • Dominant customer base in US manufacturing beef market does not encourage sophisticated innovation interface between firms and customers *(interviews)*			
Score: impact on effectiveness of SI			
Knowledge networks • Lack of trust and low levels of co-operation between firms *(interviews)* • Very difficult to engage firms in syndicated R&D projects *(interviews)*			
Score: impact on effectiveness of SI			
Collaboration between firms •			
Score: impact on effectiveness of SI			
Open innovation at system level • No issues recorded			
Score: impact on effectiveness of SI			
Shared vision of innovation • Lack of collaborative thinking resulting in lack of coherence in industry innovation and marketing strategies *(interviews)* • Focus on reactive, short-term problem solving rather than long term innovation strategy *(interviews)*			
Score: impact on effectiveness of SI			
TOTAL			

Firm capability failures

Firm capability activities (missing or ineffective)	Actors (missing or ineffective)		
	Firms/value chains	**Knowledge providers**	**Third parties**
Absorptive capacity •			
Score: impact on effectiveness of SI			
Leadership & strategy • Owner-operated businesses generally seen to exhibit low levels of innovation and are often not growth-oriented *(interviews)* • Industry firms are dominated by a focus on narrow shor-term strategies *(interviews)* • Many CEO's rely on approaches that have worked in the past and seem reluctant to embrace new ideas *(interviews)*			
Score: impact on effectiveness of SI			
Culture & systems • General lack of support for creative or entrepreneurial individuals *(interviews)* • Firms are not tolerant of failure *(interviews)*			
Score: impact on effectiveness of SI			
Learning organisations • Many firms exhibit complacency and resistance to change *(interviews)*			
Score: impact on effectiveness of SI			
Innovation performance • Competitors such as NZ are seen as superior in their capacity to adopt new ideas and technologies *(interviews)* • Many firms rely on innovations to filter into the Australian market from overseas which is seen to expose the industry to threat from fast moving competitors such as Brazil *(interviews)* • Evidence of loss of market share to competition in both domestic and export markets *(interviews)*			
Score: impact on effectiveness of SI			
TOTAL			

Adaptive Failures

Adaptive activities (missing or ineffective)	**Actors** (missing or ineffective) **Firms/value chains**	**Knowledge providers**	**Third parties**
Transition • Many CEO's not willing to move outside their comfort zone *(interviews)* • Reliance on follower strategy rather than leading technological innovation *(interviews)* • Lack of professionally educated skill base in most firms resulting in inability to implement technological innovation in areas such as automation *(interviews)*			
Score: impact on effectiveness of SI			
Lock-in • Evidence of misuse of power by industry representatives (on committees) seeking to maintain status quo and smothering unacceptable new ideas *(interviews)* • Industry not prepared to support capability building in R&D providers *(interviews)*			
Score: impact on effectiveness of SI			
Internal orientation • Large companies who have succeeded with old commodity focus appear unwilling to accept changing environment *(interviews)* • High levels of complacency with status quo …"we sell all the meat we produce, we're pretty right" *(interviews)*			
Score: impact on effectiveness of SI			
TOTAL			

Entrepreneurship culture failures

Entrepreneurship culture activities (missing or ineffective)	**Actors** (missing or ineffective)		
	Firms/value chains	**Knowledge providers**	**Third parties**
Entrepreneurial orientation • Negative attitudes towards risks associated with innovation *(interviews)* • Risk adverse culture due to past R&D failures *(interviews)* • Industry perceived as exhibiting relatively low levels of risk taking *(MLA Report: PIP review 2006)* • A need identified to attract more creative and entrepreneurial people to the industry *(interviews)* • Industry culture is dominated by suspicion, lack of trust and a mistrust of innovators *(interviews)* • Most companies not willing to be the first to try anything new as this is perceived to be too risky *(interviews)*			
Score: impact on effectiveness of SI			
Industry transformation • Industry reluctant to enter new areas and not supportive of start-ups that do *(MLA Report: Bioactives 2005)*			
Score: impact on effectiveness of SI			
Sector entry to new domains •			
Score: impact on effectiveness of SI			
Support for innovative start-ups •			
Score: impact on effectiveness of SI			
TOTAL			

Perceived impact on effectiveness of SI

1 2 3 4 5

not relevant low importance mod. importance high importance critical

Ability of MLA to Impact

Projects to Address Infrastructure failures

Project Score (1-3)	Infrastructure activities (project options)	Actors (necessary for implementation)		
		Firms/value chains	Knowledge providers	Third parties
	Creation of knowledge • Through Chain R&D Programs			
	Score: Ability for MLA to impact			
	Science & technology • R&D provider identification & alignment • Technology provider identification & development • Commercialiser incubation services • International S&T alliances • R&D scholarships for researchers			
	Score: Ability for MLA to impact			
	Pool of skilled labour • Labour retention R&D projects • Professional Development Program • Secondments			
	Score: Ability for MLA to impact			
	Education & training • Content development with university providers • Training programs via MINTRAC			
	Score: Ability for MLA to impact			
	Competitive intelligence • Implement competitive intelligence capability • Industry benchmarking • Innovation opportunity landscape mapping • Foresighting & technology scanning			
	Score: Ability for MLA to impact			
	Finance for innovation • Funding application assistance • Engage rural angels & VC's • Access alternative funding mechanisms • Increase co-investment with commercial partners			
	Score: Ability for MLA to impact			
	Physical infrastructure eg ICT • R&D "park" concept • Collaborate with government re ICT infrastructure • ICT R&D to increase uptake			
	Score: Ability for MLA to impact			
	TOTAL			

Projects to Address Institutional failures

Project Score (1-3)	**Institutional activities** (project options)	**Actors** (necessary for implementation) **Firms/value chains**	**Knowledge providers**	**Third parties**
	Legal & regulatory • Alternative procedures R&D • Regulatory compliance best practice guidelines, toolkits, workshops etc • Science-based R&D in key areas • Engage with regulators/government to identify and remove barriers to innovation • Benchmark regulatory impost with competitors			
	Score: Ability for MLA to impact			
	Industrial relations • Regular consultation with union re R&D projects • On-site workplace change R&D			
	Score: Ability for MLA to impact			
	“Rules” regarding R&D • Change IP ownership in PIPP’s • Simplify R&D contracts			
	Score: Ability for MLA to impact			
	Patterns of appropriation • Increase periods of exclusivity in PIPP’s • Ensure benefits of R&D flow equally through value chain eg hides project			
	Score: Ability for MLA to impact			
	TOTAL			

Projects to Address Interaction failures

Project Score (1-3)	**Interaction activities** (project options)	**Actors** (necessary for implementation)		
		Firms/value chains	**Knowledge providers**	**Third parties**
	Distribution of knowledge • Communication & adoption plans			
	Score: Ability for MLA to impact			
	Industry-science linkages • Industry-science secondments • Co-location of R&D resources on-sites • Strategic alliances with universities			
	Score: Ability for MLA to impact			
	Co-innovation along value chain • Increased focus on value chain innovation program • Collaboration with NFIS & others • Category management innovation projects			
	Score: Ability for MLA to impact			
	Knowledge networks • Industry learning groups • Network competency mapping			
	Score: Ability for MLA to impact			
	Collaboration between firms • Syndicated R&D projects • Innovation networks • Innovation tours • Trusted intermediaries			
	Score: Ability for MLA to impact			
	Open innovation at system level • Collaboration with international partners • Technology sourcing from other industries			
	Score: Ability for MLA to impact			
	Shared vision of innovation • MLA Through chain Innovation Strategy (whole of industry-funded – stakenolder relationships) • Innovation showcase (IMPRO-EXPO)			
	Score: Ability for MLA to impact			
	TOTAL			

Projects to Address Firm capability failures

Project Score (1-3)	**Firm capability activities** (project options)	**Actors** (necessary for implementation)		
		Firms/value chains	**Knowledge providers**	**Third parties**
	Absorptive capacity • Customised knowledge transfer tools eg process mapping tool			
	Score: Ability for MLA to impact			
	Leadership & strategy • Collaborative innovation strategies • CEO innovation leadership forum • Innovation capability diagnostic			
	Score: Ability for MLA to impact			
	Culture & systems • Innovation toolkit • Innovation skills & training programs – disseminate proven methodologies • Secondments • Innovation managers • Promote innovation case studies • Partnership projects • Commercialisation support • Develop creative & entrepreneurial people			
	Score: Ability for MLA to impact			
	Learning organizations • Develop knowledge management tools • Innovation networks • Industry learning groups • Increase innovation content in Professional Development Program			
	Score: Ability for MLA to impact			
	Innovation performance • Measure & communicate benefits of innovation • Benchmark innovation capability • Benchmark other IE indicators			
	Score: Ability for MLA to impact			
	TOTAL			

Projects to Address Adaptive Failures

Project Score (1-3)	**Adaptive activities** (project options)	**Actors** (necessary for implementation)		
		Firms/value chains	**Knowledge providers**	**Third parties**
	Transition • Technical skills development program • Targeted Professional Development Program • Focus on technology R&D projects with firms • Build R&D/technology provider capability in technology areas • Upgrade competitor technology scanning and communication to firms			
	Score: Ability for MLA to impact			
	Lock-in • Increase focus on Technology Innovation Strategy and source alternative funds			
	Score: Ability for MLA to impact			
	Internal orientation • Expose firms to new technology in other industries via tours, networks, training			
	Score: Ability for MLA to impact			
	TOTAL			

Projects to Address Entrepreneurship culture failures

Project Score (1-3)	**Entrepreneurship culture activities** (project options)	**Actors** (necessary for implementation)		
		Firms/value chains	**Knowledge providers**	**Third parties**
	Entrepreneurial orientation • Specific entrepreneurship skills programs • Promote successful entrepreneurship stories • Introduce GEM indicators to benchmarking			
	Score: Ability for MLA to impact			
	Industry transformation •			
	Score: Ability for MLA to impact			
	Sector entry to new domains • Focus on new industry opportunities eg bioactives & new markets for innovative products			
	Score: Ability for MLA to impact			
	Support for innovative start-ups • Access alternative funding • Develop register of mentors & business experts (with funding)			
	Score: Ability for MLA to impact			
	TOTAL			

Perceived ability of MLA to impact via this project option

1	2	3	4	5
not at all	low impact	mod. impact	high impact	transformational

Appendix 7: Confidential Reports and Files Accessed for this Study:

Meat Research Corporation:

Meat Research Corporation (1992a) *Confidential Fututech Files*

Meat Research Corporation (1992b) *Work Related Issues Program: Key Program Plan*

Meat Research Corporation (1995) *Management and Leadership Capabilities (Andrewartha)*

Meat Research Corporation (1996a) *Analysed to Death: a case study of industry change*

Meat Research Corporation (1996b) *RAPID Key Program: Researching Accelerated Processing Innovation & Development*

Meat & Livestock Australia:

MLA/AMPC (2004) *Impact Report Series*

MLA Report (2000) *Alternative Procedures*

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