The Role of Management Control Systems in Open Strategy Processes

Paul Jeyaranjan Thambar

Doctor of Philosophy

2014

Certificate of Authorship/Originality

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Paul Jeyaranjan Thambar

Acknowledgements

As someone with a personal faith in God, Yahweh Elohim, I thank Him for his bountiful blessings on my life including the opportunity to complete this thesis.

I would like to acknowledge the support of Bruce Pyke, Dallas Gibb and Alan Williams at the Cotton Research and Development Corporation and Adam Kay, Greg Kauter and Angela Bradburn at Cotton Australia to conduct the field work for this thesis.

My journey to complete a PhD started many years ago with a challenge placed before me by work colleague and friend, Bob Biancardi, "I think you need to be in either consulting or academia, not in industry". Well, I have come into academia via consulting and thanks, Bob! My thanks to the many people in the Accounting Discipline Group at UTS who have encouraged and challenged me. I want to make special mention of the members of the Management Accounting group who have been very supportive and the different residents of Room 311 over the past 5 years who have kept me company in this journey.

Undertaking a PhD is a challenging enterprise and requires excellent supervision. I have been fortunate to have a range of supervisors. First, I would like to thank my principal supervisor, Professor David Brown. In David, I found that good balance between academic rigour and practical pragmatism with a great sense of humour! David has pushed me intellectually, challenged me to think beyond my limited capabilities, and has taught me to not just complete a thesis but to be a researcher and an academic. Associate Professor Prabhu Sivabalan joined my supervisory panel around six months ago and has spent that period working with me on polishing and shaping the thesis and providing wonderful support, encouragement and advice. Professor Markus Granlund provided sound advice in the early stages of this process, for which I am grateful. I would also like to acknowledge Professor Zoltan Matolcsy who was present at the commencement of my journey. Special thanks to Paul Brown and Nicole Sutton who read the thesis and made helpful contributions to sharpen my ideas towards the end of the thesis journey.

Most importantly, I would like to express my love and gratitude to the two most important people in my life, my wife, Koshi and my son, Joash for whom I'm always husband and dad and who have unconditionally supported all my endeavours.

Table of Contents

List of Tables and Figures

Abstract

The objective of this thesis is to understand the operation of open strategy processes, which are strategic activities that take place beyond the firm boundary and at the inter-firm level. Three related exploratory research questions are examined: *Why do firms engage in open strategy processes? How can management control systems facilitate open strategy processes? How do meta-capabilities influence firms' engagement in open strategy processes?* Management accounting researchers have considered strategy and management control systems (MCS) to be firm-level phenomena (Chenhall, 2003). Langfield-Smith (2005) has suggested that firms carry out inter-firm strategic activities, however, there is limited management accounting research that has explicitly examined this issue. We have limited knowledge of the factors that influence a firm's decision to engage in an open strategy process, of the systems required to facilitate these open processes and the meta-capabilities required which are resources used by a firm to facilitate strategic thinking and to support open strategy activities.

The thesis makes two contributions to management accounting theory. The first contribution is to introduce open strategy processes to the management accounting literature. By doing so, it extends our understanding of strategy processes beyond the firm-level. The second contribution of this thesis is to explain the operation of open strategy processes. This is based on the development of a framework (antecedent factors, collaboration mechanisms and meta-capabilities) for open strategy processes. Antecedent factors are external to the firm and provide incentive to engage in open strategy processes. These factors incentivise firms when their impacts are similar through their effects on firm-level factors (operational activities, revenue yields and production costs) and when these firms control limited amounts of strategic assets (research and development, innovation and commercialisation skills) to manage these external impacts.

Management control systems are theorised to operate *between* firms as collaboration mechanisms to enable open strategy processes. These mechanisms provide the *context* for firms to engage in collaborative activities and provide the basis for *coordination* of open strategy activities and resource appropriation. The meta-capabilities required for firm engagement in open strategy processes are identified and how they are used and deployed through management control systems that operate *between* firms is theorised.

Chapter 1 Introduction

1.1 Objective of the research

Since the 1950s, the strategy process has been considered to be an opaque firm-level process providing a firm with the ability to create competitive advantage through well-designed strategic objectives which are achieved through strategic actions, supported by unique strategic assets (Johnson, Scholes & Whittington, 2005). Consequently, accounting researchers focused the design and use of management control systems (MCS) on supporting and enabling this strategy process through the provision of information that enabled strategic decisions and alignment of individual behaviour and goals to firm strategic objectives (Chenhall, 2003, Dent, 1991, Langfield-Smith, 2007, 1997). In this view, firm boundaries tended to be fixed and non-porous and strategy was the basis for an individual firm to create and manage a unique strategic position in its market for profit (Carpenter & Sanders, 2009).

Firms tend not to operate in isolation in any industry (Whittington, Cailluet & Yakis-Douglas, 2011). In many industries, firms are in collaborative relationships with other firms including competitors (Dekker, 2004, 2003, Hakansson & Lind, 2007), sharing information and strategic assets, indicating that firm boundaries are more open and porous than how they are portrayed in the traditional accounting and management literature (Chenhall, 2003, Langfield-Smith, 2007, 1997). The strategy process itself has become more open and there is evidence that inter-firm strategy processes are becoming more prevalent and critical to individual firm performance (Chesbrough & Appleyard, 2007, Langfield-Smith, 2005, Whittington et al., 2011). Despite the prevalence of these inter-firm strategy processes, described by Chesbrough and Appleyard (2007) as *open strategy processes*[1], very little is known about how these processes operate and their constituent variables and the role of management accounting including MCS in these processes. This knowledge would be useful to assist managers to successfully build firm performance in a competitive and networked environment (Langfield-smith, 2005). Therefore, the objective of this thesis is to investigate these open strategy processes to understand their variables and operations.

[1] Open strategy processes consist of strategic activities, which take place beyond a firm's boundary and at the inter-firm level. These processes involve multiple firms.

1.2 Motivation for the research

Accounting researchers have developed much of their understanding of firm-level strategy processes from the work of Michael Porter (1991, 1985 & 1980)[2]. In his seminal work on strategy, Porter (1991, 1985 & 1980) argued that a firm develops a competitive strategy that helps to build competitive advantage leading to firm performance *but* implements this through a well-designed operational strategy. This operational strategy is based on operational activities which are often organised into a value chain (Porter, 1991). These generic operational activities were defined by Porter (1991) to include primary activities such as marketing and sales, production and operations and inbound logistics and support activities such as procurement and research and development (R&D). For Porter (1991), an operational activity is the "basic unit of competitive advantage" (p102) and the successful achievement of the competitive strategy is determined by how well these operational activities are structured and performed by the firm. In effect, Porter (1991) has argued that the ability to structure and resource these operational activities provided the basis for a distinctive competitive advantage for the firm. Chesbrough (2003) supported this view, focusing on innovation and R&D activities, and argued that "internal R&D was a valuable strategic asset, even a formidable barrier to entry by competitors in many markets" (p35).

Taking their cue from Porter's work on strategy (1991), accounting researchers have studied how MCS is designed and used to support these firm-level strategy processes (Abernathy & Chua, 1996, Langfield-Smith, 2007, 1997). According to Langfield-Smith (2007), the strategy process examined in this stream of research has been segmented into three levels of strategy[3] (corporate, competitive and operational strategy). The main focus has been on investigating the role of MCS in strategy formation and implementation at the competitive strategy level with less attention on the other two levels (Langfield-Smith, 2007). These studies have used strategy typologies[4] which are comprehensive profiles of the competitive strategy of a firm which integrate interrelated environmental and organizational variables and embody the strategic objectives pursued by the firm (Langfield-Smith, 2007). This research into strategy has examined how strategy is implemented by

[2] Langfield-Smith (2007, 1997) identifies a number of different frameworks for strategy typologies including Miles & Snow's (1978) typologies (defenders, prospectors and analyzers), Miller & Friesen's (1982) typologies (conservative and entrepreneurial) and Gupta & Govindarajan's (1984) typologies (build, hold and harvest).

[3] Corporate strategy establishes the broad direction for the organization. Competitive strategy determines the strategic positioning. Operational strategy determines the operational activities that are needed in the value chain to help achieve the competitive strategy. Senior managers form the strategy and all other managers are involved in strategy implementation only (Ansoff, 1965, Porter, 1991).

[4] Various strategy typologies have been used in MCS research including typologies that focus on products and markets (Miles and Snow, 1978), on strategic positioning and competitive advantage (Porter, 1980), on innovation (Miller and Friesen, 1982) and on the strategic mission which focuses on balancing market share growth and earnings (Gupta and Govindarajan, 1984).

particular designs of MCS and also on how strategy formation is enabled (Langfield-Smith, 2007, Simons, 1995).

A range of firm-level MCS elements have been studied[5] (Chenhall, 2003, Langfield-Smith, 2007, 1997). Findings from this stream of research have provided knowledge on the types of MCS that are suitable for controlling specific types of competitive strategy (Langfield-Smith, 2007, 1997)[6]. Similarly, a small number of studies have examined the role of MCS in competitive strategy formation at the firm-level (Abernathy & Brownell, 1999, Henri, 2006, Kober, Ng, Paul, 2007). Strategy has been mainly conceptualised as either strategy typologies (Abernathy & Brownell, 1999, Kober et al., 2007) or organizational capabilities (Henri, 2006). MCS have been conceptualised as specific systems such as budgets (Abernathy & Brownell, 1999), and performance measurement systems (Henri, 2006) and management control practices (Kober et al., 2007). The studies provide useful findings that describe how MCS enable strategy formation by enabling changes in strategy typologies (Abernathy & Brownell, 1999, Kober et al., 2007) and changes in organizational capabilities (Henri, 2006).

There has also been a limited amount of research into firm-level MCS and operational strategy, which has developed knowledge on how these strategies, are formed and implemented by MCS (Ahrens & Chapman, 2007, Daniel & Reitsperger, 1991, Jorgensen & Messner, 2010). These studies have specified operational strategy as single components of the firm's value chain, examining new product development (Jorgensen & Messner, 2010), operational menu design (Ahrens & Chapman, 2007), and quality strategy (Daniel & Reitsperger, 1991). MCS has been specified as output controls (Daniel & Reitsperger, 1991), management control practices (Ahrens & Chapman, 2007) and accounting information (Jorgensen & Messner, 2010). The findings from these studies described how MCS enabled strategy formation through changes to operational strategies related to new product development (Jorgensen & Messner, 2010), restaurant menu design (Ahrens & Chapman, 2007) and quality (Daniel & Reitsperger, 1991). The studies (Ahrens & Chapman, 2007, Daniel & Reitsperger, 1991, Jorgensen & Messner, 2010) also found that

[5] Such as financial and non-financial controls (Khandwalla, 1972, Miller & Friesen, 1982), incentive bonus schemes (Govindarajan & Gupta, 1985), formal controls (Simons, 1990, 1987), budgets and style of use (Abernathy & Brownell, 1999, Govindarajan, 1988, Nilsson, 2002, Van der Stede, 2000), output and behaviour controls (Auzair & Langfield-Smith, 2005, Govindarajan & Fisher, 1990) and management accounting practices and techniques (Chenhall & Langfield-Smith, 1998, Ittner & Larcker, 1997).

6 Strategies with a focus on cost leadership are best controlled by formal MCS which are designed to provide cost control, tight operating goals and rigid budget controls (Khandawalla, 1972, Miller & Friesen, 1982, Simons, 1987). Strategies with a focus on differentiation are best controlled by MCS which are designed to provide planning and budget controls (Chenhall & Langfield-Smith, 1998, Govindarajan & Fisher, 1990).

management control systems and practices were used to implement these operational strategies to achieve the competitive strategy objectives of the case firms.

Finally, the work of Simons (2000, 1995, 1994, 1991 & 1990) has provided a different approach to the study of firm-level strategy and MCS. Simons (1995) has examined the interaction between competitive and operational strategy formation and implementation and the role played by MCS. Simons (1995) has developed two different ways that MCS can be used to drive strategy formation and implementation: interactive use and diagnostic use. Interactive use is reserved for senior managers in the firm and related to formal MCS used to encourage all managers to actively examine the influence of the external environment on their operational activities to identify opportunities for strategy formation (Simons, 1995). In interactive mode, MCS (e.g. project management systems) are used to provide information for use in face to face meetings between managers to enable debate and discussion on strategy related matters (Simons, 2000). Diagnostic use related to the use of MCS by all managers to assess current performance, to identify variances and their causes and to take corrective actions to bring strategy implementation back in line with actions required to meet strategic objectives (Simons, 1995).

In summary, the discussions above provide an indication of the knowledge that exists of firm-level competitive and operational strategy and MCS (Langfield-Smith, 2007, 1997). However, this knowledge is increasingly unable to help managers and firms face serious strategic issues in the external environment (Chenhall, 2003). Some of these strategic challenges such as ecological issues related to environmental pollution, climate change and carbon emissions are beyond the capacity of a single firm to manage and require collective actions by firms operating in the same geographic region and industry (Hart, 1996, Shrivastava, 1995). Individual firms are unable to own and control strategic assets (Chesbrough & Appleyard, 2007) that are required to develop operational strategy (Porter, 1991) to manage these significant strategic challenges. Strategic assets such as innovation and research and development (R&D) are no longer limited to individual firms due to the mobility of knowledge workers and capital (Chesbrough, 2003). Some firms are increasingly required to collaborate with other firms to share strategic assets such as R&D to develop information that could be used to develop better strategy to manage these external challenges (Chesbrough, 2003, 2006 & 2007). However, there is limited knowledge on how firms carry out these inter-firm strategy processes (Chesbrough & Appleyard, 2007, Langfield-Smith, 2005). There is a limited understanding of why some firms are incentivised to engage in collaborative strategic activities outside the firm boundary. We know little about the factors that provide the incentives for this

collaboration (Whittington et al., 2011). We have limited understanding of the processes that enable some firms to engage in collaborative strategic activities beyond the firm boundary (Chesborough & Appleyard, 2007). We also have limited understanding of firm capabilities which enable this collaborative strategic activity beyond the firm boundary (Doz & Kosonen, 2010, 2008).

Inter-firm collaboration between firms is not a new phenomenon in the accounting literature (Caglio & Ditillo, 2008, Dekker, 2004, 2003, Hakansson & Lind, 2007). The focus in this stream of research is on understanding the types of inter-firm relationships and on the design of appropriate MCS mechanisms to control these inter-firm relationships. This stream of research has focused on two types of inter-firm relationships: dyadic relationships involving two firms who are buyers and sellers and network relationships involving multiple firms (Hakansson & Lind, 2007). Dyadic relationships focus on how a single firm can manage its inter-firm relationship with another firm who might be a buyer of product or seller of inputs to the principle firm (Dekker, 2004, 2003). The emphasis is to ensure that both parties in the inter-firm relationship share costs and benefits equitably (Dekker, 2004, 2003). Hence, the focus on the design and use of MCS has been on mechanisms that enable these outcomes. A range of MCS and practices have been identified as appropriate mechanisms for use in controlling these relationships including open book accounting, cost information sharing, value chain accounting and social controls such as trust (Dekker, 2004, 2003).

Network relationships, which have been less of a focus in inter-firm collaborations, are more complex and involve multiple firms (Hakansson & Lind, 2007). However, the concept of a network assumes a single firm at the centre of the network controlling the inter-firm relationships for its own purposes such as a global firm controlling its supply chain firms (Hakansson & Lind, 2007, Mahama & Chua, 2005). The focus of the network relationship is also on ensuring that all firms share appropriately in the costs and benefits of the collaboration, with the firm at the centre of the network controlling this focus for its own purposes (Caglio & Ditillo, 2008). Similar to dyadic inter-firm relationships, a range of MCS and practices have been identified as appropriate mechanisms for use in controlling these network relationships including open book accounting, cost information sharing, value chain accounting and social controls such as trust (Hakansson & Lind, 2007).

Firms involved in open strategy processes tend to operate differently to firms involved in dyadic or network relationships (Chesbrough & Appleyard, 2007). In the traditional inter-firm relationship, all firms continue engaging in their own specific and opaque firm-level strategy processes (Caglio

& Ditillo, 2008). Each firm in the dyadic or network inter-firm relationship has retained their own unique competitive and operational strategies (Dekker, 2004, 2003). These firms share strategic assets or information in a limited manner and the basis for the inter-firm relationship is usually to enable the principal firm to acquire missing strategic assets or information from other firms in the inter-firm relationship (Mahama & Chua, 2005).

Open strategy is defined, for this thesis, as a *strategy process with strategic activities that take place beyond the firm boundary and at the inter-firm level.* These strategic activities include the establishment of overarching strategic objectives, experimenting with new ideas, the carrying on of strategic dialogue between managers from different firms to develop new strategic information and the development of collaboration mechanisms to carry out the open strategy process.

According to Chesbrough and Appleyard (2007), multiple firms are involved in this process and their strategy processes are more transparent and open. R&D and innovation has been identified as the key element of the strategy process where strategic activities have been carried beyond the firm boundary (Chesbrough & Appleyard, 2007). This has involved sharing of strategic assets to develop new ideas and information that can be brought back into the firm to improve firm-level operational and competitive strategy processes (Chesbrough & Appleyard, 2007, Chesbrough, 2007, 2006, 2003, Hamel, 1996, Matzler et al., 2014, Newstead and Lanzerotti, 2010, Steiger et al., 2012, Whittington et al., 2011). Chesbrough (2007, 2006 & 2003) has documented how innovation and R&D activities have been a key element of the operations strategy that has been transported outside a firm's boundary and has involved inter-firm collaboration. These relationships are neither dyadic nor network based with a single principal firm dominating the relationship but are more balanced with all firms having similar status in the strategy process (Chesbrough & Appleyard, 2007).

Open strategy processes have been a feature of inter-firm strategy in a number of industries (Chesbrough & Appleyard, 2007, Chesbrough & Crowther, 2006, Huston & Sakkab, 2006) and have involved many different types of firms, large and small. The management literature on open strategy processes has promoted the value of these processes to individual firms, particularly, in their ability to enable firms to share strategic assets to develop operational strategy related information that can be used to inform firm-level strategy processes (Chesbrough & Appleyard, 2007). But, this literature has been silent on *how* and *why* firms enter into open strategy processes and how each firm obtains value and benefits from engaging in these open strategy processes (Chesbrough & Appleyard, 2007, Whittington et al., 2011). There is a limited understanding of the

antecedent factors that provide incentives for some firms to engage in these open strategy processes (Chesbrough & Appleyard, 2007). There is a limited understanding of the processes which firms require to facilitate their engagement in these open strategy processes (Chesbrough & Appleyard, 2007). Finally, there is limited understanding of the meta-capabilitieswhich are required by firms to successfully engage in these open strategy processes (Doz & Kosonen, 2010, 2008). These meta-capabilities[7] are broad organizational attributes that enable the operational pursuits of firms such as open strategy processes. The management accounting literature related to strategy processes has been virtually silent on these issues related to open strategy processes (Langfield-Smith, 2005).

The discussion above has highlighted that our understanding of open strategy processes and their operation, which involve inter-firm relationships are limited (Chesbrough and Appleyard, 2007). Based on this discussion, there are two broad problems. First, we have limited empirical evidence or theoretical knowledge of open strategy processes in the management and strategy and management accounting literatures. Second, we lack an explanatory framework to provide knowledge of the operation of an open strategy process. This framework would include a consideration of the antecedent factors, processes and meta-capabilities related to open strategy processes.

Therefore, this thesis will examine three exploratory research questions to help improve our understanding of open strategy processes. These research questions are:

1. *Why do firms engage in open strategy processes?*
2. *How can management control systems facilitate open strategy?*
3. *How do meta-capabilities influence firms' engagement in open strategy processes*?

The first research question is focused on antecedent factors. These factors are external to the firm (social, technological, ecological, economic and political factors) and have impacts individually and collectively on a firm's strategy processes. The impact of these external factors can be exacerbated by the operational activities carried out by the firm which influence firm-level factors (revenue yields and costs). These external factors can operate as antecedents for some firms to engage in open strategy processes and how and why these factors become antecedents will be theorised and empirically examined. The second research question is focused on collaboration mechanisms. These are the systems and practices that are used by firms to operate the open strategy process. MCS (cultural and administrative systems, planning and measurement systems and

[7] Meta-capabilities are defined in Chapter 2 in more detail.

practices) provide the basis for this collaboration *within* firms and how these systems could be extended outside the firm boundary and used, *between* firms, for inter-firm collaboration will be developed.

Finally, the third research question focuses on meta-capabilities (strategic insight and resource fluidity), which provide a basis for firms to resource their engagement in open strategy processes. How strategic insight is developed and deployed and how resource fluidity is deployed will be explained.

1.3 Research Method

The exploratory nature of the research questions and the limited knowledge available on the research topic provided a sound basis for the research to be undertaken as a field based case study (Yin, 2003). However, the unit of analysis (Yin, 2003) posed a challenge and required some thought and consideration. An open strategy process involves multiple strategic activities, beyond the firm boundary. These activities are carried out by managers from the different firms involved in the process. Hence, the examination of this open strategy process required a setting which evidenced this open strategy making processes. It was important for the researcher to have access to this research setting to interview, review and observe the interactions between managers from different firms as they engaged with the open strategy process. Therefore, the open strategy process itself was considered as the most appropriate unit of analysis for this research study (Yin, 2003).

The study was carried out using an abductive approach (Dubois & Gadde, 2002). In this approach, a conceptual framework is developed and then taken to the field for further development and refinement. This approach is useful when the phenomenon under investigation is not well theorised and the researcher is looking to discover new variables and relationships.

The Australian cotton industry provided an opportunity to conduct this research study. This case setting was made available through a three year industry project between the University of Technology, Sydney and the Cotton Research and Development Corporation (CRDC). In this industry setting, it appeared that different firms[8] and managers have been engaged in open strategy processes and related activities which have provided the basis for development of information which has enabled individual firms to develop and implement operational strategies to achieve their competitive strategies. How this process has been operated and influenced by related firms through

[8] Chapter 3 provides details of the key firms examined.

the interactions of their managers was examined. How MCS elements have been used by these managers to support and enable the open strategy process was investigated.

The field work to collect data was carried out over a two year period, mainly, through four field trips to the main cotton growing regions in New South Wales and Queensland. The period of investigation covered a longitudinal timeline representing 52 years (1962-2014). The preparation for the field trips took around three months. Preliminary background work on understanding the cotton industry and key strategic and operational issues was done through literature reviews, initial semi-structured interviews, review of archival documents including annual reports, strategic plans and research reports. Data collection involved semi-structured interviews, observations and review of archival records. 54 semi-structured interviews were conducted with managers from a range of firms in the cotton industry, providing 59 hours of interview data. Observational data, representing around 34 hours of data collection, was gathered from a range of meetings, workshops and conferences which was attended by the research student. Finally, archival documents (around 300 documents) were reviewed and analysed.

1.4 Contributions of the research

Based on the above discussion, this thesis makes two broad contributions to management accounting theory.

1.4.1 Contribution 1

The first theoretical contribution of this thesis is to introduce open strategy processes to the management accounting literature. By doing so, it fills a gap, in this literature, of our understanding of strategy processes (Langfield-Smith, 2005). The thesis provides knowledge on how firms collaboratively engage in strategic activities beyond the firm boundary.

The contribution to management accounting theory is the conceptual understanding of open strategy processes which "alters our current understanding" of strategy processes (Whetten, 1989, p493). In line with arguments made by Whetten (1989), knowledge of *how* and *why* firms engage in strategic activities beyond the firm boundary provides a theoretically significant extension of knowledge of firm-level strategy processes in the management accounting literature.

1.4.1 Contribution 2

The second theoretical contribution of this thesis is to explicate operation of open strategy processes. This contribution is based on the development of a framework (antecedent factors,

collaboration mechanisms and meta-capabilities) which helps to explain the operation of an open strategy process.

Antecedent factors are external (social, technological, ecological, environmental and political) factors which have individual (as single factors) and collective impacts on firms and provided incentive for firms to engage in open strategy processes. These external factors also impact firms through their effects on firm-level factors (operational activities, revenue yields and production costs). How these factors operate as antecedent factors will be conceptually developed.

Collaboration mechanisms enable the context for firms to engage in cooperation and orchestrate open strategy activities by enabling coordination and resource appropriation. Management control systems and practices will be theorised as operating as collaboration mechanisms, *between* firms, and knowledge will be developed on how these different systems and practices carry out this function. Administrative systems (industry firms, governance mechanisms and procedures and policies) helped to establish the context for collaboration by enabling cooperation between firms to share information and engage in strategic discussions. Cultural systems helped to develop cooperation through shared values and beliefs. Planning and measurement systems helped to coordinate strategic activities and resource appropriation in the open strategy process.

Meta-capabilities (strategic insight and resource fluidity) provide the basis for firms to engage effectively in open strategy processes by financing and resourcing this engagement. A conceptual development of meta-capabilities will be undertaken to develop knowledge of these meta-capabilities and their use. Finally, these three variables will be empirically examined in a field based case study to establish their validity.

This contribution is to management accounting theory and is developed by having a theoretical framework to explain the operation of an open strategy process. The framework and variables provide theoretical knowledge on why firms engage in open strategy processes, how they collaborate and what mechanisms are used to facilitate this collaboration and what meta-capabilities are required of firms to effectively engage in these open strategy processes. This theoretical knowledge deepens the conceptual understanding of open strategy processes in the management accounting literature.

1.5 Structure of the thesis

The thesis is structured in the following manner. Chapter 2 includes a review of the limited research literature on open strategy processes. From this review, a conceptual framework of the open strategy process which forms the basis for the empirical work in the thesis is developed and included in this chapter. This framework forms the basis for the empirical work in this thesis.

Chapter 3 outlines the research method and includes a discussion of the research philosophy, the choice of the case setting, the unit of analysis, the data collection methods, and the data analysis approach.

The conceptual framework developed in Chapter 2 is taken to the field and helps to frame the data collection and analysis. The data for the empirical part of this thesis spans a period of around 52 years, between 1962 and 2014. This time period has been split into three distinct periods for analysis. Chapter 4 includes data for the first period, the Formative Years, covering the years 1962-1990. Chapter 5 includes data for the second period, the Crisis Years, covering the years 1991-2004. Finally, Chapter 6 includes data for the final period, Growth and Consolidation, covering the years 2005-2014. These chapters include a description of the open strategy process within the cotton industry and the strategy and activities of related firms in the industry. How management control systems were designed and used *between* firms, to facilitate collaboration in open strategy activities will be described and explained.

The data chapters (Chapters 4-6) set out the empirical data for this thesis and provide the basis for developing knowledge on open strategy processes. This knowledge is developed and included in Chapter 7. The data and analysis in Chapters 4 to 7 help to develop the conceptual framework and ground it on an empirical basis. The resultant framework can be used in future empirical work. Finally, Chapter 8 contains the thesis summary and conclusions. Limitations of the research study are outlined and suggestions for future research are discussed.

Chapter 2 Conceptual Framework

2.1 Introduction

This chapter contains a conceptual framework for this exploratory research study and also includes a discussion of open strategy processes. The conceptual framework, included in this chapter, is based on the three research questions for this thesis.

The discussion in this chapter commences with a review of the literature on open strategy processes, identifying and describing its key characteristics. This review, included in Section 2.2, provides a basis for identifying specific gaps in our understanding of open strategy processes. The conceptual development included in Section 2.3 focuses on the first research question- *Why do firms engage in open strategy processes?* This question provides a focus on understanding the external factors that, under specified conditions, act as antecedent factors, providing incentives for firm engagement in an open strategy process. The section will include a discussion that defines these factors and an explanation of the conditions under which these factors become antecedents.

Section 2.4 provides a focus on the second research question-*How can management control systems facilitate open strategy processes?* This question relates to understanding how the activities of firms are coordinated and managed in this open strategy process and forms the core of this research study. The conceptual development in this section focuses on defining the management control systems which are designed as industry-level[9] systems that operate *between* firms to facilitate collaboration in these processes. These management control systems are used by firms to establish the context for inter-firm cooperation, to coordinate the different activities carried out by firms and to ensure resource appropriation and sharing. Finally, Section 2.5 is focused on the third research question- *How do meta-capabilities influence firms' engagement in open strategy processes*? The discussion in this section focuses on key meta-capabilities that managers need to resource engagement in open strategy processes. The characteristics of these meta-capabilities will be described and how they operate to provide a basis for firms to engage in open strategy processes will be developed. Section 2.6 provides a summary.

[9] An industry is defined as producer firms making the same product or service and supply firms that provide input services (raw materials, research and development, logistics and other inputs) to these producer firms (Johnson et al, 2005). Industry-level management control systems are defined for this thesis as control systems and practices that operate between firms and at the industry-level. These systems and practices are not restricted to an individual firm.

2.2 Open strategy processes

This section includes a discussion of open strategy processes. First, strategy processes at the firm-level are briefly discussed. This discussion provides a basis to introduce the organizational processes (research and development and innovation processes) that operate as a foundation to open strategy processes. The section will conclude with a conceptual description of open strategy processes.

As discussed in Chapter 1, strategy has been investigated as a firm-level phenomenon with a firm developing a competitive strategy which is implemented through an aligned operational strategy (Langfield-Smith, 2007, 2005, 1997; Porter, 1991, 1985, 1980). The operational strategy is represented by operational activities which are organized into the value chain of the firm (Porter, 1991). These operational activities form the core part of the operational strategy which enables the firm to implement actions designed to achieve the competitive strategy and build competitive advantage (Langfield-Smith, 2007, 1997). Therefore, how well these operational activities are designed and executed have a direct and important impact on a firm's competitive advantage and performance.

Strategy researchers (Barney et al., 2001; Johnson et al., 2005; Porter, 1991, 1985, 1980; Teece, et al., 1997) have long argued that the ability of a firm to own and control strategic assets[10] confers a competitive advantage to the firm over its rivals. These strategic assets, by providing the ability to develop new information for products and services, operate as a barrier to entry for rival firms, securing the incumbent firm with a long-term performance advantage (Chesbrough & Appleyard, 2007).

The inability of a firm to own and control strategic assets such as R&D and innovation has provided incentives for firms to collaborate by sharing and pooling these strategic assets to leverage the benefits from this collaborative use (Chesbrough, 2003). According to Chesbrough (2007, 2006, 2003), traditional R&D and innovation processes operated as a "closed model" to support firm-centric strategy processes and were designed to provide individual firms with this competitive advantage. However, a range of issues in the operating environment of the firm have combined to create a need for firms to rethink this "closed model" for R&D and innovation.

The challenges to the 'closed model" for R&D and innovation arise from a range of issues. Firm and industry boundaries are themselves shrinking through digitalisation (the increased use of

[10] Chesbrough & Appleyard (2007) define strategic assets as operational level processes and activities such as R&D and innovation and commercialisation skills.

technology to share information to breakdown industry barriers), globalization and deregulation which have combined to provide a greater distribution of strategic assets across many different types of firms making it harder for any one firm to own and control all these assets required to successfully compete (Chesbrough & Appleyard, 2007, Doz & Kosonen, 2010, 2008, Porter, 1985, 1980). Shorter product lifecycles and rising development costs have also built the business case for firms to be more open in their R&D and innovation processes (Chesbrough, 2007, 2006, 2003).

An open R&D and innovation process is defined by Chesbrough (2006, p1) as "the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand markets for external use of innovation". This process assumes that firms can use external ideas as well as internal ideas and internal and external paths to market as they look to advance their technology (Chesbrough, 2007, 2006 & 2003, Jorgensen & Messner, 2010). External ideas can be brought in for development and internally developed ideas can be taken out to market for value capture. External ideas and external paths are placed on the same level of importance for value creation and capture as internal ideas and paths. Bringing in external ideas captures the idea in the product innovation literature (Jorgensen & Messner, 2010) that customers are an important source of innovative ideas. This process enables the organizational business model to create value and to capture a portion of that value for the firm (Chesbrough, 2007, 2006 & 2003).

An open R&D and innovation process manifests through three approaches which are interrelated (Chesbrough, 2007, 2006, 2003, Dahlander & Gann, 2010, Enkel et al., 2009, Lichtenthaler, 2011): inbound, outbound and combined. Inbound open R&D and innovation is an outside-in approach where a firm opens up its innovation process to knowledge exploration from sources outside a firm. Huston and Sakkab (2006) provide evidence of how Proctor and Gamble, a global firm providing consumer goods (e.g. detergents and washing liquids) sources more than fifty per cent of their new product ideas from outside the firm, from firms and individuals who are willing to engage in open R&D and innovation. Collaboration mechanisms such as a shared website have been used to encourage these firms and individuals to share ideas and information (Huston & Sakkab, 2006).

Outbound open R&D and innovation is an inside-out approach which focuses on knowledge exploitation from within the firm (Chesbrough, 2003). Innovations developed within the firm are taken out to external parties for licencing and revenue building. Chesbrough and Appleyard (2007) provide evidence of technology firms such as IBM using this approach to develop software which are then taken outside and licenced for use by other firms. A combined approach to open R&D and innovation is when firms combine inbound and outbound approaches (Chesbrough, 2003). New

ideas for products and services are developed internally and from outside the firm, through collaborations with other firms and managers (Chesbrough, 2003). A particular focus of this combined approach is external knowledge retention where knowledge is retained through inter-firm relationships (Huston & Sakkab, 2006).

Open R&D and innovation processes operate through three key constructs: knowledge exploration, knowledge retention and knowledge exploitation (Chesbrough, 2007, 2006, 2003, Cohen & Levinthal, 1990, Lichtenthaler, 2011, Lichtenthaler & Lichtenthaler, 2009, Zahra & George, 2002). At the firm-level, knowledge exploration refers to generating new knowledge within the firm or acquiring new knowledge from outside the firm (Lichtenthaler & Lichtenthaler, 2009). Internal knowledge generation focuses on the firm's inventive capacity and involves the development of new ideas and integrating these ideas with existing knowledge to develop new inventions (Lichtenthaler & Lichtenthaler, 2009). External knowledge exploration focuses on absorptive capacity of the firm to acquire new knowledge from external sources and assimilating this new knowledge by means of incorporating this knowledge into the firm's knowledge base to enable development of new inventions (Lichtenthaler & Lichtenthaler, 2009).

Knowledge retention at the firm-level refers to activities carried out to maintain and activate access to knowledge for developing inventions (Lichtenthaler& Lichtenthaler, 2009). Internal knowledge retention is focused on a firm's transformative capacity where resources are allocated to maintain knowledge for exploitation. External knowledge retention focuses on the firm's connective capacity to build and maintain inter-organizational relationships which help to retain knowledge for future exploitation. Strategic alliances are an example of an inter-organizational relationship which a firm can use to retain knowledge for exploitation (Huston & Sakkab, 2006).

Finally, knowledge exploitation at the firm-level refers to activities that a firm carries out to take knowledge developed and acquired to develop new products and services for building revenue (Lichtenthaler & Lichtenthaler, 2009). Knowledge exploitation includes activities such as internal innovation and design of products and licensing of intellectual property (IP) to enable the firm to build new revenues from open innovation. Through innovative and desorptive capacities, a firm can exploit its knowledge base to create and capture value from its open R&D and innovation process (Lichtenthaler & Lichtenthaler, 2009).

As discussed above, the open R&D and innovation process provides a foundation for open strategy processes (Chesbrough & Appleyard, 2007, Whittington, et al., 2011). R&D and innovation

activities form part of the firm's value chain of operational activities which consolidate into the firm's operational strategy (Porter, 1991). The open R&D and innovation process and related activities provide the basis for new information which a firm is able to bring back inside the firm to develop and fine tune its operational strategy to enable the achievement of its competitive strategy (Langfield-Smith, 2007, 1997, Porter, 1991).

Chesbrough and Appleyard (2007) describe two key constructs for open strategy: open invention and open coordination. Open invention refers to the use of pooled knowledge from different contributors to generate new ideas for products and operational activities. Open invention takes place through knowledge exploration, knowledge retention and knowledge exploitation which are open R&D and innovation activities carried out by firms. Through open invention, open strategy processes include the open R&D and innovation processes which provide the source of new information that firms are able to utilise to create value, enabling firm-level strategy processes (Chesbrough & Appleyard, 2007).

Open coordination refers to mechanisms that enable collaboration between firms as they carry out open invention activities. These mechanisms help to build consensus and cooperation between employees of firms, help to coordinate activities related to knowledge exploration, knowledge retention and knowledge exploitation and manage resource appropriation between firms to carry out open strategy activities (Caglio and Ditillo, 2008). As described by Chesbrough and Appleyard (2007, p64), "a critical element to coordinating the value created through open inventions is some underlying architecture that connects the different pieces of knowledge together". Open coordination ensures that the value created through the open R&D and innovation processes, which form part of the open strategy processes, is captured by individual firms involved in the overall processes.

Open strategy processes are poorly defined in the management and strategy literature (Chesbrough & Appleyard, 2007). The call for more transparent and inclusive strategy processes is not entirely a new approach and the call to open up strategy formation, within the firm, has been around for some time (Hamel, 1996). Focusing on the firm-level strategy process, Hamel (1996) argued that "the capacity to think creatively about strategy is distributed widely in an enterprise" (p76) and that "...an open ended and inclusive process of strategy creation substantially lessens the challenge of implementation" (p 82). Whittington et al. (2011) have broadened this call for transparency and inclusiveness by extending these strategy processes beyond the firm boundary.

Open strategy appears to provide an improved approach to understanding strategy formation in modern firms (Chesbrough & Appleyard, 2007, Newstead & Lanzerotti, 2010, Whittington et al., 2011). The leading proponents of open strategy processes (Chesbrough & Appleyard, 2007) point to examples of this openness in strategy formation including the existence of collaborative clusters of firms and communities as evidence for the need to reconsider firm-level strategy processes. Open strategy processes have been observed in different types of industry settings (Chesbrough & Appleyard, 2007). These industry settings include technology, life sciences, aerospace, medical devices and consumer packaged goods (Chesbrough & Crowther, 2006, Huston & Sakkab, 2006). However, the open strategy processes and how it operates has not been clearly described and explained.

Open strategy processes appear to be more focused on operational strategy processes with firms opening up operational strategy processes such as R&D and innovation to collaboration with other firms in the industry (Chesbrough & Appleyard, 2007). This inter-firm collaboration involves the sharing of strategic assets to develop new information that can be further developed into new products and services within firms (Chesbrough, 2007, 2006, 2003, Hamel, 1996, Matzler et al., 2014, Newstead & Lanzerotti, 2010, Steiger et al., 2012).

Consequently, open strategy is defined, for this thesis, *as a strategy process consisting of strategic activities that are carried out beyond the firm boundary and at the inter-firm level* (Chesbrough & Appleyard, 2007). This has involved sharing of strategic assets to develop new ideas and information that can be brought back into the firm to improve firm-level operational and competitive strategy processes (Chesbrough & Appleyard, 2007, Chesbrough, 2007, 2006, 2003, Hamel, 1996, Matzler et al., 2014, Newstead and Lanzerotti, 2010, Steiger et al., 2012, Whittington et al., 2011). Open strategy processes are built on the foundation provided by open R&D and innovation processes which involve firms collaborating to share strategic assets to develop new information which can be brought back inside the firm to use in firm-level strategy processes (Chesbrough, 2007, 2006 & 2003). Strategic ideas come externally from customers, suppliers and internally from managers within firms and provide the basis for open strategy processes (Jorgensen & Messner, 2010).

While, this general understanding of open strategy processes is useful, there is limited understanding of these processes in three important areas. First, why do firms engage in open strategy processes? The management and strategy literature has defined and identified external factors in the operating environment of a firm that are important considerations for strategy

development and implementation at the firm-level (Johnson, et al., 2005, Porter, 1985,1980). These factors include economic issues (e.g. rising costs of R&D, shorter product lifecycles) and ecological issues (e.g. carbon pollution). If and how these factors operate as antecedents for open strategy processes and under what circumstances is less well understood.

Second, how can management control systems facilitate open strategy processes? The focus of this question is on how the open strategy process is conducted and how collaboration between firms is achieved (Chesbrough & Appleyard, 2007). This question relates to the mechanisms that are required to enable firms to develop cooperation, to coordinate their open strategy activities and to enable appropriate resource appropriation and sharing between firms involved in the open strategy process. Existing accounting research into strategy and MCS has developed a body of knowledge on the processes involved in enabling firm-level strategy processes (Chenhall, 2003, Langfield-Smith, 2007, 1997, Simons, 1995). MCS are involved as key mechanisms supporting firm-level strategy processes and may have a role in supporting inter-firm strategy processes (Langfield-Smith, 2005). However, very little is known about if and how open strategy processes, operating at the inter-firm level, are supported and what mechanisms are used to enable these processes (Langfield-Smith, 2005). The use of MCS in inter-firm relationships related to open strategy processes is underspecified (Langfield-Smith, 2005).

Finally, how do meta-capabilities influence firms' engagement in open strategy processes? This question focuses on the resources required to enable managers to successfully engage in open strategy activities (Doz & Kosonen, 2010, 2008). There is a limited understanding of these meta-capabilities at the firm-level (Chesbrough & Appleyard, 2007). Furthermore, there is also a limited understanding of the mechanisms involved in deploying these meta-capabilities to facilitate the firm engagement in open strategy processes. These three questions and related issues provide a basis for the conceptual framework which will be developed in the rest of the chapter to carry out this exploratory research study.

In summary, open strategy processes consist of strategic activities that are carried out beyond the firm boundary and involve collaboration between multiple firms and managers (Chesbrough & Appleyard, 2007). While, the content of the open strategy process is not entirely different to the traditional firm-level strategy process (Johnson, et al., 2005), the *context* of the strategy process at the inter-firm level is different and poses challenges for firms (Chesbrough & Appleyard, 2007). These process challenges relate to understanding why firms engage in these strategic activities beyond the firm boundary, understanding the collaboration mechanisms that are used by firms to

engage in these open strategy processes and the resources (meta-capabilities) required to facilitate the open strategy process engagement. These issues are discussed in the remainder of this chapter.

2.3 Antecedents for open strategy processes

This section has a focus on conceptual development of constructs to provide the basis to answer the research question-*Why do firms engage in open strategy processes*? The discussion includes an examination of external factors in the operating environment and how and why they have the potential to provide incentives for firms to engage in open strategy processes. The management and strategy literature has identified a range of these factors that are relevant and this discussion will be based on these factors.

Strategy researchers have argued that a firm needs to manage external factors in its operating environment to be able to craft an appropriate competitive and operational strategy to build firm performance to create competitive advantage (Johnson, et al., 2005). External factors relate to industry level items such as ecological, technological and social issues which create major impacts on a firm (Hart, 1996, Johnson, et al., 2005). These external factors impact a firm directly and also by influencing internal firm factors such as availability of appropriate strategic assets, revenue yields and production costs which a firm also needs to manage to create and implement strategy (Chesbrough, 2007, 2006, 2003). These external factors have been identified as having important impacts on a firm's decision to engage in open strategy process as their contingent effects are of a magnitude which is beyond the strategic capability of an individual firm (Chesbrough, 2003, Martin & Scott, 2000, Shrivastava, 1995). Both sets of factors will be described and thereafter, their contingent effects and the consequences of these effects will be discussed.

2.3.1 External factors

As discussed above, there are five external factors, at the industry level, that are important for a firm to consider when developing and implementing strategy (Johnson et al., 2005). These factors relate to Socio-cultural issues, Technological issues, Ecological issues, Economic issues and Political issues. Collectively, these industry level factors are referred to by the acronym, STEEP. The STEEP factors are not independent of each other but are linked and produce joint impacts on a firm (Johnson et al., 2005). These factors need to be identified and their impacts understood in the present and also in the future. It is also important to understand the differential impact of these factors, on their own and in combination with other factors, for firms in different industries (Porter, 1980 & 1985).

Socio-cultural factors are an important industry-level factor that influences strategy (Johnson et al., 2005). These factors are related to people resources, perhaps, the most important resource that a firm uses to develop and implement strategy. These socio-cultural factors relate to items such as population demographics, income levels and distribution, skills and education, social mobility of labour, lifestyle changes, attitudes to work and leisure and consumerism. These factors have an influence on the types of customers and their buying behaviours and on the type of employees and their capabilities which have impacts on how a firm develops and implements strategy (Carpenter & Sanders, 2009).

Technological factors relate to the influence of different types of systems and technologies on the strategy of a firm (Carpenter & Sanders, 2009). Technological factors have become an important element of a firm's environment in recent years and have provided a basis for creativity and innovation within firms in an industry. Technological factors relate to items such as new types of technologies including social-media systems and platforms, rates of new technology adoptions, new inventions, rates of obsolescence of current technologies and research and development investment and competencies (Chesbrough & Appleyard, 2007). These technological factors influence a firm's strategy by impacting on how the firm develops its operational activities which facilitate the implementation of strategy. New technologies facilitate the design of improved products and services which have the ability to reduce costs and increase yields and profit margins.

Ecological factors are the defining strategic challenge for firms in many industries (Johnson, et al., 2005, Hart, 1995). Ecological factors related to air and water pollution, toxic emissions, chemical spills and industrial accidents have posed serious challenges to firms in industries as diverse as agriculture, manufacturing, aerospace, mining and energy firms in different parts of the world. Natural resources such as animal and plant species on water and land, soil-based minerals and other scarce and non-replenishable resources have been consumed at rates that far exceed sustainable levels of consumption (Hart, 1995, Shrivastava, 1995). Many important ecological systems are at the risk of being permanently destroyed and unavailable for use by future generations. These ecological factors pose a strategic challenge to firms as they threaten their "social licence to operate" but also impose higher economic costs through their impact on economic factors such as access to resources and socio-cultural factors such as attitudes of customers and staff (Hart, 1995, Shrivastava, 1995). These ecological factors also have an impact on firm-level factors such as production efficiency and costs (Carpenter & Sanders, 2009).

Economic factors that impact on a firm's strategy include items such as national and regional gross domestic product (GDP), general interest rates, input resource access and costs, levels of unemployment, disposable income levels and inflation rates (Carpenter & Sanders, 2009, Johnson, et al., 2005). These economic factors affect the availability and impact of other industry-level factors such as socio-cultural factors on a firm's strategy. These economic factors also impact firm-level factors. Higher input resource costs and access issues impact on production efficiencies and costs at the firm-level (Hart, 1995, Shrivastava, 1995).

Finally, political factors are important for a firm's strategy (Johnson, et al., 2005). Political factors such as taxation policy, government funding for research and development and innovation, competition policy, laws relating to employment, occupational health and safety and product safety impact on a firm's strategy by establishing rules and regulations that specify how operational activities are designed and implemented to achieve strategic objectives. Together with ecological factors, political factors provide a basis for legitimate business activity for a firm which influences how strategy is developed and implemented (Carpenter & Sanders, 2009).

2.3.2 Internal firm-level factors

External factors (e.g. ecological and economic factors) have contingent impacts on firm-level factors (Johnson et al., 2005). There are two types of factors at the firm-level that are important. First, value chain costs which relate to the cost of producing and making available products to customers (Chesbrough, 2003, 2006 & 2007). High input costs for resources have an impact on a firm's strategy by reducing the capability of the firm to acquire and use relevant resources to make products that are of a relevant level of quality (Chesbrough, 2003). Higher costs within the value chain of the firm relating to operational activities such as research and design, production, operations, marketing and sales have a negative impact on yields and increase product costs and squeeze product margins. Second, market share and revenue have an ability to influence a firm's strategy (Carpenter & Sanders, 2009). Lower market share provide a lower volume of customers and reduce revenues which impacts on a firm's strategy. Higher costs, particularly in relation to new product development, impact on the number and quality of products provided by the firm as the firm is unable to replace obsolete products on a timely basis (Chesbrough, 2003). This issue has an adverse impact on market share growth and revenues. Revenues maybe further depressed by competitive pressures that force the firm to discount selling prices to retain existing market share (Chesbrough, 2006, 2003).

2.3.3 Contingent effects of external and internal factors

The external and internal factors produce contingent effects on a firm's strategy processes (Chenhall, 2003). Traditionally, strategy researchers have argued that individual firms can craft and implement strategy to manage these contingent effects in order to enable the firm to build performance and competitive advantage (Johnson et al., 2005). However, the empirical evidence of open strategy processes involving multi-firm collaborations would suggest that individual firms are no longer capable of managing these contingent effects on their own (Chesbrough & Appleyard, 2007, Huston & Sakkab, 2006).

The external factors have impacts individually and collectively on the firm's strategy (Johnson et al., 2005). Ecological factors such as chemical pollution and degradation of natural ecosystems impact on a firm by reducing production yields and increasing costs (Hart, 1995, Shrivastava, 1995). These factors may be exacerbated by operational activities of individual firms such as production related activities that use harmful chemicals which discharge into the natural environment around the firm. These ecological factors influence socio-cultural and political factors by creating pressure for community lobbying for greater regulation and through government policy changes that tighten laws relating to the environment. Ultimately, these ecological factors, if unchecked, create a threat to the firm's "social licence to operate" (Hart, 1995, Shrivastava, 1995).

The ecological factors also combine with economic factors at the industry-level to impact on a firm's strategy (Carpenter & Sanders, 2009). The ecological factors increase the economic costs on the firm in relation input resources and through reduced production yields (Chesbrough, 2003, 2006). The firm's products may produce dwindling yields which affect the firm's revenue growth and profit margins. The higher economic costs increase production costs for the firm which also leads to a squeeze in margins (Chesbrough, 2003).

While, these external factors, contingently, impact on the firm and threaten its ability to develop and implement strategy to build firm performance and competitive advantage, the ability of individual firms to manage these impacts with strategic assets that they own and control is also argued to be limited (Chesbrough & Appleyard, 2007, Huston & Sakkab, 2006). This might be particularly problematic if the firms are small operating units with limited strategic assets (Martin & Scott, 2000). Even if a firm owned strategic assets which could be used to manage these impacts at the firm-level, the broader ecological issues are unlikely to be resolved by the actions of a single firm (Shrivastava, 1995). As these external factors are, likely, to be common to other firms within the industry, there is a strategic imperative for firms to collaborate to manage these external factors

(Martin & Scott, 2000). Firms are incentivised to share strategic assets such as research and development capabilities to develop new information to resolve these strategic impacts (Chesbrough, 2007, 2006 & 2003). Therefore, when firms face external factors that have significant and common impacts on all firms and when these impacts are exacerbated by the operational activities of the firms (which lead to higher production costs and reduced revenue yields) and the firms do not own adequate amount of strategic assets to manage these external factors, these external factors are transformed into potential antecedents factors for firms to engage in open strategy processes.

2.4 The processes used in open strategy: Collaboration mechanisms

This section includes a discussion of collaboration mechanisms that enable open strategy processes. This enablement is based on the establishment of the contextual conditions for collaboration and the provision of mechanisms to coordinate strategic activities and to ensure these activities are carried out in the right sequence, are resourced and supported and the new information developed is captured, retained and shared appropriately. Appropriate mechanisms are required to provide the basis for this collaboration. Management control systems (MCS) have traditionally provided a basis for this collaboration within firms (Malmi & Brown, 2008) and how these systems can be used, *between* firms, in open strategy processes will be discussed.

According to Chesbrough and Appleyard (2007), "open coordination" is an important activity for the conduct of open strategy processes. Open coordination is based on mechanisms that enable collaboration between firms in the open strategy process: "a critical element to coordinating the value created through open inventions is some underlying architecture that connects the different pieces of knowledge together" (Chesbrough & Appleyeard , 2007, p64). These mechanisms help to build consensus and cooperation between employees of firms, help to coordinate activities related to knowledge exploration, knowledge retention and knowledge exploitation and manage resource appropriation between firms to carry out R&D and innovation activities that enable the open strategy process (Caglio & Ditillo, 2008).

These inter-firm collaboration mechanisms enable open strategy processes in two ways: establishing the context for firms to engage in these processes and providing for the control practices that enable open strategy (Chesbrough & Appleyard, 2007, Flamholtz, et al., 1985). First, collaboration mechanisms provide the basis for the context for open strategy processes. The context for open strategy refers to establishing the values, culture and the forums that enable and encourage managers from different firms to engage in strategic dialogues, to share information and ideas, to

experiment with new ideas through R&D and to develop new information which can be used in strategy formation and implementation (Flamholtz, et al., 1985). Malmi and Brown (2008) have described how value systems are used within a firm to enable collaboration. These value systems can also be used *between* firms. Second, collaboration mechanisms also facilitate the activities within the open strategy process. Malmi and Brown (2008) have described how control practices such as planning and measurement facilitate strategic activities within a firm. These control practices can also be used, *between* firms, to facilitate open strategy processes. For example, managers may collaborate to plan R&D projects which facilitate the development of new information; managers may use an environmental audit to measure the impact of current operational activities on the external environment.

In the management accounting literature, MCS have been identified as mechanisms that provide a basis for aligning managerial behaviours and efforts aimed at achieving strategic objectives (Chenhall, 2003, Flamholtz, et al., 1985, Brown, 2005, Malmi & Brown, 2008). These mechanisms are designed to manage three types of control problems that managers face in a firm: providing strategic direction, motivating staff and developing competent staff (Merchant & van der Stede, 2012). A range of control mechanisms are described in the management accounting literature but Malmi and Brown (2008) provide a useful specification of these MCS which are relevant for this thesis as they provide specific mechanisms that support collaboration. These MCS include planning systems and practices, measurement systems and practices, administrative systems and cultural systems. Flamholtz et al. (1985) provide a description of how these MCS are used to establish the context for collaboration and how these control systems and practices are used to enable collaboration.

Open strategy processes involving inter-firm relationships provide fresh challenges in terms of managing the various interactions between firms involved in these processes. Research on inter-firm relationships and the role of MCS in controlling these relationships is a growing area of interest and focus in the management accounting literature (Caglio & Ditillo, 2008, Dekker, 2004, 2003, Hakansson & Lind, 2007). The focus in this stream of research is on understanding the types of inter-firm relationships and on the design of appropriate MCS mechanisms to control these inter-firm relationships. There are two types of inter-firm relationships: dyadic relationships involving two firms who are buyers and sellers and network relationships involving multiple firms (Hakansson & Lind, 2007).

The principal focus of the management accounting literature on inter-firm relationships and MCS has been on the dyadic relationship involving two firms, usually a buyer and seller (Dekker, 2004, 2003, Hakansson & Lind, 2007). The emphasis has been on understanding how best to control the ability of each member of dyad to cooperate and share resources to achieve strategic goals that are unique to each firm in the relationship. This focus has led to the investigation of what types of structures are appropriate for the inter-firm relationship (e.g. joint ventures or alliances) and therefore what MCS should be designed and used (Dekker, 2004, 2003, Hakansson & Lind, 2007). Each firm in the relationship has retained their own unique competitive and operational strategies (Dekker, 2004, 2003) and has operated as a "tenant in a shopping centre" with interactions limited to securing information specific to their individual needs. Networks have had a limited focus in the management accounting literature which has investigated inter-firm relationships (Hakansson & Lind, 2007). Networks are based around multiple relationships held by firms usually involved in a supply chain relationship (Hakansson & Lind, 2007). These networks are also established around a single firm which operates at the centre of the network (Mahama & Chua, 2005).

A range of MCS and practices have been identified as appropriate mechanisms for use in controlling both types of inter-firm relationships including open book accounting, cost information sharing, value chain accounting and social controls such as trust (Dekker, 2004, 2003). These control solutions have been designed to provide each firm in the inter-firm relationship with control to protect individual rights while securing benefits from its participation in the relationship (Hakansson & Lind, 2007). For example, the MCS practice of open book accounting provides all firms in the inter-firm relationship with information on activities and resource usage to ensure all participants are making equivalent contributions and reaping similar benefits. These practices are not designed to enable broader and open collaboration between these firms to build new information that could be used in strategy processes (Caglio & Ditillo, 2008, Hakansson & Lind, 2007). Multiple, open and parity-based inter-firm relationships where there is no single dominant firm in the relationship have had a limited focus in this stream of research (Caglio & Ditillo, 2008).

The management accounting literature on inter-firm relationships and MCS has focused on the type of relationship structures and the control solutions appropriate for these relationships (Caglio & Ditillo, 2008). While, this literature has examined issues related to strategy such as how control systems and practices are used in value chain systems (Mahama & Chua, 2005), there has been a very limited focus on examining inter-firm or open strategy processes (Langfield-Smith, 2005).

This limitation provides a basis for this research study to examine how these open strategy processes are enabled by MCS systems and practices.

According to Chesbrough and Appleyard (2007), an open strategy process involves multiple firm relationships where there are no individual firms dominating the relationship and therefore, collaboration mechanisms are required to manage this process for the benefit of all firms. In their discussion, there is an implicit suggestion that a focus on control problems maybe more relevant to develop the collaboration mechanisms required to enable the open strategy process. The focus on control problems provides a basis to define and develop appropriate collaboration mechanisms to help manage these problems to obtain outcomes (Caglio & Ditillo, 2008). This line of inquiry would build off the focus within a firm where control problems have been used to help design appropriate MCS mechanisms (Merchant & van der Stede, 2012).

Caglio and Ditillo (2008) identify three specific control problems which are important and relevant for open strategy processes (Chesbrough & Appleyard, 2007): cooperation, coordination and resource appropriation. Open strategy processes which involve multiple firms interacting to share strategic assets to develop information for use in operational strategy development require firms and managers to *cooperate* and align their individual strategic objectives to ensure the collaboration provides benefits to all and that resources are shared appropriately. Firms involved in an open strategy process need to *coordinate* the activities required to develop new information, to ensure resourcing of these activities are scheduled and that mutual benefits are realised as planned. This coordination needs to span firm boundaries. Finally, firms involved in the open strategy process need to ensure that *resource appropriation* takes place in a manner that is appropriate and that these resources are not misappropriated by firms to the detriment of other firms in the open strategy process.

2.4.1 Collaboration mechanisms-Establishing the context for cooperation

The work of Flamholtz (1996) and Flamholtz et al. (1985) focused on establishing a context for collaboration within a firm but provides a basis for understanding how cooperation problems can be managed in inter-firm collaborations. MCS mechanisms such as administrative systems and cultural systems provide a basis for establishing a context for collaboration which facilitates inter-firm collaboration (Flamholtz, 1996, Flamholtz et al., 1985). Administrative systems such as firm structures and design, governance mechanisms related to workshops, conferences and committees and procedures and policies provide platforms that enable firms and managers to engage in open strategy process activities (Malmi & Brown, 2008). Cultural systems such as values, symbols and

clans provide a basis for enabling a culture of collaboration which facilitates open strategy processes (Malmi & Brown, 2008). These systems will be described first, and then how they operate to enable the context for collaboration *between* firms will be discussed.

Administrative systems-firm structure and design

Administrative systems such as firm structure and design (Abernathy & Chua, 1996, Alvesson & Karreman, 2004) provide a basis for organizational mechanisms which enable specific activities related to open strategy processes. These structures provide a basis for networks and relationships to be established and for functional specialisation (Malmi & Brown, 2008). Individual firms and managers will find the task of establishing networks and relationships onerous and challenging if required to undertake this task on their own. Even if this task is undertaken by individual firms, the networks and relationships that result from this individualistic approach might be limited and incomplete. However, when firm structures and design are established collaboratively, they function as platforms for networks and relationships (Malmi & Brown, 2008).

In order to set the context for open strategy processes, firm structure and design can be used creatively to encourage collaboration and cooperation (Abernathy & Chua, 1996, Malmi & Brown, 2008). First, a firm that functions as the representative firm for the industry can be established, providing a basis for fashioning the strategic direction for all firms and providing policy and advocacy capability (Flamholtz, 1996). This representative firm provides a platform to raise the collective voice of all participant firms, providing scale to individual firms to raise and discuss strategic issues and actions to manage these issues which are beyond the capability of single firms. This representative firm also plays a key role in directing effort in relation to strategic R&D which is a key strategic asset in open strategy processes which is pooled and shared by all firms participating in the open strategy process. A key function in relation to strategic R&D assets is the prioritising of R&D projects and their outcomes and developing new information and mechanisms that can be made available to individual firms.

Second, a representative firm that acts as the "banker" managing the shared investment pools of capital and people resources that are used to carry out activities would be useful in relation to the context for open strategy processes (Doz & Kosonen, 2010, 2008). This representative firm receives capital funds contributed by individual firms, aggregates these funds with funds contributed by government and other private sources and manages the consolidated investment pools.

Finally, in helping to establish the context for open strategy processes, firm structure and design can be used to encourage firms with resource skills related to carrying out R&D projects (Doz & Kosonen, 2010, 2008). The "banking" representative firm can be involved in establishing resource pools relating to people with R&D skills who can be allocated to conduct R&D projects determined by firms involved in the open strategy processes. Furthermore, specialist firms, which are essentially R&D supply firms who contract out their resources and competencies to carry out R&D projects, can be established. People resources in these specialist firms have specific technical skills and competencies in R&D in specific areas which are aligned to the strategic issues in the operating environment. An example would be a specialist R&D firm with skills and competencies to carry out R&D projects related to ecological issues such as ecosystem pollution and degradation.

Administrative systems-governance mechanisms

Governance mechanisms provide a basis for open strategy processes by enabling a context that encourages inter-firm collaboration (Abernathy & Chua, 1996, Malmi & Brown, 2008). Governance mechanisms such as workshops, conferences and committees provide a basis for cooperation in open strategy processes by instituting formal and informal lines of authority and accountability to guide managerial behaviours (Abernathy & Chua, 1996, Malmi & Brown, 2008). The shared agenda developed by managers as part of the collective commitment to open strategy processes provides a basis for these mechanisms to enable cooperation. Governance mechanisms provide a basis for managers to span firm boundaries to establish networks and relationships to coordinate their operational activities and are particularly, relevant for open strategy processes.

Workshops are meetings of small groups of managers, either on a regular or ad-hoc basis, which are established to focus on specific issues. These workshops have an agenda which provides the focus and guidance for the issues to be raised, the information to be shared, the discussions held and decisions made (Malmi & Brown, 2008). The agenda also provides a basis for determining attendance and participation. The chair of the workshop also has a pivotal role in ensuring the agenda is used to frame and guide the conduct of the meeting and to completing the agenda.

Conferences are similar to workshops but involve a larger group of managers and have a broader agenda. The shared agenda can be more exploratory including strategic issues which are still being experimented with using strategic R&D projects. The range of issues on the agenda could be used to develop strategic sensitivity of managers in firms in order to focus open strategy collaboration on strategic issues which are still on the horizon as opposed to specific strategic issues that require strategic foresight and strategic insight for immediate actions. The conference could also include

smaller forums which focus on the outcomes of specific R&D projects which provide a basis for new information that can be used in the short-term to resolve particular strategic issues (Malmi & Brown, 2008).

Finally, administrative governance mechanisms such as committees are important for establishing the context for open strategy processes (Abernathy & Chua, 1996, Malmi & Brown, 2008). These committees are formal mechanisms for governance and consist of two types: management committees and special-purpose committees. Management committees include boards of directors and executive committees which are governance mechanisms within firms which set strategic direction, provide management and governance oversight by guiding and monitoring development and implementation of strategy and provide annual reporting and information to external and internal stakeholders. These management committees provide a basis for managers to develop strategic insights through interactions with external managers and firms and by sharing information and ideas with these managers and firms (Doz & Kosonen, 2010, 2008).

Administrative systems-procedures and policies

Procedures and policies are MCS mechanisms (Malmi & Brown, 2008, Simons, 1987) that provide a basis for the context for open strategy processes. A key contextual role that these mechanisms undertake is to provide a basis for sharing new information as described by Chesbrough and Appleyard (2007, p64): "a critical element to coordinating the value created through open invention is some underlying architecture that connects the different pieces of knowledge together". Procedures and policies are bureaucratic ways to specifying behaviour and processes and include best practices and operating activities (Malmi & Brown, 2008, Simons, 1987). Best practices reflect procedures and policies that have been developed from examining similar procedures and policies in different organizations and industries and from research and development projects. As these best practices are distilled into procedures and policies and diffused to managers in individual firms, they are able to influence individual operating activities. Managers are able to benchmark their operational activities against these best practice based procedures and policies and are able to identify areas where improvements can be made. These procedures and policies provide guidance for open strategy development and implementation by specifying changes to operational activities at the firm-level.

Cultural systems

Cultural systems provide a basis for managers to establish a context for open strategy processes. Cultural systems comprise values, symbols and clan based systems (Malmi & Brown, 2008,

Simons, 1995). Value systems represent beliefs which provide direction and purpose and impact the behaviours of managers. These values are established and communicated through mission and vision statements and in statements of principles established by firms within an industry. These values influence behaviour by encouraging managers to exhibit similar values, to realign their beliefs and to carry out operational activities in accordance with these values (Alvesson & Karreman, 2004). Values are institutionalised through belief systems (Simons, 1995). Values impact on three levels: individuals are recruited with similar values, employees are socialised and have their values changed to fit firm values and employees are encouraged to behave in accordance with the firm values.

Symbol based systems are visible expressions such as common work places, co-location and dress codes which help to develop a specific culture. Clan based systems are professional groups that exist which have their own values and beliefs, which are aligned to broader belief systems (Malmi & Brown, 2008, Simons, 1995).

Establishing the context for collaboration

The context for open strategy processes are usually established by visionary managers who have a heightened sense of strategic sensitivity which is based on values related to open collaboration and cooperation (Doz & Kosonen, 2010, 2008). These managers in individual firms espouse values that regard other firms and managers as partners, not only competitors. These managers have strategic foresight to understand the impact of strategic issues related to industry-level and firm-level antecedent factors but they also have strategic insight which facilitates the "recreation of the box" to take perspectives on strategic issues that are novel (Doz & Kosonen, 2010, 2008). These values provide a basis for these visionary managers to use administrative systems such as firm structure and design and governance mechanisms to collaborate and share information and ideas to facilitate the development of strategic insights of other managers, to build collective commitment through agendas and enable resource fluidity through flexible allocation of capital and people resources.

Symbol based systems provide visible mechanisms that provide a basis for cooperation and establishment of contexts for open strategy processes. These symbol based systems play a structural role by enabling co-location of managers from different firms to provide a basis for managers to improve their strategic insights, develop shared commitments and establish flexible resource sharing mechanisms. These symbol based systems also play a social role by helping to facilitate strategic insights through sharing information, experimenting with new ideas and maintaining a strategic dialogue between different groups of managers (Malmi & Brown, 2008, Simons, 1995).

Finally, clan based systems provide a basis for developing professional groups of managers with shared values and culture. The co-location of managers from different firms provides a basis for improved cooperation and sharing of information, ideas and skills (Malmi & Brown, 2008, Simons, 1995). These professional groups of managers encourage the further development of strategic insights amongst the group members, facilitate the development of shared commitments through a shared agenda and establish a context for open strategy processes. The maintenance of a strategic dialogue is also facilitated within the professional group due to the shared values and culture.

In conclusion, MCS related to administrative mechanisms and cultural systems provide a basis for the establishment of a context for open strategy processes. Administrative systems such as firm structure and design and governance mechanisms provide a platform for inter-firm collaboration, by operating as industry-level control systems, enabling cooperation of managers from different firms. Managers are able to use these platforms to improve their strategic insights to engage in open strategy processes. Administration systems such as procedures and policies provide the mechanisms required to capture, retain and share information developed through open strategy processes which enable managers to use this information for development and implementation of strategy at the firm-level. Finally, cultural systems such as values, symbols and clans provide a basis for a collaborative culture which enables managers from different firms to cooperate and engage in open strategy processes. These cultural systems are used by visionary managers to promote open strategy processes to develop new information for strategy development and implementation at the firm-level.

2.4.2 Collaboration mechanisms-Planning and measurement systems and practices

The second role of collaboration mechanisms is to provide a basis for coordination of activities in open strategy processes and to ensure resource appropriations are conducted in an appropriate manner (Chesbrough & Appleyard, 2007). At a firm-level, MCS such as planning and measurement systems and practices provide a basis for this collaboration (Chenhall, 2003). These MCS can be extended and used, *between* firms, in open strategy processes to provide a basis for collaboration (Caglio & Ditillo, 2008). These systems and practices will be first described and then how they are used as collaboration mechanisms will be discussed.

Planning systems and practices

Planning systems and practices are ex-ante forms of control (Flamholtz, et al., 1985, Malmi & Brown, 2008) and are focused on three key activities. First, through strategic objectives, planning practices direct actions and behaviour. Strategic objectives are developed through the strategic

planning process. Second, planning helps to establish the standards to be achieved in relation to strategic objectives by clarifying the actions required and behaviour expected from managers. Action plans provide the basis for establishing these standards and clarifications. Finally, planning practices help to coordinate actions. Through strategic and actions plans, planning facilitates alignment of different strategic objectives across functional areas within a firm and across firms. Through this coordination, planning facilitates the development of strategic insights needed to enable the open strategy process and ensure relevant resource appropriation practices are put in place (Flamholtz, et al., 1985, Malmi & Brown, 2008).

Administrative governance mechanisms such as workshops provide a context for planning practices to be undertaken (Malmi & Brown, 2008). Firms within an industry can establish an industry forum such as a strategy workshop to carry out strategic planning activities. At these workshops, managers from the various industry firms collaborate, sharing ideas and information and making decisions. Managers utilise their strategic insights to assess strategic issues, develop strategic objectives, experiment with new ideas and maintain a strategic dialogue which enables open strategy processes. These workshops are used by managers to enable resource fluidity by making decisions on flexible mechanisms for allocating capital and people to research programmes which are used to develop new information.

Administrative mechanisms such as committees can also be used to provide a context for the use of planning practices to develop and implement strategy related to new information developed through open strategy processes. New information related to product technology developed through open strategy processes needs to be developed into a strategy that can then be implemented through revised operational activities. A group of managers from different firms can use the context of a committee to carry out planning practices to develop this strategy and plan the operational activities required for its implementation at the firm-level (Malmi & Brown, 2008).

Measurement systems and practices

Measurement practices function as ex-post controls (Malmi & Brown, 2008) and are focused on two key activities. First, measurement enables assessment of performance. Actual performance can be measured and information provided to assess if performance is in line with strategic objectives. Second, measurement of performance enables assessment and identification of variances and their causes. This variance analysis provides the basis for developing strategic options to improve performance. Measurement practices enable coordination and appropriation by providing information on current performance and on any variances.

Firm-level operational activities may have a detrimental impact on the external environment, leading to higher production costs and reduced revenue yields. These activities magnify the impact of external factors on the firm-level strategy process. This performance related issues need to be measured to assess the impact of current operational activities and how this performance can be improved. Measurement practices such as audits provide a basis for managers from different firms to assess performance and to identify variances and their causal factors. This information provides a basis for feedback practices to inform managers of actions required to develop new information that can be used to develop and implement strategy to manage these ecological issues.

Measurement practices also provide a basis for assessing open strategy process activities such as strategic R&D projects and their outcomes. Administrative governance mechanisms such as conferences provide a platform for managers from different firms to meet and assess R&D projects. The presentation of R&D project outcomes at these conferences provides an opportunity for other managers to assess these outcomes, to provide comments and feedback. This process enables managers to measure performance of these projects and to assess their findings and outcomes in line with strategic objectives. Measurement practices provide a basis for identifying variances and their causes and for facilitating strategic dialogue between managers to develop information on approaches to improving project outcomes.

Finally, measurement systems also enable the operation of feedback practices. These feedback practices relate to how information developed from measurement is used to influence behaviours and outcomes (Flamholtz et al., 1985, Malmi & Brown, 2008). Two key activities enable feedback practices to be carried out. First, feedback provides direction by providing information that enables corrective action. Second, feedback provides information that motivates managers to improve performance by promising future rewards. Feedback practices enable coordination and appropriation by using information to direct managers to improve their strategic insights and to enable resource fluidity.

Administrative mechanisms such as a workshop or a conference provide a platform for feedback practices to be used (Flamholtz, 1996). At a conference, managers use feedback practices to share information on R&D projects, to assess this information and to provide feedback on outcomes that can provide a basis for new information to be developed or to re-work the R&D project to obtain improved outcomes. The feedback practices provide a basis for managers to share information to improve performance outcomes and to better coordinate activities in the open strategy process.

In summary, collaboration mechanisms support the open strategy process. MCS mechanisms provide the basis for enabling this collaboration, *between* firms, in open strategy processes by operating as industry-level control systems. MCS mechanisms such as planning and measurement systems and practices provide the basis for the coordination of activities and resource appropriation in these open strategy processes. MCS mechanisms related to administrative systems and cultural systems provide the context for cooperation between firms and managers in the open strategy process. Administrative systems such as firm structure and design, governance mechanisms such as workshops and conferences and procedures and policies helped to establish the platforms for managers and firms to meet and share information and agree actions. Cultural systems such as values, symbols and clan systems provide the basis for cooperation by enabling managers to reach out and engage in cooperative activities as part of the open strategy process.

2.5 Firm meta-capabilities for open strategy processes

This section includes a discussion of meta-capabilities firms need to develop and use to engage in open strategy processes (Chesbrough & Appleyard, 2007). While a plethora of different perspectives exist for defining the variable "capability" (Nussbaum, 2000), I adopt the definition introduced in Holland (2008), owing to its explicit identification of the "capability" construct, and subsequent extension arguments explaining a meta-capability. I will then explain how the organisational literatures regard meta-capabilities prior to providing the definition of meta-capabilities used in the thesis. Nussbaum (2000) defined a capability as "the conditions or states of enablement that make it possible for people to achieve things" (p 320), and linked capabilities to basic freedoms pertaining to individuals, within a context (e.g. the ability to move about freely). Holland (2008) advanced Nussbaum (2000), clarifying how a meta-capability represented a broad attribute that sustained the basic human capital capabilities existing in firms, linking meta-capabilities to the "environment". Within firms, Miles, Snow & Miles (2000) linked meta-capabilities to the innovation and R&D literatures, explaining "collaboration" as a meta-capability whereby key managers think beyond the boundaries of their own team, business unit or firm, choosing to operate with those "outside" their groups. Similar arguments were put forward by Snow, Miles & Miles (2005) in discussing meta-capabilities as a social asset, and Blomqvist, Hara, Koivuniemi, & Äijö (2004) when citing the importance of collaboration in networked R&D functions, explicitly characterising this attribute as a "meta-capability". Aligning to and adapting from the above studies, I define meta-capabilities as *broader organisational attributes that drive the efficacy of operating pursuits in organisations – ultimately in this thesis, the open strategy process*. The two meta-capabilities we select directly speak to the Miles, et al (2000) argument that

meta-capabilities relate to the willingness of key individual and institutions to see beyond their own firm boundaries, engaging in strategic thinking (strategic insight) or committing to moving resources beyond their own boundaries (resource fluidity). Managers in firms already possess meta-capabilities that provide a basis for strategic thinking and for resource allocation decisions that facilitate strategy formation and implementation (Johnson et al., 2005). These meta-capabilities need to be enhanced and broadened to enable managers to think and act more collaboratively outside the traditional boundaries of the firm to engage in open strategy processes (Doz & Kosonen, 2010, 2008). These meta-capabilities will be described and how they are used to support firm engagement in open strategy processes will be discussed.

Two meta-capabilities are described in the management and strategy literature for enabling open strategy processes (Doz & Kosonen, 2010, 2008). These are: strategic insight and resource fluidity. Strategic insight relates to the strategic mindset of managers in a complex and fast moving industry environment (Chesbrough & Appleyard, 2007). Strategic insight provides managers with the ability to assess strategic issues in the industry environment and their impact on the firm's strategy and also to view these strategic issues in non-traditional ways. Through combining foresight on current strategic issues and by having insight into how these strategic issues impact on the firm's strategy in the present and in the future, managers are able to engage in open strategy processes to develop new information that facilitates improved development and implementation of strategy (Doz & Kosonen, 2010, 2008).

Resource fluidity provides a basis for flexible allocation of capital and people to carry out activities related to open strategy processes (Doz & Kosonen, 2010, 2008). Traditionally, strategy researchers argue that strategic assets such as financial resources and people skills are a core element of the firm's strategic capability which drives the creation of competitive advantage (Johnson et al., 2005). Through ownership and control of these strategic assets, a firm is able to build entry barriers, preventing new firms from establishing themselves in the industry and building firm performance and competitive advantage (Chesbrough & Appleyard, 2007). However, to develop resource fluidity, these strategic assets need to be made available to be shared with other firms in the open strategy process. Firm specific strategic assets are released from functional control within the firm to be used to prepare resource pools that can be shared with other firms to enable open strategy processes (Chesbrough & Appleyard, 2007, Doz & Kosonen, 2010, 2008).

2.5.1 Strategic insight

Strategic insight is an important resource attribute that firms need to engage in open strategy processes (Doz & Kosonen, 2010, 2008). Strategic insight is related to but is different from strategic foresight (Doz & Kosonen, 2010, 2008). Typically, strategic foresight provides managers with a strategic mindset that facilitates an ability to develop and implement firm-level strategy (Johnson et al., 2005). Strategic foresight provides a basis for managers to engage in traditional strategic planning activities such as assessing the external environment for the STEEP factors and identifying opportunities and threats, identifying firm-level strengths and weaknesses and developing a competitive strategy with strategic objectives and then developing operational strategy and related operational activities to implement the strategy (Carpenter & Sanders, 2009). Strategic foresight provides the basis for managers to develop and implement strategy from a firm-level perspective.

Strategic insight provides a basis for managers to develop the ability to perceive, analyse and make strategic sense of complex strategic situations in new ways (Doz & Kosonen, 2010, 2008). The same strategic issues can be assessed by managers with strategic foresight and strategic insight but can produce different outcomes. Through strategic insight, managers perceive strategic issues in new ways as they have developed greater strategic sensitivity through external engagement and dialogue with other managers that provide fresh perspectives (Doz & Kosonen, 2010, 2008). Strategic foresight leads to "outside the box" thinking and outcomes; however, strategic insight "recreates the box" and produces more creative outcomes.

Strategic insight is based on three key activities: establishing "stretch" strategic objectives, experimenting with new ideas and establishing and maintaining strategic dialogues (Doz & Kosonen, 2010, 2008). First, strategic objectives that provide a "stretch", encourage managers to "recreate the box" by examining current operational activities to identify significant improvements. "Stretch" strategic objectives cannot be achieved by carrying out current operational activities. Managers are encouraged interactively to seek greater strategic insight by engaging with other managers outside the firm to share ideas, source new information and to identify new strategic options which provide the basis for new operational activities (Simons, 1995).

Second, experimenting with new ideas provide a basis for improved strategic insight (Doz & Kosonen, 2010, 2008). Managers develop greater strategic sensitivity when they are able to experiment by developing alternate options to resolving strategic conundrums. The ability to experiment in a safe and controlled environment provides a basis for managers to develop their

strategic insights and to improve their strategic sensitivity as a key capability for open strategy processes (Doz & Kosonen, 2010, 2008). Experimenting can take many forms. A simple experiment might involve managers making changes to procedures relating to a current operational activity and conducting the activity to view the impact of changes. Making a change to product pricing, increasing advertising and marketing expenses or taking a part of an activity and giving it to a third party to conduct provide examples of simple and easy experiments that can usually be carried out by an individual firm. More complex experimenting involves multiple firms and managers. Industry-level factors such as ecological issues create impacts on similar operational activities at the firm-level and require managers to experiment together as the information needs to be developed with greater resource use (Martin & Scott, 2000). R&D projects might need to be commissioned to carry out experiments to develop this information. Through these more complex experiments, managers are able to improve their strategic insights into these industry-level factors and their impacts on the firm and are able to develop new information to manage these strategic issues (Doz & Kosonen, 2010, 2008).

Finally, strategic dialogues provide a basis for improved strategic insights for managers (Doz & Kosonen, 2010, 2008). Managers who operate on their own or in a secluded team develop narrow strategic insights into strategic issues. However, opportunities for greater collaboration with managers in other firms provide a basis for greater sharing of information, ideas and practices which facilitate the development of broader and deeper strategic insights. The different experiences and insights of different groups of managers provide the basis for diversity in information and understandings of the same strategic issues. The R&D scientist who steps outside the laboratory and establishes a strategic dialogue with a practitioner who will use the information developed by the scientist is likely to improve his strategic insights by hearing and receiving feedback from the practitioner. The practitioner is also likely to improve his strategic insight through this strategic dialogue (Doz & Kosonen, 2010, 2008).

In summary, strategic insight is an important meta-capability for managers which enable their engagement in open strategy processes. Strategic insight provides a basis for managers to develop greater strategic sensitivity to complex strategic situations and to be positioned to collaborate outside their firm boundaries to develop new information which can be brought back into the firm for development and implementation of strategy.

2.5.2 Resource fluidity

The second meta-capability considered important for open strategy processes is resource fluidity (Doz & Kosonen, 2010, 2008). Resource fluidity relates to the development of capital and people resources required for open strategy processes and how they are deployed for this purpose (Doz & Kosonen, 2010, 2008). Strategy is a plan to achieve strategic objectives which needs to be resourced (Johnson et al., 2005). In the traditional approach to strategy, a firm acquires these strategic assets and uses these assets to carry out operational activities that secure the firm a competitive advantage and builds firm performance (Carpenter & Sanders, 2009). These strategic assets relate to capital and people and these assets are, usually, locked up within the firm functionally and remain inflexible in terms of their re-allocation (Chesbrough, 2003). However, resource fluidity is important in the open strategy process for creating the open invention activities that are required to develop new information (Chesbrough & Appleyard, 2007).

Open invention activities within the open strategy process require capital funding (Doz & Kosonen, 2010, 2008). Knowledge exploration, exploitation and retention activities create a pooled knowledge base which can be shared by firms engaged in the open strategy process (Chesbrough & Appleyard, 2007). Open capital allocation provides a basis for managers and firms to pool capital to fund these open invention activities. These mechanisms include R&D investment pools which are funded based on firm product revenues. These investment pools can be supplemented by similar capital funds from private equity and venture capital firms and from government funds. The investment pools are managed by a firm with responsibility for funding open invention activities in the open strategy process. Contributions to these investment pools increase as firms benefit from using the information from open strategy processes in developing and implementing strategy which build firm performance. These capital funds are used to develop new information through experiments on new ideas based on R&D projects.

The modular deployment of people provides a basis for resource fluidity which facilitates open strategy processes (Doz & Kosonen, 2010, 2008). This modular deployment relates to the flexible allocation of people from firms to work on collaborative activities and projects in the open strategy process. The assessment of antecedent factors, the development and use of strategic insight and the establishment of collaboration mechanisms to facilitate the open strategy processes require the engagement of managers in firms (Chesbrough & Appleyard, 2007). This modular deployment is obtained by establishing flexible arrangements within firms to encourage managers to function in multiple roles including serving on inter-firm projects, workshops, and committees and in attending

and contributing at industry conferences (Doz & Kosonen, 2010, 2008). Key managers need to be released to engage in open strategy processes to facilitate the development of new information.

In summary, resource fluidity provides a basis for flexible allocation of capital and people resources to enable firms to engage in open strategy processes. Open capital allocation mechanisms such as allocation of capital funds by each firm based on product revenues to common investment pools to fund open invention activities provides a basis for resourcing open strategy processes. Similarly, modular deployment of people such as the allocation of key managers to work in inter-firm project teams provides a basis for people resources to be used to facilitate open strategy processes.

2.6 Chapter summary

This chapter has included a discussion of open strategy processes and a definition of the conceptual framework for this exploratory research study. Section 2.2 has included a description of open strategy processes and their key characteristics. The review identified three key gaps which have formed the basis for the conceptual framework for this study. The remainder of the chapter has included the detailed discussion of this conceptual framework. Section 2.3 includes a discussion of the reasons why firms engage in open strategy processes. The conceptual development has focused on understanding the external factors in the operating environment that, under specified conditions operate as antecedents, providing incentives for firm engagement in open strategy processes.

Section 2.4 included a discussion of the processes involved in enabling collaboration in open strategy. This discussion focused on the mechanisms that provide the basis for activities to be coordinated, for resources to be appropriated and shared and for cooperation to be enabled to facilitate open strategy processes. Finally, Section 2.5 included a discussion of the meta-capabilities required by managers to engage in open strategy processes. The characteristics of these meta-capabilities and how they are used to facilitate the engagement of managers and firms in open strategy processes have been described in detail.

The discussion of open strategy processes and the development of a conceptual framework provide the basis for the field work in this study.

Chapter 3 Research Method

3.1 Introduction

This chapter includes an outline of the research method used in this thesis. The first section includes a brief discussion of research philosophies in accounting research and outlines the research philosophy adopted for this research study. The second section outlines the reasons for the use of a case study. The third section provides an overview of and rationale for the choices made in relation to the unit of analysis and the case setting for this thesis. The open strategy process has been identified as the most appropriate choice for the unit of analysis for this thesis and the reasons for this choice are discussed in this section. The reasons for the choices relating to the case setting are also outlined. The next section deals with the design of the case study and includes a discussion on data collection techniques, interview questions and data analysis. The final section summarises the chapter.

3.2 Research philosophy

This section includes a discussion of the main research philosophies that guide accounting researchers. Descriptions of key assumptions that underpin the two broad research philosophies, positivist and interpretive, are outlined and their impact on choices made by researchers on how to conduct a research study are discussed. Finally, the research approach taken by the research student in this thesis are outlined and discussed. This discussion has been included to demonstrate the conscious and informed methodological choices made by the research student to carry out the research study.

Mainstream accounting research is undertaken with two broad sets of assumptions about the social science and the nature of society (Baxter & Chua, 1998, Chua, 1996, 1986). Social science assumptions include assumptions about the ontology of the social world, epistemology, human nature and methodology. The assumptions about the society describe it as either orderly or subject to conflict.

In accounting research, the ontology of the social world is based on a physical reality, on a claim that there is a world of objective reality separate from human beings and with an essence that can be discovered (Baxter & Chua, 1998, Chua, 1996, 1986). Consequently, as an independent observer, the researcher can discover this objective reality. This ontological belief is reflected in

contingency based management accounting research (Chenhall, 2003) which attempts to discover objective realities of the organizational world (Baxter & Chua, 1998, Chua, 1996, 1986).

The epistemological basis of accounting research is predicated on the objective ontology which separates observations of the reality from the theory used to represent and explain this reality (Baxter & Chua, 1998). Positivist research aims to either verify or falsify these theories of the objective reality. This approach leads to the development of hypothesis from theory, which is then tested with empirical data and analysis to either verify or falsify. The focus is placed on universal laws or regularities and casual relationships. The research method used in this research approach is focused on large samples, surveys and archival data and statistical and mathematical methods of analysis and there is a lesser focus on case study and other qualitative methods (Chua, 1996, 1986).

Mainstream accounting research makes two assumptions about the social world (Baxter & Chua, 1998). First, the social world consists of human beings who exhibit purposive behaviour. Human beings are utility maximisers and are focused on undertaking actions that help achieve this purposive behaviour. Second, based on individuals having these purposive goals, it is assumed that there is a relatively controllable social order. The role of the manager in an organization is to design control systems such as budgets and cost standards to manage this social order and to prevent and resolve any conflicts that may arise through multiple stakeholder goals (Chua, 1996, 1986).

The broad positivist approach taken by mainstream accounting researchers has been criticised on a range of issues (Baxter & Chua, 1998, Chua, 1996, 1986). First, the objective view of the world has resulted in the acceptance of institutional structures such as governments, markets and organizations unproblematically and there has been limited interest in understanding or changing these structures or in studying emergence of new phenomena. Second, goals and purposes are not questioned but accepted as valid. Even if these goals are shown to represent one set of stakeholders in an organization and not representative of all stakeholders (Sundin, Brown & Granlund, 2010), the focus of mainstream accounting research has been on these owner goals. Dissatisfaction with the positivist approach has led to another approach, called the interpretive approach (Baxter & Chua, 1998, Chua, 1996, 1986).

In the interpretive approach, the social world is made up of objects that are interconnected and interact (McKinnon, 1988). Human beings are one of many social actors in this world and interact with other social actors. Reality is constructed through the actions of these actors and these actions need to be interpreted by all actors. There is no one, uniform social reality. Furthermore,

knowledge is based on subjective interpretation of the actors in the social setting (Lukka & Modell, 2010, Paton, 2002). The researcher is not an independent observer but is immersed in the social setting and is one of the social actors. In this approach, thick case studies which examine the processes of social life are the only reliable method to be used to empirically collect and analyse data (Yin, 2003). Interpretive research seeks to understand and explain the meanings provided by social actors to their actions and interactions. The interpretive approach has a subjective focus (Chua, 1996, 1986).

Management accounting researchers have argued that empirical research does not have to take either an interpretive or positivist approach but can "straddle these paradigms" by including relevant elements from both paradigms in the research study (Ahrens & Dent, 2008, Kakkuri-Knuuttila, ML, Lukka, K, Kuorikoski, J, 2008). Kakkuri-Knuuttila et al. (2008) use the study by Dent (1991) of organizational change in the railways in the UK as an example of case study research that includes both subjective and objective elements to provide an exemplary causal explanation of organizational culture and change. The study by Dent (1991) involves both explanation and interpretation and is based on local contexts and the emic interpretations of research subjects. Other management accounting researchers have argued for richer descriptions of accounting in action containing greater attention to detail, developing and matching patterns to develop theory and concepts and writing of rich stories that provide the reader with an insight into the research context that allows him to "obtain a better understanding of how management accounting functions in practice" (Ahrens & Dent, 1998, p33).

The adoption of a research philosophy for an empirical study involves making appropriate assumptions about ontology, epistemology and the nature of man that guide the researcher (Granlund, 1997). In the present research study, the focus is on understanding and explaining *what* are the elements of an open strategy process and *how* the open strategy process operates. MCS and strategy theories have been used as the theoretical framework to help explain the operation of the conceptual model in Chapter 2. The focus on process has enabled the research student to examine the key variables and their interactions to provide knowledge on the empirical phenomena.

In this research study, the social world is viewed as consisting of objective entities such as managers, organizations, MCS, the external environment and strategic objectives that are *interdependent* and interact to shape and create the social reality (e.g. open strategy processes). Managers are social actors with agency which is influenced by their interaction with other social entities such as MCS practices in organizations. Organizational strategic objectives are objective

entities that are interdependent and are shaped and influenced by managers and other social entities such as MCS within the social setting. The performance of these objectives entities can be examined empirically and changes in the performance of these actions can be identified as leading to emergence of new phenomena (Paton, 2002, Yin, 2003).

Consequently, the research philosophy adopted by the research student for this thesis "straddles" the positivist and interpretive paradigms (Kakkuri-Knuuttila, et al., 2008). The study involves explanation and interpretation and takes into account the local contexts and the emic descriptions and interpretations of research subjects. Through the examination of the open strategy process and its variables (antecedent factors, collaboration mechanisms and meta-capabilities), a richer and more comprehensive understanding of strategic activities outside a firm boundary is developed using narratives that allows the reader to obtain an improved understanding of strategy processes and the role of management control systems. This narrative is developed by taking the social world that is relevant to open strategy processes as consisting of *objective* entities (e.g. managers, firms, strategic objectives, management control systems) but recognising their *interdependence* and studying their *interactions* to provide explanations.

3.3 Case study method

The fieldwork will be conducted using a qualitative case study design (Eisenhardt, 1989, Otley & Berry, 1998). There are two related factors that support the use of a case study design for this study: first, the nature of the research question and, second, the nature of the phenomenon to be examined.

A case study approach is recommended for research questions which are exploratory, examining *how* a phenomenon occurs (Chua, 1996, Yin, 2003). There are a number of factors that favour a case study approach. *How* questions are able to address recursive operational connections between constructs over multiple time periods which is difficult in cross sectional research methods (Yin, 2003). *How* questions involve the study of phenomena which are "messy, fluid, emergent and politically sensitive" (Chua, 1996, p211) and the case study approach "seeks to understand social phenomena in terms of patterns of interactions and feedback loops developed in time" (Tsoukas, 1998, p12). Finally, case study research allows accounting researchers to "develop an intimate, contextually sensitive knowledge of actual management practices" (Keating, 1995, p66).

The research objective for this thesis is to understand the operation of an open strategy process and therefore, three related exploratory research questions are posed: *Why do firms engage in open strategy processes? How can management control systems facilitate open strategy processes? How do meta-capabilities influence firms' engagement in open strategy processes?* The questions focus on the concept of strategy as an open process and how managers work with this process. The concepts of an open strategy process and the role of MCS remain "messy, emergent and, possibly politically sensitive" (Chua, 1996, p211). As discussed in Chapter 2, the specification of the open strategy process framework consisting of three key variables (antecedents, collaborative mechanisms and meta-capabilities) is relatively new to management accounting research and has had limited exploration in empirical studies. The conceptual framework of the open strategy process developed in Chapter 2 contains "operational links" that need to be considered over time and within a specific context to gain an improved understanding of how this process operates (Keating, 1995).

The nature of the phenomenon studied also favours a case study approach. When the type of research question is of an exploratory nature, a case study approach allows for a deep understanding of the phenomenon (Ahrens & Dent, 1998). Case study research enables an understanding of the world of practice, allowing researchers to gain a deeper appreciation of strategy and control systems in their natural setting (Chua, 1996, Keating, 1995). The research

questions for this study are situated in a real world context where the objective is to understand the phenomenon in a natural setting.

There are two aspects contained within the research questions that relate to studying strategy and control systems in their natural setting. First, an understanding of the open strategy process framework and variables as specified in Chapter 2 and to use strategy and management accounting theory to understand how these variables relate to each other. The second aspect relates to an understanding of the open strategy process from an empirical perspective. This aspect involves an examination of how the open strategy process is operated by managers. The conceptual model and theory in Chapter 2 will be further refined through the case work and general principles on how managers operate the open strategy process. This approach, where a theoretical model is developed prior to field work and then refined and developed during the field work, is supported by case study research (Dubois & Garde, 2002, Yin, 2003).

Finally, case study research provides an opportunity to examine a wide range of field evidence using a range of data collection methods (Yin, 2003). Interviews and observation can focus on contemporary events and activities which are recursive, while, archival documents provide a historical and contemporary view on these events and activities (Yin, 2003). The framework and operation of the open strategy process is the focus of the study and therefore, a case study design is suited for this purpose.

3.4 The case: Unit of analysis and the choice of the case setting

3.4.1 The unit of analysis

The unit of analysis refers to the "unit of study" adopted by the researcher to examine the research question (Yin, 2003). This unit represents the location for the study. The unit of analysis can be a person, an organizational unit, a specific business process (e.g. strategy process) or a whole organization or multiple organizations (Paton, 2002, Yin, 2003).

Yin (2003) identifies two factors that are important to consider when defining the unit of analysis for any case study research. The first factor relates to the type and nature of the research question. The detail included in the research question will provide clues as to the appropriate unit of analysis. Generally, the unit of analysis for many management accounting research studies would be a single organization as the research objective and questions are focused on organizational phenomena such as management control systems (Malmi & Brown, 2008). Yin (2003) suggests that the unit of

analysis is almost an indicator of the clarity of the research question as the clear nature of the question more or less signals the appropriate unit of analysis.

The second factor to be considered in choosing the unit of analysis is the ease of comparability with prior studies into the research topic (Yin, 2003). Consistent theory and knowledge is developed from research studies that build on each other helping to consolidate knowledge on specific topics (Malmi & Granlund, 2009). This process depends on studies that examine similar phenomena using similar and appropriate units of analysis (Yin, 2003). It would be difficult to consolidate knowledge on a topic from a range of empirical research studies if there was not a consistent unit of analysis. Malmi & Brown (2008) showed how this process operated for research into MCS by developing theory on MCS packages which built on prior MCS studies that had examined individual MCS. The knowledge from this stream of research was able to be consolidated due to the different research studies using a similar unit of analysis, in most cases, an organizational unit (Chenhall, 2003).

In this thesis, the research questions examine the open strategy process. The focus of the study is on understanding how this process operates and in developing a theoretical framework with key variables which could be examined in a case setting to determine its validity in helping to explain the operation of this process. The open strategy process exists at the inter-firm level, beyond the boundaries of any single firm. The process involves multiple firms and managers within these firms. The collaboration mechanisms used to support the interaction of managers from these multiple firms are owned and operated by a range of these firms. The activities related to the open strategy process take place within a firm and also outside a single firm and at the inter-firm level. In order to study open strategy processes, the focus of the research student has to be on the process that spans individuals and individual firms. For these reasons, following the guidance provided in the case study literature (Yin, 2003), the open strategy process will be the unit of analysis for this thesis.

3.4.2 The choice of the case setting

The Australian cotton industry was chosen as the appropriate case setting for this thesis. There are a number of factors that make this case setting appropriate for the study of open strategy processes. First, there is evidence that firms and managers in this case setting have collaborated to develop and implement strategy through an open strategy process. This evidence is longitudinal as these firms have engaged in these open strategy activities over a long time period, around fifty years or more. Second, there is evidence of external factors that have had similar impacts on firms within the industry which have provided incentives for firms to collaborate in strategic activities. Third,

there is evidence of mechanisms such as industry conferences, workshops and committees that have been used to promote and enable collaboration between firms to carry out strategic activities beyond the firm boundary. Finally, the case setting provides evidence of managers from different firms using strategic thinking and different resource allocation mechanisms to facilitate these open strategy activities. Consequently, the Australian cotton industry was chosen as the case setting for this thesis.

3.4.3 The description of the case setting

Based on the discussion above, the Australian cotton industry was chosen as the case setting for this thesis. A three year research project funded jointly by the industry's research funding organization, Cotton Research and Development Corporation (CRDC) and the University of Technology, Sydney's UTS Business School provided an opportunity to access the case setting to conduct this research study. One of the research questions of interest to the CRDC was to better understand the strategy processes within the industry and how these processes could be leveraged to improve strategy processes which coincided with the research objective and questions focused on in this thesis. In the remainder of this section, the case setting and key firms within this setting will be described to provide the background and context to the examination of the open strategy process.

An overview of the cotton industry

Cotton has been a key agricultural product in Australia since colonial times. The First Fleet brought cotton seed from Brazil and various attempts were made to grow cotton in places such as Norfolk Island, Hunter Valley and Moreton Bay. The history of cotton growing from the time of the First Fleet to the 1960s is one of limited successes and numerous failures due to a variety of reasons including poor farming knowledge and practices, resource scarcities (e.g. water), lack of capital investment and short-sighted government policies.

The modern cotton industry dates from the 1960s and had its origins in northern New South Wales near a town called Narrabri in the Namoi Valley. Cotton growing is heavily dependent on the availability of water and the development of dams and river systems have benefited cotton growing. In NSW, cotton growing expanded to the Gwydir Valley, again helped by the development of dams. The other major area for cotton growing is in Queensland in the St. George and Emerald regions. NSW produces around two-thirds of the cotton crop with the remaining one-third coming from Queensland.

American cotton growers have had a key role in the development of the modern cotton industry in Australia. They began arriving in numbers and investing in large scale farming using new farming technology in the early 1960s. Within a few years, approximately half of the cotton growers in the Namoi Valley were Americans. They came from the south-west of the USA and brought intensity to cotton growing. They invested in new farming technology and used chemicals and pesticide on a large scale to control insects and pests affecting yield.

The development of the modern industry has been helped by four major factors. First, the availability of water resources, through the construction of dams in the key cotton growing areas and allocation of water rights to growers has provided this vital resource to all growers. Research and development into effective water use practices has helped growers to be judicious in their use of this scarce resource.

Second, improved management practices in the use of pesticides to control key cotton pests. Cotton growing in Australia faced an unusual challenge in controlling harmful insects in these early days of the modern industry. The significant use of pesticides in the Australian cotton industry became a significant challenge for the industry. The chief pest of intensive cotton growing was a moth known as *Helicoverpa* which was dangerous as it was highly mobile, fecund and adaptable. The use and management of pesticides, particularly Endosulfan which helps to control *Helicoverpa*, has been improved to make the industry more environmentally sustainable. Pesticide contamination was a key challenge for the industry in the 1990s and had three key impacts: contamination of workers and regional communities, riverine system and other agricultural products, particularly, beef products. The industry undertook a major research programme and better management methods developed through research has helped the industry become more proficient in the use and management of pesticides. The introduction of transgenic cotton varieties in 1996 (Bt cotton) has also assisted growers in reducing the use of pesticides due to the inbuilt resistance of Bt cotton to cotton pests.

Third and more importantly, research and development has been a key factor in the development of the industry. While, American expertise helped to rejuvenate the modern industry, local research has made a substantial contribution to improving farming methods and practices. The major focus of research efforts has centred on improving the use and management of pesticides, water and cotton varieties and the introduction of new technologies including farming equipment to enhance

the efficiency of cotton growing. Key stakeholders such as the CRDC, CSIRO[11] and universities have led research efforts. The cotton industry has established a leading reputation for research and development and adoption within the Australian agricultural sector.

Finally, a key factor in the development of the industry has been the individual cotton grower who has proactively adopted and adapted research and development outcomes to improve cotton growing methods and practices. This adoption and adaptation approach has been facilitated by an extraordinary level of collaboration within the industry where growers are willing to share their experiences in research adoption and where different stakeholders (growers, researchers, agribusiness consultants) have successfully combined to develop new knowledge and practice.

In the 2011 growing year, the industry produced a cotton crop worth $5.4 billion in revenues. The cost to produce this crop amounted to $3.5 billion. On a per hectare basis, the average yield in 2011 was 10.04 bales which had a sale value of $526 and a cost of $346 to produce. There are approximately 1500 cotton farms and 800 growers currently operating in Australia, 72% of whom are based in New South Wales, with the remainder in Queensland. Farming is done by a mix of individual farmers and corporate farms.

Other stakeholders in the cotton industry

The Australian cotton industry includes a range of different individuals who have played a key role in the open strategy processes within the industry. These individuals include cotton growers, cotton consultants and cotton researchers. These individuals are closely involved and aligned with the key industry firms discussed in the prior section and brief commentary is provided here on each group for completeness.

There are around 1,500 individual cotton growers who operate through around 800 cotton farms in the Australian cotton industry. Cotton growers can operate within the industry in a range of formats. These include tenant farmers who lease a small cotton farm, family owned cotton farms and large corporate farms. Typically, cotton growers are irrigation agriculturalists who also grow other crops such as sorghum and also cattle.

Cotton growers are located in two main regions in Australia: in North-West New South Wales around the Narrabri region and in South-East Queensland in the St George and Toowoomba regions. Growers are organized by regions into Cotton Growing Associations (CGA) which hold

[11] Commonwealth Scientific and Industrial Research Organization. CSIRO is Australia's national science agency responsible for scientific research and developing practical solutions.

membership in Cotton Australia. These CGAs also nominate individual growers to serve on the CA Board and other governance committees and generally encourage their participation in industry activities.

The second group of stakeholders are cotton consultants. These consultants are private business operators with an agricultural science and business background who provide advice to cotton growers on a range of matters related to cotton growing including agronomy, water and pest management and fibre quality. These consultants in some instances have operated as cotton growers and have solid farming experience. They have played an influential role in identifying strategic challenges across the industry, particularly in relation cotton pests and their management, and in helping other groups of stakeholders and industry firms to develop solutions to these issues.

Cotton researchers are important stakeholders in the Australian cotton industry. These researchers are employed by the research organizations such as the CSIRO, universities and state governments but are contracted by cotton industry firms such as the CRDC and CRC to engage in research and development projects to develop new information on issues such as managing cotton pests, improving cotton cultivars and developing better farming practices around water and land management. The economic and environmental performance improvements in the cotton industry in the past fifty years have benefited significantly by research work and outputs from this group of researchers who have worked collaboratively with cotton growers and cotton consultants to manage the strategic challenges faced by the industry.

3.5 Case study design

This section outlines the key features of the design of the case study. The key features described are the type of the basic design, boundaries of the cases, types of data and the method of analysis. A key strength of case study research is its flexibility which means that improvements to the design of the study are possible to increase its effectiveness. Explanation will be provided where the design of the case study is changed during the study.

3.5.1 Design type

Qualitative research tends to take a deductive or inductive approach (Dubois & Gadde, 2002). A deductive approach moves from general to specific knowledge. The research design involves developing theory and an empirical model that is tested to either prove or falsify the theory. In a pure inductive approach, the researcher enters the field to understand the rich social interactions between people that provide meaning and context to help understand the research question. The

researcher enters the field with some understanding of constructs from the literature and generates theory from the empirical data to explain relationships between the constructs (Lukka & Modell, 2010).

A more pragmatic approach combines deductive and inductive research designs (Dubois & Gadde, 2002). The researcher enters the field with a conceptual model and some theory to explain the operation of the model and refines and develops the model from the analysis of the empirical data. This approach is useful when the researcher is looking to discover new variables and refine and develop relationships, particularly when existing theory is limited. The focus of this pragmatic approach is on theory development (Dubois & Gadde, 2002). This approach is also aligned with the research philosophy adopted for this empirical study.

Case study research is not linear with defined phases but proceeds in a recursive manner with the researcher going back and forth between empirical observations and theory, expanding his understanding of theory and empirical phenomena. The initial conceptual model is refined and developed through what is discovered in the empirical field work and through data analysis and interpretation. Empirical observations yield new and unanticipated issues that need to be further explored in interviews and other data collection methods, resulting in changes to the conceptual model. New theory may then need to be developed and used to explain the empirical phenomena represented in the revised conceptual model. This process is referred to as *systematic combining* and is the core of the pragmatic approach (Dubois & Gadde, 2002).

Systematic combining involves four ingredients: empirical world, theory, conceptual model and the case. The empirical world and theory require matching where the researcher moves between data, analysis and theory to develop the initial theoretical assumptions and explanations contained in the relationships between constructs in the conceptual model. As new data and analysis arise to challenge the initial understanding of the conceptual model, fresh theory will be required to help explain the empirical phenomena. The matching process is also enabled by the re-direction of the study to collect more data through collection methods such as interviews, observations and archival records to provide greater opportunity for issues to be identified (Dubois & Gadde, 2002, Yin, 2003).

The conceptual model plays a key role in systematic combining. In the pragmatic approach, an initial conceptual model provides a set of general guidelines for the researcher. The conceptual model needs to be tight but remain flexible so as to evolve with empirical observations. An

inflexible conceptual model can "blind the researcher to important features of the case or cause misreading of local informants' perceptions (Miles & Huberman, 1994, p16). The conceptual model evolves as new theoretical insights are gained from empirical observations (Dubois & Gadde, 2002).

This pragmatic approach is considered appropriate for this research study. There is limited theoretical knowledge on open strategy processes. From the review of literature, an initial conceptual model has been developed and described in Chapter 2. The empirical field work will be used to further develop this conceptual model.

The field work will be conducted in the case setting with the focus on the open strategy process as the unit of analysis. First, an assessment and description of the open strategy process will be developed with a theoretical framework. This framework is based on three key variables (antecedents, collaboration mechanisms and meta-capabilities). This framework and related analysis will be informed by the theory developed in Chapter 2. From this theory informed analysis, constructs and relationships that can hold in other case contexts will be identified to further develop the conceptual framework. In order to collect data for this analysis, a range of evidence will be collected through semi-structured interviews with managers, reviews of archival documents and records and through observation of managers and activities. The sources of evidence are discussed in Section 3.5.3.

3.5.2 Boundaries of the case

The boundaries of a case relate to its location in time and space (Brown, 2005, Dubois & Gadde, 2002). This research study examines the open strategy process and the conclusions of the study will be dependent on the time at which the study was conducted. Ideally, the researcher is in the field when the open strategy process is conducted but this is not the only approach to studying this phenomenon as the process can be identified from data provided through interviews and archival records. The time boundaries for data collection for [12]the case study are outlined in Table 1. The field work was conducted simultaneously in all industry firms (refer Section 3.4) and was facilitated by their co-location in Narrabri, NSW and in Sydney. The research study is part of an industry project commissioned by the CRDC with the University of Technology, Sydney and the project timelines have had an impact on this study's timelines.

[12] The time boundaries for the case analysis are from 1962 to 2014.

Table 1 Case time boundaries

Stage	Preparation	Data collection & analysis	Debrief & write-up
Time frame	Jan 2012-March 2012	April 2012-Dec 2013	Jan 2014-Nov 2014

The preparation period included ethics approvals, familiarisation with the industry and key firms, meeting key gate keepers in each of the firms and preliminary background work including literature reviews, development of the initial conceptual model and theory development. The main field work involving data collection and analysis was undertaken between April 2012 and December 2013 and involved periods of time spent at Narrabri (NSW), Toowoomba (Queensland) and Sydney. Debrief and write-up of the study and findings took place progressively over the period between January and November 2014. As part of the industry project, annual reports were provided to the CRDC (and made available to Cotton Australia) and provided an opportunity to debrief and discuss data analysis and findings with key managers. The challenge of balancing the reporting and analysis for the industry project vis a vis the thesis was also problematic and took up time additional time.

The space boundary for the study is set by conducting a field study in the Australian cotton industry. Johnson et al. (2005) define an industry as consisting of firms producing the same products. For this thesis, cotton firms, producing the same cotton commodity, are classified as the cotton industry and are considered to be small operating units. The industry also includes support firms providing services such as strategy and advocacy, R&D and other inputs. These firms include Cotton Australia and related industry firms-ACGRA, CRDC and CRC. Support firms are classified as medium sized enterprises. Both types of firms (cotton firms and support firms) have sufficient depth and breadth to provide adequate case data for analysis and conclusions. Based on the analysis of field data, findings will be developed that can be theoretically generalised to other settings. The data set provided by the case setting is quite rich and thick and has been of sufficient depth to provide meaningful outcomes.

3.5.3 Types of data

Interviews

The primary data collection method used in the case study was semi-structured interviews. A list of interviews conducted is contained in Appendix 1. Interviewee details have been masked to protect their identities.

The interviews were focused on specific issues and topics and a range of questions were prepared prior to each interview. The majority of interviews were tape recorded and transcribed and were conducted by, at least, two researchers. Some interviews were not taped but extensive notes were made of the responses (refer Appendix 1 for details). The research supervisor attended the initial interviews and reviewed interview transcripts and was involved in regular debrief sessions with the researcher to identify key issues. Immediately, after each interview, the researchers made notes on overall impressions and other observations and key issues identified.

The specific method of interview data collection varied with each stage of the study with early interviews focused on gaining an understanding of the structure of the case setting, the key industry firms, their strategy processes and their MCS. As a broader knowledge of the open strategy process developed, interviews focused on a deeper understanding of the interaction of managers from related industry organizations with this process and its key variables.

Interview questions

Interviews were conducted using a semi-structured approach. In preparation for the interviews, a list of general questions was prepared (see Appendix 2). These questions were adapted for each interview depending on the firm from where the manager is chosen. The interview questions were set to draw out data on the experience and opinion of managers (Paton, 2002). Experience questions focus on what a manager does or have done and are aimed to draw out experience and activities that would have been observable if the researcher had attended and shadowed the manager. Opinion questions are designed to understand what managers think about the phenomena to be studied. Questions were worded to ensure that they exclude presuppositions and would not enable dichotomous responses. Probes and follow up questions were used to complement the general questions to draw out a more comprehensive set of data.

Archival documents

A range of archival documents, around 300 (refer Appendix 3) were considered in the research study. These documents included annual reports, strategic plans, minutes of board and other committee meetings, industry reports, books, Australian Cotton conference proceedings and papers and website information and documents. These archival documents covered a longitudinal period of over fifty years and carefully documented details of collaborative strategic activities carried out in the open strategy process within the cotton industry. There were no restrictions placed on research access to these documents.

Field observations

Field observations of managers and their activities were conducted and supported interviews and archival document data. The observations included formal meetings of managers from industry firms, industry and regional conferences, project meetings and workshops and informal office gatherings. A range of data was collected through these field observations. The research student operated as an observer and did not actively participate in these meetings. Appendix 4 provides details of these field observations including the data collected for analysis.

3.5.4 Data analysis

There are two general strategies for data analysis in case study research (Yin, 2003). The first strategy is referred to as theoretical orientation and the second is case descriptions. In an exploratory study such as this one, where exploratory research questions are studied in the case setting and some theory is available to test, the theoretical orientation approach is valid and has been used for the study. The second approach of working with case descriptions is valid when there is no theory developed prior to entering the field and the study involves inductive theory development. This approach will not be used in this study. A clear understanding of the general analytic approach is important as it will guide subsequent decisions on data analysis methods (Yin, 2003).

The study has used a primary pattern matching approach supplemented with an explanation building approach as the data analysis methods (Yin, 2003). This data analysis approach requires specific constructs and relationships between constructs to be specified prior to entering the field. The basic theoretical framework, as outlined in Chapter 2, is then assessed and refined as new data is collected (Yin, 2003). The explanation building approach helps to clarify relationships within the theoretical framework that may have been underspecified at the start of the field work. The overall approach is theory development (Dubois & Gadde, 2002).

The content of the data gathered was analysed to establish patterns to develop and refine the theoretical model. The coding of data for content analysis was based on theoretical constructs. This study used coding based on theoretical constructs as a theoretical model and theory was available prior to entry into the field. Data was coded[13] using theoretical constructs from the theoretical framework developed in Chapter 2. Coding of data was based on manifest coding where the visible content in the text is coded. This approach is more reliable and the interview questions address the theoretical constructs and relationships outlined in the theory (Neuman, 2000).

[13] Nvivo software (V10) was used to code and analyse all data.

There is no formula for transforming data into findings but there is guidance available for qualitative data analysis (Paton, 2002). A two stage approach was adopted to analyse the case data. The first stage has four interrelated and structured steps. This stage is focused on establishing the open strategy process and a framework with key variables that could be used to understand its operation. The second stage involved using the data and MCS and strategy theories to explain how managers used the framework to enable the open strategy process. The second stage helped to further develop and refine the conceptual model in Chapter 2.

Stage 1

The first step in stage one involved identifying the key variables of the open strategy process (antecedents, collaborative mechanisms and meta-capabilities) in the case setting using the constructs developed in the conceptual framework. How this process was influenced by managers in related industry firms was also considered. Naturally occurring data[14] from observations and archival documents were coded using the manifest coding approach previously discussed. The same approach was used for interview data. The coding and analysis conducted by the researcher was reviewed by the research supervisor.

The second step involved development of "thick descriptions" of the open strategy process, antecedents, collaboration mechanisms, meta-capabilities and other aspects such as the role of managers and further analysis and interpretation to develop a summary of data and findings (Paton, 2002). This data analysis was interactive, moving between data sources.

The third step involved an analysis of the data to establish how the open strategy process operated and how MCS was used to support and enable this process. The fourth step involved refinement and further development of the conceptual framework based on the analysis of the data. The framework has been discussed, progressively, with the CRDC Program Manager responsible for the project, and will be formally presented to senior managers in Cotton Australia and the CRDC as part of the final reporting on the industry project.

Stage 2

The second stage of the data analysis focused on developing the explanation of *how* the open strategy process operated. The explanation building was based on analytical insights and themes from the data with a focus on substantive significance which enabled refinement of emerging themes and insights down to those that are most relevant (Paton, 2002). Paton (2002) lists four

[14] Silverman (2010) defines this type of data as occurring naturally in the case setting and which is not research generated.

criteria for substantive significance which were used in this analysis: data coherence and consistency, relevance of findings for understanding of the phenomenon, consistency of findings with other knowledge and usefulness of findings for theory development.

According to Weick (1989), theory development, in management studies, needs to be improved by carrying out disciplined imagination that "unfolds in a manner analogous to artificial selection" (p516). Weick (1989) defines theory as "an ordered set of assertions about a generic behaviour or structure assumed to hold throughout a significantly broad range of specific instances" (p517). For Weick (1989), theory development consists of three key activities: variation, selection and retention. Theory building commences with a representation of the context for the study which is built up from the data (collected through interviews, archival records and observations). The researcher then develops variations based on scenarios which are used to construct possible explanations of the data and context. From these different scenarios, the researcher makes a selection of the most appropriate scenario which explains the context. This selection maybe based on judgements influenced by issues such as whether the scenario is interesting, plausible or consistent.

Following, Weick (1989), the research student used data from the cotton industry setting to develop a representation of the open strategy process and its key variables. Variations will be developed by examining scenarios which will focus different explanations of how these open strategic activities are carried out. From these different scenarios, the research student will make a selection of the appropriate scenario which is related to the conceptual framework and the research literature and which helps to provide a theoretical development of open strategy processes which is plausible, interesting and consistent with the data.

3.6 Chapter summary

This chapter has detailed the research method for this study. After a discussion and choice of research philosophy, it was argued that the most appropriate approach was a case study for two reasons. First, the research questions are *how* questions which requires the study of a phenomenon which is fluid and emergent in nature. Second, the phenomenon is rooted in a real-life setting and a case study enables exploration of this phenomenon in this real world context. A single case study design was advocated to develop a theoretically generalizable model of open strategy processes. However, the field study was based on the open strategy process as the unit of analysis and examined four related industry firms (Cotton Australia, CRDC, ACGRA and Cotton CRC) and a range of managers linked to these firms (cotton administrators, cotton growers, cotton consultants

and cotton researchers). Following this discussion, the Australian cotton industry and the industry firms and three groups of stakeholders were introduced and reasons for their choice were outlined.

How open strategy processes are operated is not well known but some knowledge is available enough to develop a preliminary framework for further development. A pragmatic approach using systematic combining of theory, framework and data was considered to be the most appropriate approach to refine and develop this framework. The conceptual framework was further developed through the data collected from the case setting and related analysis. The remaining sections outlined the case boundaries (time and space), type of data (interviews, archival documents and observations), and interview questions and data analysis.

The next chapters (4- 6) include the case descriptions. The time period covered by this thesis is a period of fifty two years, spanning the years 1962 to 2014 and the case descriptions are split into these three chapters.

In Chapter 4, the time period covered is from 1962-1990 and is called the Formative Years. This chapter documents the early period relating to the formation of the industry and the establishment of industry firms. A pioneer group of cotton growers, cotton researchers and cotton consultants played a major role in helping to establish the foundations for collaboration by focusing on developing mechanisms for the conduct of inter-firm open strategy processes. Chapter 5 covers the time period from 1991 to 2004 and is called the Crisis Years. This time period was the critical for the industry as it grappled with the strategic challenge posed by cotton pests and diseases and pesticides. It was also a period of intense creativity and innovation as cotton growers and cotton researchers collaborated together to develop new information and approaches to improve their operational strategies. Chapter 6 covers the final time period for the thesis from 2005 to 2014. This period, called the Growth and Consolidation Years, relates to bumper growth period for the industry as it leveraged the innovations introduced into cotton farming such as transgenic cotton to improve cotton yields and fibre quality to earn higher revenues. The result of the descriptions and explanations in Chapters 4, 5 and 6 is an empirically grounded open strategy process in the case setting. This provides the basis for the analysis and theoretical development included in Chapter 7 and thesis summary and conclusions in Chapter 8.

Chapter 4 The Formative Years 1962–1990

4.1 Introduction

This chapter includes a discussion of key events in the Formative Years of the cotton industry – from 1962 to 1990. This chapter is one of three chapters that collectively provide a description of the 52 years of the cotton industry from its modern inception.

The Formative Years of the cotton industry is based around the actions of a core group of cotton pioneers, growers and researchers, who came together through circumstances. The actions of this pioneer group, from establishing the culture and values that provided a basis for inter-firm collaboration, to the firm structures that provided organization and functional specialisation, to the governance mechanisms that provided the context for collaboration, facilitated the development of the cotton industry. As a consequence, the industry was well prepared to withstand a serious threat that arose to challenge its viability in the late 1990s, known as the Endosulfan[15] crisis. The ability of firms within the industry to develop and implement strategy, using information developed through open strategy processes, provided a basis for the industry to quickly improve its environmental and economic credentials. This chapter commences with a description of this serious challenge and describes key events that led to the successful resolution of this crisis.

Section 4.2 includes a discussion of the Endosulfan crisis in the late 1990s which precipated a significant existential threat to the ongoing viability of the industry and provided a basis for industry firms to engage in the open strategy process. To understand how the industry faced up to this challenge, it is important to go back to the commencement of the modern industry and the pioneers who helped establish the industry. Section 4.3 includes a discussion of the arrival of the cotton pioneers, migrant cotton growers and researchers from America and Hungary, who arrived in Australia with a dream of growing cotton. Their role in establishing the cotton industry is described.

Cotton growing involves a number of different actors and operational activities and presented many challenges which are described in Section 4.4. The social values of the cotton pioneers, growers and researchers, were vital to the level of collaboration and partnership in the industry that has underpinned its growth and development. How these social values provided a basis for this collaboration is described in Section 4.5. Section 4.6 describes the range of administrative mechanisms that were established and used by the cotton pioneers in their development of the

[15] See Section 4.2

industry. Administrative mechanisms, such as firm structures and governance mechanisms (including committees and conferences), were used to organize collaboration and partnerships. These mechanisms also provided the basis for processes which enabled collaboration in open strategy processes. R&D provided an important basis for cotton growers and researchers to collaborate to develop new information and technologies to improve cotton yields and to develop the industry. How capital funds were raised and invested by cotton growers, and how this investment was directed to produce new information and technologies, will be described in Section 4.7. Section 4.8 includes a discussion of the failure of Pyrethoid chemical sprays to control cotton pests – the damage caused by pests, as well as the harm from chemicals, highlighted that the long-term viability of the industry would be under threat without the development of pest resistant cotton varieties and a reduction in chemical control measures. The failure of the Pyrethoid chemical sprays provided a basis for the industry to focus on a new strategy to consolidate the focus of everyone on finding new information and technologies to improve cotton's environmental and economic performance. The ecological issues precipitating from this incident indicated a need for an open strategy process which could enable the development of new information for firm-level strategy processes; this is discussed in Section 4.9. Section 4.10 provides a summary.

4.2 The Endosulfan crisis

Ecological issues thrust the Australian cotton industry into the public consciousness in 1998 with a series of incidents that threatened its ongoing viability and its "social licence to operate". National newspaper headlines on the 18 and 19 December 1998 provided a simple, yet clear enunciation of the ecological challenge faced by the industry. The Sydney Morning Herald (SMH), a Sydney based national newspaper ran a story with the headline *"Cotton chemicals found in Export Beef"*. The article was based on the news that cattle from a number of properties in northern NSW and southern Queensland had been contaminated with the chemical endosulfan which was a key chemical used in the cotton industry to control cotton pests:

> The Queensland Government has been accused of covering up a meat contamination scare after news emerged yesterday that cattle from 10 properties have been rejected at export abattoirs in the past week. The northern NSW and southern Queensland produce tested positive for endosulfan, the main chemical spray for the cotton industry, which today launches its $1.5 million "good neighbour" policy. Several samples had levels of endosulfan higher than the maximum allowable of 0.2 mg/kg, sparking a week of high tension between the beef and cotton industries. Mr Justin

> Toohey, the Cattle Council of Australia's director, said producers were unhappy with the cotton industry. "This is a Christmas present the industry doesn't really need," he said. Mr Digby Cooper, a grazier from St George in western Queensland, said pastures on his property had returned endosulfan levels up to 0.75 mg/kg, while four cows tested recorded levels of up to 0.36 mg/kg.

The headline of the related news story which appeared the next day, 19 December 1998, in the SMH was even more serious for the cotton industry: *"Growers Need to be Greener, Says Vaile"*. Quoting the Australian Agriculture Minister at the time, the article recorded the Minister issuing a blunt challenge to the cotton industry to *"improve its environmental practices"*. Minister Vaile is quoted as saying: *"unless we are squeaky clean, we won't sell our cotton, we won't sell our beef, we won't sell our wheat, we won't sell our dairy products"*.

The news about pesticide contamination related to Endosulfan was not totally unknown as the cotton industry, through a major research and development programme, known as The Program, had discovered that these chemicals were a major cause of contamination of the riverine systems around cotton farms. In July, 1998, The Program provided public information that warned of the contamination problems and also provided information on actions being taken by the cotton industry and cotton researchers to minimise the problems. The Australian Associated Press (AAP) ran an article on 23 July 1998 which covered these issues:

> Australia's most comprehensive research project into pesticides in streams and rivers has revealed a concerning concentration of a widely used cotton pesticide, a conference heard today. Unveiling the findings, project architect Dr Nick Schofield said the $6 million initiative was already paying off by helping scientists and agricultural industries to develop ways of minimising the impact of pesticides. "The level of pesticides in rivers varied depending on the time of the year, natural phenomena such as storm events, the type of chemicals being used and the way crops were managed," he said in a copy of his speech. "Endosulfan, a widely used pesticide in cotton production, was detected in low background concentrations in river," Dr Schofield said. "(But) even at these low levels, the presence of endosulfan was still a concern." The cotton industry is heavily dependent on pesticides to combat damaging pests, often applying insecticides up to 14 times a year to irrigated cotton crops. The industry was already taking steps including using less spray and water to produce crops and developing bug resistant plants, Mr Corish (Chairman of

> Cotton Australia) said in a statement. The industry is aware that we can still do better and we have learnt a great deal from this research exercise about pesticide application, transport, soil degradation and aquatic biological impact.

The cotton industry response to the strategic challenge posed by pesticide contamination was based on two new approaches to cotton growing. As foreshadowed in the AAP article, these two approaches related to improved cotton growing practices and the use of cotton varieties that were resistant to cotton pests. Genetically modified or transgenic cotton provided the basis for cotton varieties which were resistant to cotton pests.

The cotton industry introduced improved cotton growing practices in a system referred to as Best Management Practices (BMP) soon after these public incidents in 1999. BMP for cotton growing was based on information from research and development projects including the use of transgenic or Bt cotton. All cotton growers were encouraged to adopt these new approaches to cotton growing. By 2004, the industry was promoting its improved environmental credentials. Research commissioned by Cotton Australia – a leading firm for the industry's strategic policy, advocacy and research direction – documented the significant improvements in cotton growing practices through the use of BMP which had combined to reduce the impact of pesticides and their effects on the environment around cotton farms. A report commissioned in 2004 by Cotton Australia to evaluate the BMP program provided a key finding: *"BMP had created significant beneficial change in cotton farm practices since the BMP Manual was introduced in 1997….. the change is evident across all modules that are currently in operation…..including Integrated Pest Management"* (Macarthur Agribusiness, 2004, Evaluation of the Australian Cotton Industry BMP Program, p1).

The public airing of significant ecological issues and their impacts, the existential threats to the cotton industry, and the practical and effective solutions introduced by the cotton industry and the adoption of BMP, provided information to individual firms who appeared to shape their firm-level strategy processes in a short and orderly sequence that may suggest that it was planned. However, the reality was different.

The genesis for these solutions also related to the formation, in the 1960s, of the modern cotton industry. Managers and firms in the cotton industry engaged in open strategy processes over this period to develop new information which were transformed into BMP and encapsulated in a system that could be accessed and used by all cotton growers. The development of transgenic cotton began

in the 1970s with cotton and biotechnology researchers, independently, examining improved cotton varieties that were resistant to cotton pests. Managers identified antecedent factors related to ecological issues long before they became content for a newsworthy article in the national newspapers which threatened the very existence of the industry. Collaboration mechanisms for open strategy processes were established and developed over this 52 year period. A cotton agribusiness consultant gave voice to this long period of open strategy processes that led to the transformative changes:

> If I was to be able to take us to a field of cotton, even in 1992, let alone 1982, really only the plants would be recognisable today. The way we grow the crops changed, the way it's protected from insects has changed. The way it is watered has sort of changed to a large degree. The way it is picked has changed. It is amazing really and yet I don't know that anyone necessarily stood there in '92 or '82 and said, this is what we want to see, this is what we'd like. [CC1]

In order to understand this narrative of open strategy processes in the Australian cotton industry, it is important to return to the 1960s to start with the seminal event that changed and transformed cotton growing in Australia. This seminal event relates to the arrival of American cotton growers in the Narrabri region of northern NSW.

4.3 The cotton pioneers: A story of resourceful migrants

The role played by migrants from America and Europe in the development of the modern cotton industry in Australia is an important pre-cursor to the understanding of how open strategy processes were developed and conducted in this industry. These migrants provided the leadership which guided managers in firms within the industry to embrace collaboration as the basis for developing the industry (McHugh, 1996)

In the curious way of the world, three seemingly unrelated events that happened on three continents during the Second World War presaged the development of the modern Australian cotton industry (McHugh, 1996). In Hungary, an enterprising plant-breeder, Nicholas Derera, graduated from university as an agronomist. In Australia, the pressures of war stopped work on a new dam on the Naomi River in the north-west of New South Wales (NSW). In the United States (US), following America's entry into the war, a small farmer, Paul Kahl joined the US Airforce as a fighter pilot.

After the end of the war, Derera returned to Hungary, then under occupation by the Soviet Union, to resume his career as a plant-breeder, focusing on cotton. Due to the hard life under communism,

Derera decided to escape Hungary and communism and took his family and attempted to relocate to Kenya. His attempts to move to Kenya, and then his second choice New Zealand, were unsuccessful and he applied and got accepted into Australia. Despite his qualifications as a cotton plant-breeder, Derera struggled to find a suitable job and eventually accepted a temporary role with the NSW Department of Agriculture, based in the Naomi region. His role was to investigate cotton growing opportunities in the region (McHugh, 1996)

The arrival of Derera in the Naomi region coincided with the completion of the Keepit Dam on the Naomi River. Derera's preliminary investigations indicated that cotton growing and the Keepit Dam were connected and that the availability of large amounts of water would enable the development of an irrigated cotton industry in the region (McHugh, 1996). McHugh (1996) quotes Derera (p3): *"the best utilisation of the Keepit Dam was to produce cotton under an intensive irrigated cropping system in the Naomi Valley"*. Derera began to lobby local business groups and the community in the region about the potential for an irrigated cotton industry. Through his lobbying efforts, the Naomi Valley Agricultural Advisory Council was formed to act as a pressure group to foster the development of the industry.

As a cotton plant-breeder and researcher, Derera carried out research into cotton growing and published his research widely. An American farming magazine reprinted a paragraph about the cotton research that Derera was carrying out in the Naomi region, which caught the eye of Mrs Jean Kahl of Merced, California (McHugh, 1996). Jean and her husband, Paul Kahl, were American farmers who had a small 160 acre farm where they grew cotton, corn and sugar beets. Following his two year stint as a fighter pilot, much of it spent as a Japanese prisoner-of-war, Paul Kahl was energised to build a career and be successful and to put behind him the wasted years of the war. The problems they faced in farming in California with rising land prices, increased taxes, low profits, and government policy and controls on agriculture, provided a basis for American growers like the Kahls to examine other options. The article and the potential for cotton growing in Australia, where it was a new industry, provided a strong attraction for the Kahls.

After reading Derera's research article, Kahl wrote to him seeking his advice on the viability of large-scale cotton growing in the Naomi region. Derera provided extensive information and documented evidence to help Kahl and other American growers such as Frank Hadley to evaluate the potential and viability of irrigated cotton growing in the Naomi region. Derera emphasised the good potential for intensive cotton growing in the Naomi region, telling Kahl that:

> Cotton growing in Australia has a great future…….I wish to assure you that the climatic and environmental conditions desirable are available in NSW and especially in the Naomi Valley……most of the present farmers are not accustomed to intensive farming… therefore this industry must depend on new young farmers or on migrant farmers who have experience with any type of intensive farming. (McHugh, 1996, p6-7).

Based on the warm response from Derera, Kahl and Hadley came to Sydney, Australia, to meet with key people in the NSW Department of Agriculture and politicians including the local Member of Parliament for the North-West which covered the Naomi region and local community members. Despite pressure from the NSW Department of Agriculture to focus on the Riverina region as a potential area for cotton growing, Kahl and Hadley were suitably impressed with their discussions with Derera and other community members in the Naomi region. They decided to jointly invest in a cotton farm in Wee Waa, a small country town in the Naomi region and began growing irrigated cotton in 1961.

The Americans planted 60 acres in that first year. Local Australian cotton growers, such as Frank Boyle and Vic Melbourne, joined them but planted smaller amounts of cotton. The initial cotton variety used was known as the Empire variety which was sourced from Queensland. It had been used extensively in Queensland and in the Mississippi region of the US over a number of years. Derera continued to provide advice and assistance to the American pioneers. The local community in Wee Waa and surrounding towns watched the Americans and their attempts at growing cotton intensively with much interest and some concern. The first harvest day in 1962 was set up as a Field Day, open to the community and people came from all over the region to see what the "crazy Americans" had achieved and to help with the harvesting.

The American pioneers harvested around 90 bales of cotton providing a yield of around one and a half bales per acre. Compared to Californian experience, this yield was considered to be good. The harvested cotton was packed and transported to Brisbane for ginning, a process which separates the cotton lint from the seed. Paul Kahl is quoted by McHugh (1996, p10) as being cautiously pleased and highlighting three lessons: *"cotton would do well in Naomi, we had to have a gin as Brisbane was too far to haul it; and we had to have a pure seed program"*. Based on three key observations, these pioneer growers began to focus on developing solutions to these practical challenges with the assistance of cotton researchers.

Around the same time as the arrival of the pioneer cotton growers from the US, the NSW Department of Agriculture and research organizations such as the CSIRO had developed a cotton research presence in the Naomi region in Myall Vale. The Australian Cotton Research Institute (ACRI) was set up in Myall Vale[16] to provide cotton research capabilities to support the development of the new irrigated cotton industry. Apart from Derera, other pioneer cotton researchers such as Tom Lawler, Brian Hearn and Norm Thompson played a key role in these early years to develop cotton research that was useful to support the industry. A focus of this research was on developing local Australian cotton varieties suited for the local climatic and environmental conditions, including varieties that were more resistant to cotton pests.

4.4 Growing cotton in Australia: Key actors, operational activities and challenges

Cotton is grown, mainly, as an irrigated crop, in the Narrabri region of north-west NSW and in the Darling Downs and St. George regions of south-east Queensland in Australia. Around 84% of the cotton crop is irrigated while 16% of the crop is dryland[17].In Australia, there are around 1,500 cotton farms[18]. Many of these farms are small holdings with family based farming. Some corporate and trust-based cotton farms are operated by larger non-family based interests including Auscott which is one of the largest cotton growers owned and operated by the American family, the Boswells.

Cotton is a complex, risky and difficult crop to grow. Conventional cotton required growers to have deep agronomical and entomological knowledge and understanding in order to manage and produce a significant harvest. Conventional cotton required significant use of natural resources such as water and energy. Cotton growing also required significant capital to fund the resources and technology (e.g. cotton pickers) needed to manage the production system

Australian cotton is a commodity product which is ginned and sold in bulk to overseas spinning mills, mainly in China and other parts of south-east Asia. Australia is no longer involved in the industry value chain beyond ginning and shipping of cotton to international mills. Australian cotton is considered to be of very high quality and is used together with lower quality cotton from competing countries such as Indian and Pakistan to produce quality cotton yarn and materials at a reasonable and competitive cost.

---

[16] In 1958, the Myall Vale Experimentation Station was established. In 1972, the CSIRO established a presence. In 1974, the Narrabri Agricultural Research Station was established.
[17] Australian Grown Cotton Sustainability Report, 2014, Cotton Australia
[18] These farms are spread roughly equally between New South Wales and Queensland (http://cottonaustralia.com.au/cotton-library/fact-sheets/cotton-fact-file-the-australian-cotton-industry) - accessed 15 December, 2014

Cotton growers worked collaboratively with a range of others in the industry to develop the environmental and economic credentials of the industry. Two key groups were cotton researchers and cotton agribusiness consultants. Cotton researchers were a key group of individuals who have successfully facilitated research to improve the quality of cotton grown in Australia. Through their research on cotton varieties, including transgenic cotton, and improved cotton growing operational activities, related to integrated pest management practices (IPM), cotton researchers have provided a basis for Australian cotton to be recognised as an environmentally and economically value added agricultural commodity.

Cotton growing operational activities, particularly relating to managing cotton pests, are specialised activities which have been supported by agribusiness consultants. These operational activities include aerial spraying of pesticides, checking cotton plants for pest damage (chipping) and providing advice on plant and soil nutrition and maintenance of surrounding ecosystems.

Frequently contracted to chemical firms and agricultural product wholesalers, these agribusiness consultants provided a specialised consulting service to busy cotton growers in areas related to cotton pests and improved cotton yields. Their links with input suppliers provided these agribusiness consultants with a vested interest to promote use of pesticides and related technologies. However, these agribusiness consultants have also been instrumental in helping cotton growers improve their operational activities to produce higher cotton yields.

Cotton pests and water use were two key strategic challenges that would plague the industry in these early formative years and which would bring some of its major crises and controversies. Cotton pests were a particular challenge in Australia which the pioneer American cotton growers had not encountered before in the US:

> To be a cotton farmer, you've got to have pretty big balls. You've got to lay a lot out there. You've got to be prepared to have a pretty high debt to equity ratio in terms of a farmer. You are terribly reliant on climatic events, as all rural authorities are, but cotton is particularly exposed to insect proliferation invasion and you were very vulnerable to government intervention. (Senior Executive, Industry firm)

The only valid and effective option available to combat cotton pests and diseases in conventional cotton is the use of chemical sprays. Cotton pests are *Helicoverpa armigera* (also known as the cotton bollworm) and *Helicoverpa punctigera (*also known as the native budworm). These two species exist throughout the whole of the cotton season and have provided the main threat to conventional cotton

crop yields. In order to manage these cotton pests, cotton growers had to carry out on average 8–12 aerial sprays on each farm in each growing season at an estimated economic cost of around $1,000 per hectare.[19] These chemical sprays also had an impact on other insects such as plant bugs and stink bugs, and also on secondary pests (e.g. two-spotted mite and cotton aphid) which grew in numbers as their natural enemies were decimated by broad spectrum insecticides.

But aerial spraying cotton pests and cotton plants with chemicals created another and a far more challenging issue for cotton growers. Cotton pests developed resistance to these chemical sprays and as a consequence the chemicals became less effective. The development of resistance created a vicious cycle as chemical companies developed more potent chemicals and growers used more aggressive operational practices to spray these chemicals to control cotton pests and diseases.

Controlling resistance in cotton pests to chemical control measures has been a major challenge for the cotton industry. Resistance management remains a major challenge in evolutionary biology and in the agricultural sector in general. The following commentary[20] from experts in the field bears testimony to the significance of this challenge:

> I can think of few problems in evolutionary biology that are more important than controlling resistance, a problem that is serious enough now, and certain to become more so. Despite significant advances in our knowledge of the genetics, physiology and biochemistry of resistance, little progress has been achieved in formulating practical countermeasures against the inexorable march of resistance(Prof. C.E. Taylor, 1985, Address to the Linnean Society of London).

4.5 The social values of the pioneers-the basis for collaboration

The pioneer cotton growers, American and Australian, drove the development of a culture and values in the Australian cotton industry that emphasised collaboration and partnerships. This focus on collaboration put cotton growers, cotton researchers, cotton agribusiness consultants and other managers from firms involved in the industry, in a mutually dependent partnership which was designed to help the industry face to its key strategic challenges – particularly in relation to cotton pests, diseases and biological resistance. The American cotton growers knew that they had no prior

[19] Murray, D, Cotton Pest Control in Australia Before and After Bt cotton: economic, ecologic and social aspects, Conference paper

[20] As quoted in Forrester, NW, 1993, Management of pyrethoid and endosulfan resistance in H.armigera in Australia, Bulletin of Entomological Research Supplement Series, Supplement No 1, September.

history or connections in Australia and this provided a basis for them to drive this collaborative development of the industry. One cotton consultant from Narrabri, NSW described the role and influence of this early group of pioneer growers:

> I think some of the early leaders in the industry basically identified that the only way that they could make progress was to work together. So there was that collaborative aspect right from the outset. (CC2)

The relatively recent development of the cotton industry (from the 1960s), the lack of a long history, the complex nature of cotton growing, and the range and volume of environmental challenges,all combined to encourage cotton growers and related managers to develop a culture of partnering and sharing. A cotton consultant from Narrabri, NSW described how these factors combined to help develop the cotton industry culture of collaborative partnerships:

> The cotton industry probably can still claim to be a bit younger than some of the other industries. The irrigated industry really only started in the '60s……So people who weren't social equals at all, in any way, culturally, traditionally, financially, were very equal when it came to the ability and skill to grow a new crop, this new crop that was quite specialised. So, to some degree, there was no baggage…… It has crafted a very egalitarian culture because the barriers were the same for everybody which actually changes the kind of power distribution and therefore politics. (CC1)

Key industry firms and their managers were enlisted by the pioneer leaders to act as champions to help foster, develop and spread these common values to establish the culture of collaborative partnerships. These firms encouraged and volunteered their managers to serve on industry committees such as the ACGRA Executive Committee and to help deal with the challenges faced by all managers. These managers provided leadership in encouraging their peers to adopt these common values. One cotton consultant from Narrabri, who was involved with the ACGRA during this period, describes the role and influence of these key organizations and managers in this process:

> In the old days, the industry was really governed by AUSCOTT, Namoi Cotton and Queensland Cotton. So they would have more representatives on all the industry bodies like Cotton Australia, ACGRA. To their credit, they also would support their staff. But they would send growers, now people that are members of the co-op … to their gins to represent ACGRA to sit on ACGRA and discuss these things. (CC3)

The development of this common culture and values was not an easy task and was not without its challenges, but managers from different industry firms were encouraged to search for these common values due to the challenging issues faced by the cotton industry in this period when grower operational activities, particularly with regard to managing the threats from cotton pests and diseases, appeared to be overwhelming and destructive. One cotton consultant, who was also a regular attendee at ACGRA[21] executive committee meetings, describes how the focus on this common value provided the rationale for collaborative partnerships: *"we have to try and act as a collective regardless of what individuals think…. We essentially have to reach for that common value as the rationale for what we're involved in and why we're involved in it"* (CC1).

The pioneer growers focused the development of the common culture and values on a strategic tool that could help the industry develop solutions that could be implemented to improve grower operational activities. They realised that knowledge and information on managing industry challenges in relation to cotton pests and diseases was unavailable; they also recognised that unless this knowledge and information was developed and turned into practical outcomes, grower operational activities would not improve – this helped to focus attention on R&D. One cotton consultant, a son of one of these pioneer cotton growers, described how his father was committed to the value of research and helped to foster this belief in other managers involved in the cotton industry: *"my father was just absolutely committed to the value of research and the importance of research and it could have been just the fact that there was enough people around that saw that it was important enough to invest voluntarily in to make the industry work"* (CC3).

The research based culture was jointly developed by cotton growers and cotton researchers who developed R&D projects which were identified as relevant to the production of knowledge and information that could be used to help develop improved grower operational activities. The success of these projects in producing useful and practical knowledge, adopted by growers and used to improve their operational activities, helped to cement the research based culture in the cotton industry. A cotton researcher from one of the key research partner firms described how growers and researchers jointly helped to develop and spread the research based culture:

> Another factor, I think, is in small scale and it grew slowly at first and that was true of research as well. They tended to be very much focused on the immediate and not the longer term….. The industry was also very blessed in having some very, very good researchers at both entomology and plant breeding. So the industry, I suppose,

[21] Australian Cotton Growers Research Association

> was having successes handed to it through the quality of their researchers. So it had a very positive sense about the value of research. There were some real tangible successes the industry could point to, the value it received from investing in the research….. Everyone I'd spoken to had said, if you're going to pick an industry to work in, cotton is the industry. They're really progressive; they actually adopt the research that you do.

The development of a common culture and values has been fostered by the co-location of cotton researchers from different disciplines and research partner firms in one physical location. This co-location helped to break down barriers to communication and collaboration by enabling these different types of researchers to interact. From the commencement of the modern cotton industry in the 1960s, cotton researchers have been based at the Australian Cotton Research Institute (ACRI) in Myall Vale, just outside Narrabri, NSW. Occupying the same physical space has helped to develop networks and connections between different cotton researchers and has helped them overcome organizational and discipline barriers to work collaboratively to research and develop knowledge that has practical value for cotton growers. A research scientist from a research partner firm described the benefits from the co-location of cotton researchers:

> So this place was set up in 1958…. there were less than 10 of us at the ACRI. There were three - seven - scientists at that time or maybe three. Roughly 10…It naturally makes it collaborative because you just see people at the ping pong table at lunch time…. It naturally makes it a bit more collaborative and it gives…, a real sense of the industry.

The locating of cotton researchers in the cotton growing region of Narrabri, NSW helped to develop close networks and connections between grower and researcher. Researchers were able to visit cotton farms and examine grower issues and challenges first hand and share their research outputs; developing common outcomes that helped growers improve their operating activities. These networks and connections helped to foster good research outcomes which contributed to closer relationships between growers and researchers. One cotton consultant who has observed the operation of these networks described how growers and researchers used these networks to develop useful and practical research outcomes:

> So with those real successes but also charismatic is probably too strong a word but we were blessed by researchers that didn't just sit at the research station and do their

> research and publish papers…. These were guys that went out into the fields and spoke to farmers, got feedback from farmers but also told their story to farmers. There was always very much a working relationship, certainly a core of the really respected researchers rather than being in this ivory tower that gave information down from on high…. they have these relationships with growers where growers will just ring them direct and say, I've got this kind of bug, what is it or how do I manage it or whatever… The industry was also very blessed in having some very, very good researchers at both entomology and plant breeding. So the industry, I suppose, was having successes handed to it through the quality of their researchers. So it had a very positive sense about the value of research. It wasn't like, we'll be spending this money - every year we fork out all this money and what do we get for it. There were some real tangible successes the industry could point to, the value it received from investing in the research (CC3).

4.6 Establishing administrative mechanisms

In order to meet the challenges (cotton pests and diseases) of growing cotton in Australia, the pioneers focused on R&D to develop new information to help improve operational activities of cotton growers. These pioneer growers established a range of administrative mechanisms to facilitate the development of the industry. This included industry representative firms providing functional specialisations of work and governance mechanisms, such as committees and conferences, to enable cotton growers and related managers to be organized to support the development of the industry. As identified by pioneer Paul Kahl, the industry development required value chain infrastructure such as gins; research investment and direction, including capabilities to develop new cotton varieties; marketing and sales capabilities; and strategy and policy development capabilities (McHugh, 1996).

One of the first representative firms established in the cotton industry by growers was Cotton Australia (CA). It was established in 1972[22] by three firms involved in growing, ginning and marketing cotton; the Namoi Cotton Cooperative, Auscott Limited and the Queensland Cotton Marketing Board (now OLAM). CA started life as a client of a public relations firm. Cotton Australia's main role was as an advocacy and policy making organization for cotton growers. CA was also tasked with lobbying governments to secure investments in capital infrastructure such as

[22] The original firm was known as the Australian Cotton Foundation. The name was changed to Cotton Australia in 1997.

roads, rail, electricity and water, to support a growing and developing industry. One of the partners of the public relations firm described the decision to establish Cotton Australia as follows:

> I had just started my up my own public relations firm when Jack Messick came into my office and announced he represented the cotton industry. That was early in 1972. He felt that the industry was being unfairly attacked in the media and that I should stop them from writing these things against an industry that was relatively new and trying hard to establish itself. The only way to fix the media issues was for the growers to change their methods of operation and we worked together in those early days to do just that. At the same time, we created the Australian Cotton Foundation (now Cotton Australia) to promote Australian Cotton. (CA 40th Anniversary Annual Report, 2012).

Cotton growers are members of CA and participate in its activities. Cotton growers are organized into regional Cotton Growing Associations (CGA) and each CGA is a member of CA. CA was established with its own board of directors and a management team and was funded by voluntary levies paid by cotton growers. The management team was led by an Executive Director (later renamed as CEO) and included regionally based staff supporting cotton growers. The CA Board was drawn from cotton growers from different CGAs. A key organizational role within the management team was the role of the Environmental Director, responsible for all environmental management issues. The role was supported by regionally based environmental staff who worked closely with cotton growers.

As indicated above, the cotton industry has enjoyed a unique foresight introduced by some of its early pioneers that research and development and translation of research outcomes into practical output to help growers was the pathway to a successful and sustainable cotton industry. Two key managers involved with the industry for a long time described this unique insight in the following terms:

> Well, I think the whole cotton industry has always had a philosophy that R&D is very good for it and it's always been on that sort of basis, industry wants to go forward. …..there's been a culture – this industry started funding its own research before government did back in the '70s. (Manager)

> I have never seen anything like it, anywhere else in the world, the way success – or the way research has been taken up and the success of an industry. (Manager)

This R&D focus was centred on two important firms which were established by these pioneer cotton growers with support from other managers in the industry. The first firm was the Australian Cotton Grower Research Organization (ACGRA)[23] which was established in 1972 with a mandate to provide research direction and investment from cotton growers. Cotton growers were members of the ACGRA which was focused on sourcing and funding cotton research. The ACGRA was purposefully kept separate from Cotton Australia to enable R&D, and its funding, to be separated from advocacy and political lobbying. R&D funding was sourced through a levy on cotton growers. A pioneer grower describes this decision in the following terms: *"The cotton industry in Australia set itself up in its formative years to control its own destiny free of government controls. In the process it separated research from politics" (CA 40th Anniversary Annual Report, 2012).*

The ACGRA Constitution identified its key objectives as including the advancement and promotion of the interests of cotton growers, raising funds from members and other sources to advance the interests of ACGRA, and determining guidelines for research. It also sets out guidelines for the governance of ACGRA including membership, committee structure and procedures for meetings.

Cotton growers served on the ACGRA Executive Committee which was its governing body, but the meetings of the committee included representatives from other firms within the industry. These representatives included managers from CA, ginning firms, merchant firms, research partner firms, cotton agribusiness consultants, seed firms, chemical firms, biotechnology firms, and government related regulatory agencies. This practice enabled the ACGRA Executive Committee meetings to provide an effective governance mechanism to enable sharing of information by managers from different parts of the industry value chain and to help in the development of new strategic opportunities. ACGRA was instrumental in providing a governance mechanism to foster industry wide collaboration.

The ACGRA's Executive Committee was chaired by innovative growers with strategic foresight who drove the development of industry related strategic issues. The first chair was Richard Williams, an American grower who is credited with the strategic development of the cotton industry in the 1970s and 1980s. He was instrumental in developing the R&D funding model for ACGRA and in driving R&D based solutions to improving cotton growing practices. He was

[23] Merged with Cotton Australia in 2008

succeeded by another innovative cotton grower, Dick Browne, who led ACGRA along a similar path in the 1990s.

The second important firm, established in 1990, was the Cotton Research and Development Corporation (CRDC). The CRDC is a statutory corporation set up by the Australian Government to fund rural agricultural industries such as cotton and grains. These rural research corporations are established by an Act of the Australian Parliament and provide a vehicle for taxpayer funds to be distributed by the Australian Government to fund and support research projects.

The CRDC is required to work closely with a lead industry representative firm for strategy and policy for cotton growers and ACGRA took on this role. ACGRA provided research direction and investment which guided the CRDC in relation to R&D project scope and investment. Cotton grower managers on the Executive Committee of the ACGRA were involved in lobbying for the establishment of the CRDC. The minutes of the ACGRA executive committee for the meeting held on 9 April 1990 documents the following item which supports and describes this lobbying role:

> …meeting be organised at an early date with the Minister for Primary Industries and Energy to discuss both the role of ACGRA being the responsible industry to which the new R&D Corporation would report to and also the eligibility of ACGRA members nominating as directors of the new corporation.

The Board of Directors of the CRDC is an administrative governance mechanism responsible for reviewing and approving R&D projects. These approvals are made following advice from cotton growers through the ACGRA on the scope and outcomes of R&D projects. Cotton growers on the ACGRA Executive Committee are involved in influencing the choice of cotton growers chosen to serve on the CRDC Board. The foundation Board was established through nominations provided by the ACGRA. Cotton grower managers on the Executive Committee of ACGRA established a selection sub-committee to call for and review nominations from cotton growers to serve on the CRDC Board of Directors. The minutes of the meeting of the ACGRA Executive Committee, held on 28 June 1990, documents the appointment of eight members of the ACGRA to a selection sub-committee for potential Directors to the new CRDC Board of Directors. Two of these grower members were also on the Executive Committee of the ACGRA.

The CRDC is required to provide an annual report to the ACGRA on R&D projects funded and on key findings from these projects, and the basis for turning these findings into information and technologies that could be used by cotton growers to improve their operational activities. This

practice ensures that managers from these firms collaborate, share information and knowledge, and develop common strategic approaches. The minutes of the ACGRA executive committee meeting held on 6 February 1992 documents the inaugural reporting by the CRDC Chair to the ACGRA. The report covered the strategy and operations of the CRDC in its first year of operation and included information on R&D projects funded and outcomes from these projects.

An important administrative mechanism used in the industry is the bi-annual Australian cotton conference. Since 1969, the ACGRA had organized bi-annual cotton research conferences which provided a useful forum for cotton growers, cotton researchers and other industry managers to collaborate, share information from research projects, provide feedback on the usefulness of research outcomes, and identify new strategic issues and approaches.

A special sub-committee of growers from the ACGRA Executive Committee were given responsibility for organizing the cotton research conferences including developing the conference agenda, identifying relevant conference presenters, deciding on conference venues, accommodation, entertainment and pricing. The conference agenda provided the key mechanism for interaction between different groups of managers from the industry. A research project carried out by the Cotton CRC documents the role of these conferences and how they have enabled collaboration between researchers and growers:

> Cotton conferences in Australia have been an instrument used to overcome geographical and social challenges by bringing communities together, sharing ideas and research, and uniting growers. Conferences became a showcase for local research and became a key resource for both early adopters and prospective growers. It was also used to address industry-wide matters. (A historical geography of cotton farming in NSW and QLD: adaptation and adoption, p15).

The formation of the conference agenda was a collaborative activity between ACGRA and other industry firms such as Cotton Australia and the CRDC. The conference agenda showcased R&D projects carried out by cotton researchers on a range of topics relevant to the industry and cotton growers. As cotton researchers presented these research projects – including the scope of the work, key research questions, methods used and findings – managers from different industry firms, including cotton growers, were able to assess the practical value of the research findings, discuss their translation into grower operational practices, and understand the mediums to be used for this translation (e.g. new technology, best practice information). Table 2 provides an extract from the

1996 conference agenda which describes a range of R&D projects relevant to the development of transgenic cotton and improved IPM practices.

Table 2 Extract of 1996 Cotton Research Conference Agenda

- Resistance management-a key to the transgenic era
- Refuges: a key element in transgenic cotton management
- Qualifying the value of refuges for resistance management of transgenic Bt Cotton
- Will current secondary pests become a problem
- Using predators and parasites to control cotton pests
- Alternative crops for producing natural enemies of cotton pests
- The potential for transgenic cotton plants to select for resistance in *Helicoverpa armigera*
- Arming cotton plants with an insect virus to beat the Bollworm
- Environmental risk assessment of GM insect viruses for the control of *Helicoverpa* species

4.7 Investing in R&D

The Australian cotton industry has been a proactive investor in R&D to innovate and develop new technologies, information and practices, to facilitate the development of a world class global industry with sound environmental and economic credentials. Led by the pioneer cotton growers who helped establish the modern industry, R&D has been used as a strategic tool to improve the business performance of the industry. The cotton growers and cotton researchers within the industry understood the importance of R&D and developed mechanisms to ensure investment in R&D was organized in a way that enabled growers and the Australian taxpayers to share the responsibility for investment. There are two aspects to the investments made by cotton growers in R&D: investment of capital and providing research direction.

First, through the ACGRA, cotton growers put in place a mechanism for R&D capital investments by all growers. A voluntary levy was established that each grower was required to contribute towards an R&D investment pool which was managed on behalf of all growers by the CRDC. This levy was linked to the market price earned by growers on each bale of cotton and was collected from revenues earned once the bale was ginned and sold to cotton merchants. The levy was collected and invested in the R&D investment pool, initially by the ACGRA and later by the cotton merchants who paid the net market price to the cotton grower. The inaugural R&D voluntary levy (from around 1972) was set at 25 cents per cotton bale. The voluntary levy was raised to $2 per bale in 2000 and is now at $2.25 per bale.

The R&D capital investment funds provided by cotton growers were matched by the Australian Government. The Australian Government has developed an approach to funding agricultural

sectors through Rural Research and Development Corporations which have been established to fund R&D in each of the major agricultural sectors such as cotton, cattle and beef, grains and horticulture. These research and development corporations are established by Australian Government legislation with a mandate to direct research funding to R&D projects to develop and improve technologies and practices in these industries. In the cotton industry, the CRDC has replaced the Cotton Research Council which was the precursor firm providing and managing research funding within the industry. Around 0.5% of the gross value of cotton at the farm gate is invested by the Australian taxpayer in cotton research. The CRDC also earns royalties from new technologies developed and patented which are reinvested in the R&D pool to fund R&D.

Second, cotton growers have also invested in R&D by providing research direction to enable appropriate scoping and conduct of R&D projects which have provided new technologies, information and practices. Initially, this research direction was provided by the Executive Committee of the ACGRA. The ACGRA Executive Committee sourced, funded and managed R&D projects to identify how grower activities were impacting on the environment and on their economic productivity.

The first task was to identify issues that needed to be researched. This task was carried out by industry sub-committees established by the ACGRA Executive Committee. These sub-committees covered a range of relevant cotton growing topics including entomology, soils and tillage, agronomy, plant breeding, genetic engineering and marketing. Each sub-committee comprised of grower members with a chair who provided a reporting line to the Executive Committee. The sub-committee was responsible for identifying key issues in their portfolio area which required R&D. This information was provided to the Cotton Research Council which was responsible for coordinating the scoping and funding of R&D projects.

The second task was for the Executive Committee to review R&D projects which had been submitted to the Cotton Research Council. As an example, the ACGRA Executive meeting on 12 April 1988 considered 32 continuing R&D projects to the value of $1.2m and 43 new projects to the value of $1.5m (see Table 4.2). These amounts were considered substantial investment of funds at the time.

Table ACGRA R&D projects

R&D project type	Continuing projects	New projects
Cotton plant	$0.2m	$0.1m
Cotton crop	$0.3m	$0.3m
Insect pests	$0.4m	$0.7m
Cotton diseases/Weeds	$0.1m	$0.1m
Crop management systems	$0.2m	$0.2m
Communications/transport		$0.1m
Total	**$1.2m**	**$1.5m**

Source: Minutes of ACGRA executive committee, 12 April 1988

The Executive Committee made recommendations on each R&D project to the Cotton Research Council. These R&D projects played a monitoring role in helping cotton growers assess their current operational activities, particularly in relation to chemical use to control cotton pests. The R&D projects assessed the natural environment and riverine systems for chemical pollution and helped to identify the pathways used for the transport of the chemicals from the cotton farm. Other R&D projects examined new operational activities that could help to better protect cotton plants from cotton pests and diseases without creating the adverse impacts on the environment and the high economic costs of chemical use.

The ACGRA Executive Committee provided a platform for cotton growers, cotton researchers, cotton agribusiness consultants, and other managers of firms within the Australian cotton industry, to collaborate to scope and carry out R&D projects that were focused on key strategic issues faced by the industry. Key strategic issues such as developing improved cotton varieties which were resistant to cotton pests, new technologies, and "best practice" information to improve cotton growing operational activities, provided the basis for these R&D projects.

4.8 The failure of Pyrethoid chemical sprays

From the early days of the modern cotton industry, cotton growers recognised the strategic challenge posed by cotton pests. Paul Kahl, one of the American pioneer growers, is one of the cotton growers who saw a benefit in developing improved cotton varieties including transgenic cotton as a way of combatting cotton pests (McHugh, 1996). Cotton breeding researchers were the leaders in helping to identify and develop new cotton varieties including transgenic cotton (McHugh, 1996). This fundamental understanding by cotton growers and researchers that sustainable cotton growing required better varieties and growing practices, such as reducing the use

of harmful pesticides, provided a basis and focus for R&D in providing new technologies and information which could be used to improve cotton growing.

The issues relating to cotton pests and resistance came to a head in the 1983/84 cotton growing season when Pyrethroid chemical sprays failed to provide satisfactory field control of *H.armigera* (cotton Bollworm) at Emerald, Queensland. Since the late 1970s, Pyrethroids had been considered miracle insecticides and had many redeeming features which favoured their use by cotton growers: they were regarded as cost effective, were required in low dosages, had no residue problems, were safe to mammals, had low environmental impact, and were immobile in the soil. By 1986, Pyrethroids represented 25 per cent of all insecticides used in agriculture and public health and 49 per cent of insecticides used in cotton (McHugh, 1996). They were well regarded in cotton farms due to their effectiveness against most cotton pests. The breakdown in Emerald showed for the first time that cotton pests had developed resistance to Pyrethroids. A research scientist with a research partner organization described the advent of resistance in this period-

> The *Helicoverpa,* which had developed resistance to DDT, developed resistance to the next generation of … synthetic pyrethroids. When the synthetic pyrethroids came in, in the late '70s, we told the industry very clearly, if you use these the same way that you used DDT, you will have resistance…… When resistance finally came in about '83, I think that was a turning point. (Research Scientist)

The failure of Pyrethroid chemical sprays to control cotton pests forced the industry to consider improving operational activities. The focus of these improved activities was on reducing the reliance on insecticides and chemical sprays, and developing a more holistic approach to pest management that used a range of measures. These improved operational activities included the use of biological control measures, such as the use of beneficial insects to prey on cotton pests, and activities to manage the spread of chemicals from the farm to the natural environment around the cotton farm. The use of transgenic cotton varieties was also identified as an improved operational activity, but these varieties were yet to be available commercially.

A research scientist from a research partner organization described the renewed focus on improved operational activities:

> So the original idea when they came here was that there was a major problem with pest control. The plant breeding research and a lot of the entomological research was put in place to develop varieties not as susceptible to insect damage and to develop a

> management of the insects that utilised beneficial parasites that might be there to control insect as well… Within five years it became evident that wasn't the only problem, that disease was a big problem, and so there was a lot of effort put into diseases as well. The yield benefit you see there are down a lot to disease resistance and the pest management work highlighted how difficult it was and that is why transgenics were going to be the way in which you were going to make an order of magnitude change into the use of pesticide rather than the host plant resistance that we worked on prior to that, was taking away 10 per cent of the - or reduced the amount by 10 per cent of pesticide use rather than by 80 per cent which is what Bt (transgenic) cotton can do. (Research Scientist)

The challenges posed by cotton pests and diseases and the related but significant issue of resistance forced cotton growers to rethink their operational activities. Cotton Australia, as the key strategy and policy firm for growers, became focused on developing a strategy to "reinvent" the industry to allow the industry to *"shoulder the economic, moral and legal responsibilities of adulthood"* (Executive Director, CA, Strategy Document, August 1990).

Environmentally, high dependence on insecticides led to a range of issues including contamination of riverine systems and pastures, decimation of beneficial insect populations, outbreaks of secondary pest populations, and contamination of other agricultural products (e.g. beef). Socially, regional communities and the environmental movement were mobilising public opinion against the cotton industry. Cotton growers were considered to be high users of chemicals and water and, even though their profitability brought financial benefits, their "social licence to operate" was questioned. The high reliance on pesticides using aerial spraying methods served to reinforce community perceptions that the industry was not clean or safe.

4.9 Cotton Australia: Providing a strategic focus for the industry

The development and implementation of strategy was an informal or ad-hoc process within firms in the industry during these formative years. Cotton growers were coming to grips with the strategic challenges involved in cotton growing, particular in relation to cotton pests and diseases. Cotton growing operational activities, such as aerial spraying of chemicals to control cotton pests and water related issues, were creating community concern and were providing a basis for the industry's environmental and economic credentials to be challenged. Cotton yields were declining due to the prevalence of a range of cotton pests and diseases. The pressure to develop a coherent strategy and policy that could focus cotton growers and other managers within the industry on

improving these strategic challenges was building. As the Executive Director of CA explained, the cotton industry was forced to adopt a strong environmental management focus and to develop new and innovative solutions to combat cotton pests and diseases as traditional operational practices were inadequate: *"Environmental management focus is based on the need to adopt a new approach to problem solving – one that involves environmental awareness, technical expertise, and a willingness to adopt innovative and imaginative solutions*" (Cotton Australia Strategy Document, Aug 1990).

The operational activities of cotton growers also resulted in unwanted attention for the industry from the environmental movement. Historically, the 1980s represented a growing awareness of environmental issues in Australia and across the world. Major catastrophic events such as the Chernobyl nuclear plant disaster[24], and the Bhopal[25] chemical plant disaster, focused the attention of the environmental movement on the need to examine and monitor industries and organizations with a history of unsafe operational practices. The environmental movement was in favour of increased government regulation of industries which had harmful operational activities – the cotton industry was a particular target:

> The resolute, articulate and well-organised environmental movement is a definite threat to our industry. In the long-term, it may also prove to be one of our greater opportunities. Cotton Australia is charged with the responsibility of undoing many years of neglect and public ignorance about this industry. Our biggest and most testing challenge is to ensure the industry is not regulated out of existence. (Executive Director, CA)

In this context, as the industry's representative firm for cotton growers, Cotton Australia developed and published the first formal strategy for cotton growers in the Australian cotton industry. The purpose and focus of this "industry strategy" was to provide a strategic focus for cotton growers, consultants and researchers by elevating the importance of achieving important strategic objectives and to also highlight the gap between these strategic objectives and current operational activities.

The strategy provided a focus on ambitious competitive strategic objectives which focused on environmental management and economic management issues. The role of the strategy was to provide a basis for cotton growers and other managers, such as cotton researchers and cotton agribusiness consultants, to consider how to develop information and technologies to design "best

[24] http://www.livescience.com/39961-chernobyl.html (accessed 11 October, 2013)
[25] http://www.greenpeace.org/usa/en/campaigns/toxics/justice-for-bhopal/ (accessed 11 October 2013)

practice" operational activities which could be used to implement actions to meet these strategic objectives at the firm-level. At the time of their development, these strategic objectives were not achievable as the industry had not developed this new information and technologies.

The strategy document[26] prepared stated the mission in the following terms:

> To be the key industry forum, ensuring the viable growth and development of the Australian Cotton growing and processing industries.

The environmental management objective was described as to:

> Foster, educate and influence growers, consultants, aerial operators, processors, chemical manufacturers, farm input suppliers and other industry organizations and partners in responsible practices in land care, chemical and water use, and in other related practices that support and maintain a sustainable base for cotton growing. (Cotton Australia Strategy Document, Aug 1990)

The economic objective was described broadly as to:

> Create a positive profile of the Australian cotton industry as reliable producers of high quality product, as a major Australian agricultural export industry earning in excess of A$ 750m export revenue, and as a valuable natural fibre in the domestic fashion, homewares and industrial sectors. (Cotton Australia Strategy Document, Aug 1990)

The Cotton Australia strategy provided a basis for cotton growers and related managers to focus on developing new information and technologies to improve cotton growing operational activities and to achieve these strategic objectives by using information and technologies at the firm-level. This strategic focus helped firms and managers to develop strategic insight, a key attribute required to engage in open strategy processes. The "stretch" strategic objectives provided a basis for firms and managers to search for novel solutions which enabled development of strategic insight as a key meta-capability.

4.10 Chapter summary

This chapter is one of three data chapters for this thesis. The focus of this chapter has been on the Formative Years, mainly between 1962 and 1990. This period commenced with the arrival of

[26] CA Strategy Document, August 1990

American cotton growers to join Australian cotton growers in the Narrabri region of north-west NSW to establish the modern cotton industry. These pioneers, together with cotton researchers, carried out a series of actions which helped develop the industry and provided a basis for the industry to meet the future challenges posed by excessive use of pesticides to control cotton pests and diseases.

These pioneers developed social values which provided a basis for collaboration and partnerships within the industry – between growers, researchers and other managers within firms in the industry. These pioneers developed firms such as Cotton Australia and ACGRA to provide organizational and functional specialisation to help develop the industry. These firms provided the basis for networks and relationships to be developed. These cotton grower pioneers believed in R&D and established mechanisms to support long-term funding of research through pooled capital funds from growers and the Australian taxpayer. They established the context for open strategy processes by setting up administrative governance mechanisms, such as the Australian cotton conference, which provided a basis for managers within firms in the industry to meet and collaborate.

These formative actions provided a basis for the industry to be prepared to meet the serious existential challenge for the industry in 1997 with the Endosulfan crisis. In a short period of time, the industry was able to develop best management practices (BMP) and introduce transgenic cotton, which provided a basis for firms to improve their operational activities and re-establish their environmental and economic credentials. The story of how the industry was able to develop new information related to transgenic cotton and improved pest management practices (IPM), to make it available for access and use by managers in firms to develop and implement strategy, forms the basis of discussion in the next chapter (Chapter 5).

Chapter 5 The Crisis Years 1991–2004

5.1 Introduction

This chapter covers the Crisis Years which includes the period between 1991–2004. During this period, the cotton industry faced its most significant existential crisis related to cotton pests and diseases. The growing community concern, about cotton grower operating activities related to the wide use of pesticides, came to a head in this period with a series of incidents of pesticide contamination. The cotton industry faced intense regulatory pressure from the Australian Government and the community to improve its environmental credentials. The introduction of transgenic cotton varieties and improved operational activities related to integrated pest management provided a basis for cotton growers to reduce their reliance on pesticides and to improve their environmental performance. By the end of this period, the cotton industry had transformed itself from an environmentally unsustainable industry to an industry that was able to differentiate its product on the basis of its environmental credentials. The key events of this period are discussed and described in this chapter.

Section 5.2 includes a description of the first environmental audit carried out in the cotton industry to assess and take stock of the environmental impact of cotton production. This section includes a discussion of how this information provided the basis for a major R&D programme which developed new information on best practices for cotton growing. Section 5.3 includes a description of The Program, one of the largest R&D programme carried out in the cotton industry, which provided the basis for the industry to develop information which formed the basis of the Best Management Practice (BMP) system. The BMP system provided access to this information for all growers and facilitated development and implementation of strategy at the firm-level. Section 5.4 includes a description of the Cotton CRC, a research partner firm which provided the basis for the extensive research collaboration evident in the cotton industry. The CRC was involved in facilitating and carrying out many of the R&D projects within The Program. How the CRC was organized and used to manage these R&D projects will be discussed. The strategic solutions to managing the ecological issues relating to pesticides were based on improved cotton varieties and integrated pest management practices (IPM). Section 5.5 includes a description of transgenic cotton varieties and IPM, and discusses how these strategic solutions were developed and the mechanisms that were used to make them available to all cotton growers. Section 5.6 includes a description of the BMP system and provides a discussion of how this important collaboration mechanism was

developed to provide a basis for sharing best practices related to cotton growing with all growers. Section 5.7 provides a summary.

5.2 The first environmental audit and stocktake of knowledge on pesticide impacts

As discussed in Chapter 4, Cotton Australia formed the first strategy for cotton growers in 1990 to provide a basis for the industry to focus on improving operational activities related to the use of pesticides to control cotton pests, diseases and biological resistance. As the Executive Director of CA (at the time) explained, the cotton industry was forced to adopt a strong environmental management focus and to develop new and innovative solutions to combat cotton pests and diseases as traditional operational practices were inadequate: *"…. environmental management focus is based on the need to adopt a new approach to problem solving-one that involves environmental awareness, technical expertise and a willingness to adopt innovative and imaginative solutions"(Strategy Document, Aug 1990)*

Growing community concerns about cotton growing operational activities related to the use of pesticides was increasing pressure on the Australian Government to regulate the industry. The environmental movement was in favour of increased government regulation of industries which had harmful operational activities and the cotton industry was a particular target:

> The resolute, articulate and well-organised environmental movement is a definite threat to our industry. In the long-term, it may also prove to be one of our greater opportunities. Cotton Australia is charged with the responsibility of undoing many years of neglect and public ignorance about this industry. Our biggest and most testing challenge is to ensure the industry is not regulated out of existence. (Executive Director, CA)

Against this background, managers in Cotton Australia developed the first formal strategy for cotton growers to focus attention on the twin challenges of improving cotton varieties and to reduce reliance on pesticides. This strategy was designed to provide a basis for strategic direction for all cotton growers and to enable cotton growers to focus on the impact of their operational activities. Managers in Cotton Australia, and in other firms within the industry, either individually or collectively, were not in an immediate position to carry out actions to achieve the strategic objectives; however, the intent of the strategy was to focus attention on the strategic challenges and to enable the development of strategic insight – a key attribute required for engagement in open strategy processes.

The key strategic uncertainty for the cotton industry was resistance in cotton pests to chemical based control measures. This resistance emerged over a long period of time and was linked to the grower operational activities related to aerial and ground spraying of chemicals to control cotton pests and related diseases. In the absence of more sophisticated practices to control cotton pests, cotton growers resorted to the increased use of various chemicals to manage these threats. The increased use of chemical control measures created resistance in cotton pests in future generations. Unwanted by-products from the excessive use of chemicals were the destruction of beneficial pests that provided natural control and the pollution of the riverine environment, triggering community and environmental concerns. A cotton grower who served as the chairman of the board of directors of Cotton Australia during this period described these challenges:

> Pesticides and their impact on the surrounding environment and communities have several times been thrown into sharp focus during the year. Helix was of course the most notable incident and the rapid industry-wide response to voluntarily withdraw the use of Helix was remarkable…..in some regions, community concerns over alleged health effects arising from aerial application of chemicals and burning cotton trash have escalated…..some communities continue to believe that so-called cotton chemicals cause chronic ill-health. (Cotton Australia Annual Report, 1992)

The strategic uncertainty related to resistance in cotton pests to chemical control measures were also impacting on the economic performance of the cotton industry. The increased use of chemical control measures created higher costs of production for cotton growers and also led to *" yields which were declining or stagnant"* (CC3). The operational activities of growers were not only impacting adversely on the environmental management objective but were also impacting negatively on the economic objectives.

The adverse environmental impact created two strategic challenges for cotton growers. First, they faced a growing call for more regulation "*to maintain access to the tools and the pesticides…" (CC3)*. As chemical companies developed more potent chemicals for use in controlling cotton pests, growers and chemical companies were at the receiving end of more regulatory requirements and hurdles that had to be met before approvals were granted for their use. Second, the environmental lobby was mobilised and called for greater regulation of all aspects of cotton growing. The Executive Director of Cotton Australia described this strategic challenge: *"The resolute, articulate and well-organised environmental movement is a definite threat to our industry.*

Our biggest and most testing challenge is to ensure the industry is not regulated out of existence" (Strategy Document, August 1990).

Key managers in Cotton Australia and ACGRA recognised that the strategic uncertainty of increased resistance in cotton pests to chemical control measures posed a major threat. The strategic uncertainties focused attention on the operational activities of cotton growers which in the words of CC3 *"were just not working"*. These managers understood that they needed to develop improved approaches to managing these strategic uncertainties or "*someone will be belting us over the head with this" (CC2)*.

However, there was also acknowledgement by these managers that they lacked knowledge and information on the specific impacts of chemicals on the environment and how chemicals ended up in regions outside cotton farms including riverine systems. There was wide acknowledgement that changes to operational activities had to be grounded in research based knowledge and information that helped to design improved practices. This knowledge and information had to be assessed, developed and translated into best practice with the involvement of cotton growers. The Environmental Director of Cotton Australia described this strategic approach in the 1992 Annual Report (p 5):

> Cotton's response to mounting pressure in the late 1980s and early 1990s was to commission the now historical Environmental Audit in 1991. Addressing its findings…..provides a focus for solid foundation for best practice. The means by which the cotton industry will steer itself through the increasing political and environmental pressures is by adhering strictly to an industry code of practice or best practice guidelines.

From the outset, managers at Cotton Australia held the view that ecological objectives were compatible with economic objectives, and that both sets of strategic objectives could be achieved with the relevant and appropriate operational activities. They were of the view that abiding by sound environmental practices provided the cotton industry with a cotton product that could appeal to customers and create competitive advantage and greater economic rewards. They viewed the strategic uncertainties not merely as a strategic threat but also as a strategic opportunity. As the Environmental Director at Cotton Australia explained:

> It is a fact that ecological and economic sustainability are not mutually exclusive…. Ecologically sustainable development principles can deliver on-farm cost

> savings….through industry wide adoption of the code of practice, the natural qualities of cotton can be promoted and the Australian industry can take advantage of new niche market opportunities. (Cotton Australia Annual Report, 1992)

The first step in assessing and understanding the impact of the strategic uncertainties was the environmental audit which was planned and undertaken by managers in Cotton Australia in 1991. The audit was undertaken by two external consulting organizations: Arbour International and Gibb Environmental Sciences. The environmental audit, the first of its kind in the agricultural sector anywhere in the world, had as its overall aim the *"identification of major environmental issues relating to the Australian cotton industry and to assess the overall performance of the industry with respect to these issues"*.[27] Major objectives of the audit included:

1. Assessment and identification of improvements to environmental standards
2. Assessment and identification of improvements to industry environmental performance, particularly with respect to shared resources such as water and land, and related ecosystems
3. Developing independent information on the environmental performance of the industry that could be used to inform community perceptions of the cotton industry.

The scope of the audit was to investigate the *"environmental impacts of cotton production from the establishment of new cotton farms to the production of ginned, raw cotton"*.[28] The range of activities investigated were those engaged in by members (i.e. growers) of Cotton Australia. The scope was restricted to investigating industry practices and issues; individual audits of cotton growers were not conducted. The data used for the audit was based on existing data and there was no physical monitoring or investigation undertaken to generate new data. Existing data from archival data sources and interviews with key stakeholders were developed and used for the audit.

The *1991 Environmental Audit Report* provided 69 key recommendations. The recommendations covered a range of areas:

1. Pesticide use (31 recommendations)
2. Land use (7 recommendations)
3. Water use (11 recommendations)
4. Cotton processing (20 recommendations)

[27] Gibb Environmental Sciences and Arbour International, 1991, An Environmental Audit of the Australian Cotton Industry, p1
[28] Gibb Environmental Sciences and Arbour International, 1991, An Environmental Audit of the Australian Cotton Industry, p2

The pesticide recommendations covered a range of operational activities and suggested improvements. Cotton Australia managers provided an initial response to each of the 69 recommendations in an Action plan.

Table 3 provides examples of these recommendations and responses from Cotton Australia managers.

Table 3 Extracts from 1991 Environmental Audit Report – recommendations and industry response

Audit Recommendation	Cotton Australia Response
5. More monitoring of spray drift in populated areas is required. Air monitoring should be introduced in a small number of key sites (e.g. Wee Waa, Moree). Methods used should be compatible with those currently used in Emerald.	The Mungindi Cotton Growers Association will pilot a monitoring program for the 1991-92 season in conjunction with Cotton Australia and Department of Water Resources. Cotton Australia will pressure both State Governments to implement sophisticated monitoring programs similar to those in place in Emerald.
10. Aerial spraying has many advantages over boom spraying. These include: fewer operators required and thus less occupational exposure to pesticides, easier control by regulatory authorities and less soil compaction.	The cotton industry, through its research arms-CRDC and ACGRA, is funding new equipment designs to improve application technology for ground and aerial spraying.
13. Cotton farmers should plant tree lines around their own properties (with due allowance for the safety of crop spraying aircraft) to limit the drift of spray off the property	Cotton Australia will encourage cotton growers to implement this recommendation
18. Research into integrated pest management techniques should be continued and encouraged. This can help avoid problems of pesticide resistance and contribute to a reduction in the quantities of pesticides used.	The cotton industry through the ACGRA and CRDC will continue to research integrated pest management.
20. Research into all aspects of pesticide resistance should be maintained and encouraged.	The CRDC has recently commissioned research projects to address this issue

The second step in assessing and understanding the impact of strategic uncertainties was the commissioning of research to identify current knowledge on the impacts of grower operational activities on the environment. This step was focused on undertaking a stocktake of knowledge and was carried out in parallel to and alongside the environmental audit.

An example of this research is provided by the report *The Impact of Pesticides on the Riverine Environment with specific reference to Cotton Growing* by three researchers, JWH Barrett (Barrett Purcell and Associates Pty Limited), SM Peterson and GE Batley (CSIRO Centre for Advanced Analytical Chemistry). The research was commissioned, by the CRDC and a research partner, the Land and Water Resources Research and Development Corporation.

The research study provided a detailed review of current knowledge of the impact of cotton pesticide use on rivers and the biodiversity within these rivers. The topics covered included water management issues on the farm, pesticide use issues covering the chemical structures and lifecycles, the regulatory environment covering the rivers in New South Wales and Queensland, industry attitudes, fate and impact of pesticides in river waters, and current research into pesticide impacts on rivers and biodiversity.

The report provided summary findings in each of the key areas to help managers in Cotton Australia and their partners at ACGRA to identify gaps in knowledge and to develop further research projects. In relation to pesticides, the report stated that:

> Pesticides may be applied by either aerial or ground spraying, or incorporated directly into the soil. Loss from the target area can occur through spray drift, volatilization, deep percolation, and run off of tail water or storm water. Rainfall events can result in the pesticides being washed from plant leaves and stems or from the soil, reaching the riverine environment, either in soluble forms or attached to soil particles. (page 1 of Executive Summary)

The stocktake of knowledge in key topic areas relevant to the impact of grower operational activities helped to identify gaps in knowledge which provided project topics suitable for research. These research topics were developed into new research projects to help develop knowledge to improve grower operational activities. The report identified *"areas where research is required to fill knowledge gaps and thereby permit effective management of impacts on riverine environments" (page 1 of Executive Summary)*. The report goes on to specify seven broad areas for research, including the stripping of pesticides by running the water over grass or other media such as coal

dust; toxicity, fate, and transport data on new pesticides; and the establishment of databases of all relevant pesticide research for use in the development of models to provide more rapid predictions of the impact of new chemicals on Australian aquatic biota.

The stocktake of current knowledge and identified gaps and the findings of the environmental audit provided the basis for managers in industry firms to collaborate to determine research priorities. A workshop was held in the NSW town of Goondiwindi in May 1992 where managers from Cotton Australia, ACGRA, CRDC, Cotton Consultants Association and other stakeholders came together to review the state of knowledge on the use of pesticides and their impact, and to provide an approach to developing knowledge on practice improvements that were needed.

Based on the discussions at the Goondiwindi workshop and ongoing interactions between managers from various industry firms, a major R&D programme was formalised in 1993 as a partnership between three key industry firms: the CRDC, the Land and Water Resources Research and Development Corporation (LWRRDC), and the Murray Darling Basin Commission (MDBC). The R&D programme was formally named *Minimising the Impact of Pesticides on the Riverine Environment* (The Program) and was conducted for a period of five years to 1998.

5.3 The Program

The Program was one of the longest R&D programme carried out in the cotton industry. The Program involved multiple smaller R&D projects which were carried out over a number of years from 1993 to 1998. Many other firms including universities and research firms such as the CSIRO were involved in R&D projects within this large research programme. The consolidated findings of the R&D projects in The Program formed the basis for the development of "best practices" relating to a range of cotton growing operational activities which were included in a Best Management Practices (BMP) system and made available to cotton growers. The BMP system provided information that individual cotton growers could access and use to develop and implement strategy at the firm-level.

The range of management control mechanisms (planning and administrative systems) deployed as part of managing The Program provide exemplars of the collaboration mechanisms used in the open strategy process within the cotton industry.

The Program had 3 key strategic objectives:

1. To assess the impact, if any, of current pesticide use on the riverine environment

2. To develop practical and economic methods to minimise the transport of pesticides from application sites and to minimise their effects on the riverine environment
3. To provide a sound scientific basis for the development of management guidelines and regulatory codes.

The Program was structured into three linear phases, with each phase requiring substantial progress and outcomes to help facilitate the following phase. The three phases and their key objectives were:

1. Phase1 had a focus on identifying and framing the pesticide issues. Key objectives were to:
    a. Determine and quantify the major pathways of pesticide movement to rivers, and
    b. Determine the level of impact of these pesticides on riverine biota
2. Phase 2 had a focus on developing solutions to issues identified in Phase 1. The key objective was to develop methods and resource allocations to provide solutions to pesticide issues
3. Phase 3 had a focus of practice adoption of research outcomes. The key objective was to develop a Best Management Practice (BMP) system which could be made available to cotton growers for adoption and to be able to audit the programme to provide evidence of compliance. The BMP programme could also be used to communicate the industry's environmental credentials to the community.

The Program had a range of expected outcomes including identifying sources of pesticides in the riverine systems, determining the impacts of pesticides on aquatic ecosystems, and designing operational activities for all relevant aspects of cotton farming (e.g. water, spray and river management).

Within each phase of The Program, different R&D projects were commissioned to focus on specific gaps to develop new knowledge that could be used to design new and improved operational practices. Phases 1 and 2 of The Program ran for around two years from 1993, and projects within these phases were run either concurrently or linearly with the results from one project providing scope for new projects. Priority was afforded to fundamental field based research to understand key pesticide related issues such as pesticide spray applications, soil deposits, wash off and run off, and degradation of chemicals in soil and water.

Phase 3 commenced in 1995 and ran for three years. Research projects in this phase were focused on designing best practices to help cotton growers improve their operational activities in relation to the use of chemicals to control cotton pests and diseases. The best practices were designed to help growers reduce the harmful effects of pesticide use on the natural environment and ecosystems, and

to focus their operational activities on getting the best outcomes in terms of chemical control of cotton pests and diseases.

5.3.1 Management of R&D projects within The Program

A sophisticated project management system (PMS) was developed and implemented to manage all aspects of The Program. The PMS had a number of important features. First, a management committee was established to manage The Program. Specifically, the management committee had the responsibility for setting the strategic direction of The Program, agreeing R&D priorities, designing the research programme (including phases and research projects), and the financial and operational management of The Program.

Second, the management committee had membership drawn from industry firms including CRDC, LWRRDC, MDBC and other stakeholders within the cotton industry. The chairperson was drawn from LWRRDC as the lead industry firm for water resources and research. These representatives also held positions in other industry firms providing a common and shared focus across these firms. A cotton grower who was involved with a number of firms and forums within the cotton industry described The Program as a *"huge cooperative venture involving research funders, a range of research providers and the cotton industry. Progress is usually achieved through cooperative effort and this program has highlighted such benefit"*. The common membership from managers, who also were involved in related roles in the cotton industry provided a mechanism for inter-firm collaboration – a feature of the cotton industry.

Third, the management committee established a clear strategic direction which was embedded in the three strategic objectives set for The Program. These three strategic objectives included the assessment of pesticide use on the riverine environment, development of practical and economic methods to minimise the transport of pesticides from application sites, and the provision of a sound scientific basis for the development of management guidelines and regulatory codes. The strategic direction and objectives were focused on understanding, assessing and developing new approaches to managing the key impacts of grower operational activities in relation to pesticide use. As a cotton grower from a major private cotton grower firm described: *"the Australian cotton industry, perhaps more than any other agricultural enterprise, has been at the epicentre of tension over agricultural practice. Clearly, the use of chemicals and concern for the riverine environment has been key pressure triggers"*.

The strategic direction was supported by a range of management principles which established the value system for The Program. These principles operated as cultural systems which helped to

establish the culture for The Program, establishing and driving the behaviours expected of all managers involved in The Program. The value system included management principles that focused on stakeholder consultation and contribution to identification of key research issues and involvement in developing and implementing practical changes to operational activities, collaborative approaches to communicating and sharing knowledge and information on improved activities, developing adequate funding and operational support for R&D projects and designing best practices for use in cotton farming operations that could be used as a model for other industries.

Fourth, the PMS established specific performance outcomes that were communicated to all stakeholders and operated as a measurement control to manage the performance of The Program. These performance outcomes were developed for The Program as a whole and for each Phase, and acted to focus and influence managerial behaviour to achieve the strategic direction established. The performance outcomes for The Program overall included the identification of all impacts of operational activities in relation to pesticides on the riverine systems and aquatic ecosystems, and the development of improved operational activities to reduce the environmental footprint of cotton growers. Table 4 describes the outcomes by phase.

Table 4 The Program: Key outcomes by phase

Phase	Outcomes
Phase 1	1. The sources, types and quantities of water-borne pesticides moving off-farm are determined 2. The processes involved and factors affecting the movement of pesticides in water and sediment are determined 3. The movement of water-borne pesticides within and off cotton farms is modelled 4. The magnitude and frequency of tail water pesticide releases to rivers from irrigated cotton crops are determined 5. The quantities of pesticides moving to rivers by aerial transport as spraying drift, volatilised material and airborne particulate material (dust) under specified conditions are determined 6. The persistence of pesticides, particularly Endosulfan, in soil and waterbodies is determined through degradation studies 7. The impacts of Endosulfan, Profenofos and pyrethroids on the aquatic biota of the rivers of cotton growing regions are determined through laboratory and field studies 8. The factors and processes influencing the impact of pesticides on the aquatic riverine biota including sources and forms of chemical, local habitat effects, organism lifecycles and climatic events are determined

Phase 2	1. Potential solutions or amelioration approaches are identified 2. Resources allocated according to highest potential payoff solutions and approaches 3. Solutions and approaches are compared and evaluated
Phase 3	1. Regulatory guidelines are developed based on outcomes from Phases 1 and 2. 2. Best management practice in terms of farm, spray, chemical and river management, as identified in Phase 2 are implemented

Source: Schofield, NJ, 1998, Origin and design of the cotton pesticides program, Pesticides Conference proceedings

These performance outcomes helped to focus behaviour of managers towards meeting the strategic direction by helping to change practice, as described by a cotton grower: *" best practices provides a process for benchmarking and where necessary methodical and rational change in management systems. It also provides a vehicle for cultural change"*.

Finally, the PMS scoped and commissioned R&D projects with a focus on fundamental field-based research to understand and develop knowledge of pesticides and their effects on rivers systems. R&D projects examined issues such as aerial transport systems to understand pesticide transport to river systems, dust related transmission between farm and river systems, and tail water management and discharges. After the first two years of R&D projects, which developed key knowledge and understanding on pesticides their movement and transport from farms to river systems, projects were scoped and commissioned to develop knowledge and information on solutions and best practice approaches.

5.4 The Cotton Cooperative Research Centre (Cotton CRC)

The Cotton Cooperative Research Collaborative (Cotton CRC) is a specialist research firm established and funded by the Australian government with a focus on applied research in the cotton industry. The Cotton CRC was first established in 1993 and was in existence until 2012. The Cotton CRC was mandated by the Australian Government to operate as a collaborative research partner firm on a seven year cycle, with extensions provided at the end of this seven year period. Two extensions to the CRC were granted by the Australian Government.

The CRC mission is described as providing high quality collaborative research, education and adoption activities which benefit the Australian cotton industry, regional communities and the nation. The purpose of the CRC is described as facilitating the delivery of a cotton industry that adopts world best practice in production, environmental and catchment management; secures

international competitiveness using research to increase yield and fibre quality; and generates improved social and economic conditions in cotton communities.

The CRC operated on a collaborative partnership model which included 11 core partners and 36 affiliate partners. Core partners included Cotton Australia, CRDC, CSIRO, private companies (e.g. cotton seed distributors), and several universities. Core partners provided research expertise, funding and resources to further the research agenda of the CRC.

> The key functions of CRC to fulfil have been the role of collaborator and facilitator for the multiple organisations and actually having the Commonwealth agreements with which state what you're going to achieve as a collective. It really drives collaboration, drives that communication. So it is akin to very much the mortar and the brickwork, so you've got the large bricks obviously being Cotton Research Development Corporation, your university partners, CSIRO, the state agencies, Cotton Seed Distributors (CSD), they're the bricks and they provide the mortar which goes between and it's a commonality of a focus in pulling it together. The ability to talk to another institution or organisation under the umbrella of the CRC – it's not one organisation talking to another organisation and there's no connection between them. That's the bridge that operates between them. (Senior Executive, CRC)

The CRC conducted its research, development and extension programme through five streams. Each stream was managed by a CRC manager and involved program managers from key partner agencies. Research projects in each stream were conducted by research partners with funding from the CRC, CRDC and partners. The five research streams were: Farm, Catchment, Community, Product and Adoption.

The Farm research stream had a focus on improving the profitability and sustainability of cotton production and commissioned and managed research projects that worked on a range of production issues such as integrated pest management, new technologies, water use efficiency, and plant and soil management. Outcomes from this research stream included improved management of pesticide use, improved plant resistance to bio-security threats, better use of water, and improved environmental and social sustainability of the production system.

The Catchment research stream had a focus on best practice cotton enterprises to deliver sustainable ecosystems and reduced impacts on catchments. The research projects commissioned

within this stream focused on a range of issues such as integrated management of river systems, managing on-farm water storage, and managing biodiversity and ecosystem services on farms. Key outcomes from this research stream included development of technology to monitor soil water at different depths and practices to monitor impact of grazing on vegetation inundated by floods.

The Community research stream, itself an innovative concept, focused on developing mutually beneficial interactions between the cotton industry and regional communities. The focus of research was on understanding the economic and social impacts of cotton production on regional communities, developing opportunities for employment and human capital development in regional communities hosting cotton production, and developing community and industry positions and information on natural resource policy issues. Key outcomes from this research stream included resources and information for use in policy debates and policy development, and raising industry profile and awareness through rural community conferences.

The Product research stream focused on the post-farm gate value chain and developing high quality, consumer-preferred cotton. Research projects focused on developing improved fibre quality, improved ginning and spinning processes, developing new marketing and branding initiatives, and reducing contamination in cotton product. Key outcomes have included improved ginning and classing practices, and the development of branding initiatives.

Finally, the Adoption research stream focused on application of research through the increased adoption of new knowledge within the industry, catchment and communities. The main thrust of this stream has been on holding workshops and forums to disseminate knowledge and helping to build connections between growers, researchers and administrators.

5.4.1 Management control systems: Administrative governance mechanisms

The Cotton CRC employed a range of management control systems within the firm to influence managerial behaviours to enable achievement of its key strategic objective of encouraging research collaboration.

Overall governance was provided by a Board of Directors. The Board of Directors provided advice on the strategic direction of the firm and the establishment of research collaboration. Board members were selected for their business expertise and their knowledge and understanding of the cotton industry.

> One of the things about the CRC Board of Directors is that they are a skills based board, they're not a representative board, so they all had individual skills. Some were

> representative but in their own right, they were actually skills based even within the representative stuff. That was an absolute godsend because we had some key people who had commercial skills, we had some key people who had research skills, legal skills, industry leadership skills, connectivity, all that sort of stuff. (Senior Executive, CRC)

The other key governance mechanism within the firm was the senior management team, headed up by the Chief Executive Officer. Other members of the senior management team included the Chief Operating Officer, the Lead Scientist, Business Manager, Program Leaders, Accountant and Communications Manager. The main role of the senior management team is program management of the portfolio of R&D projects carried out by the Cotton CRC and its research partners.

5.4.2 R&D project management

The main focus of the Cotton CRC was on managing a portfolio of R&D projects. These projects were sub-contracted out to research partners who had, generally, entered into a long term partnership arrangement supported by a specific research contract. In some instances, R&D projects were sub-contracted to a research firm on one-off basis as regular research partners were either not available or did not have the required skills to carry out the research. Regular reporting and monitoring of all sub-contracted projects were carried out by CRC staff.

5.5 The development of transgenic cotton and IPM

From the late 1980s, cotton researchers and cotton growers, particularly those managers closely associated with industry firms such as Cotton Australia and ACGRA, were slowly coming to the view that cotton growing strategies and operational activities needed to be changed and new strategic approaches were required to make the cotton industry more sustainable both environmentally and economically. During this period, there was a growing realisation that the best and more effective solution for managing resistance in cotton pests and reducing the harmful effects of chemical control measures was to move to non-conventional cotton and to adopt integrated pest management (IPM) practices that took a holistic approach to managing resistance.

Non-conventional cotton involved the use of gene traits that provided natural biological protection against cotton pests and was less harmful to the natural environment and to beneficial pests. Consequently, non-conventional cotton was considered to be able to produce higher and more consistent yields for cotton growers. As a research scientist from one research partner firm explained:

> The yield benefit you see there are down a lot to disease resistance and the pest management work highlighted how difficult it was and that is why transgenic (non-conventional) cotton were going to be the way in which you were going to make an order of magnitude change into the use of pesticide rather than the host plant resistance that we worked on prior to that. (Research scientist)

The stocktake research projects undertaken during this period also pointed to the need for more focused research on non-chemical based measures to control cotton pests. The research report by Barrett et al. (1991, p.2) summarised their key finding on this issue as: *"to minimise potential environmental impacts and the need for monitoring, research into non-chemical methods of insect control should receive continued encouragement"*. Non-conventional cotton provides a non-chemical method of insect control.

Biotechnology organizations such as Monsanto had been researching the development of non-conventional or transgenic cotton varieties since the late 1980s. These transgenic cotton varieties were aimed at providing biological control of the main cotton pest varieties- *Helicoverpa armigera and Helicoverpa punctigera*. The first generation of transgenic cotton produced by Monsanto was branded as Ingard cotton and included a gene called Bt (i.e. *Bacillus thuringiensis*). This bacterium produces a protein which controls certain Lepidopteran larvae (caterpillars) when they feed. The Ingard cotton has a gene which produces the same protein and provides similar outcomes. The Bt bacterium are microscopic, single-celled organisms which are found in large numbers in any soil sample anywhere in the world. A teaspoon of soil could hold millions of Bt. More than 20,000 different Bt strains have been isolated by scientists from soil samples.

Bt[29] are unique in the bacterial world because of their ability to produce proteins that kill certain insects. Each of the subspecies of Bt produce a protein that targets specific pests. As the pest feeds on the protein, it works to suppress feeding. If the Bt protein is swallowed whole by the pest, it fits like a key into a specific "lock", called a receptor site, in the pest's gut. The protein key chemically opens a lock which, in turn, opens a hole in the gut, killing the pest in a few days. Importantly, the Bt protein acts only on a narrow range of insect pests and has no effect on any other living thing including humans. The Bt protein achieves this targeted effect due to the operation of the receptor

[29] Until the 1970s, scientists thought that Bt could only kill a few larvae (caterpillars) from the Order *Lepidoptera* (moths and butterflies). In 1977, scientist discovered that Bt proteins could also kill insects. In 1983, a Bt protein was discovered to be effective against the Colorado potato beetle and the elm leaf beetle. The scientific basis for developing Bt genes that could make targeted killing of cotton pests was established (Ingard Brochure, Monsanto, 1995)

sites and the insect's alkaline (high pH) gut. Most living things have a more acidic (lower pH) stomach. Except for the Bt sensitive insects, no living thing has these special alkaline receptor sites or locks, so Bt protein keys cannot work on any other living thing: *"Specificity is what makes Bt so effective and environmentally benign".* (Ingard brochure, Monsanto, 1995, p4).

In the late 1980s, Monsanto scientist and cotton growers successfully spliced[30] the Bt gene into cotton plants and tested and found that the gene was able to express (i.e. make a protein) at a rate higher than normal. In other words, Monsanto had developed a transgenic cotton variety with a Bt gene capable of effective targeted killing of cotton pests with no damage to any other living thing or the environment. Soon after, Monsanto began the long process of commercialising its transgenic cotton which was branded as Ingard.

The availability of transgenic cotton varieties has also helped cotton growers adopt integrated pest management (IPM[31]) practices more effectively. IPM represents a collection of "best practice" cotton growing practices[32] that improve growers' individual operational activities in relation to managing cotton pests and diseases. IPM is based on a thorough understanding of the ecology of pest and beneficial species and their interaction with the crop, and provides growers with a range of strategic activities which must be integrated to achieve economic and environmental sustainability.

The new strategic approaches, transgenic cotton and IPM, were being developed and tested in this period and there was a growing awareness amongst key industry managers that these approaches could help manage industry-level ecological issues relating to cotton pests. But the practical adoption and application of these strategic approaches to influence grower operational activities had not as yet materialised. These developments provided the basis for new information and technologies which had been developed through open strategy processes in the cotton industry.

---

[30] Refers to the plant breeding process used by agricultural scientists to improve plant yields by identifying and developing beneficial traits. Traditional plant breeding required scientists to cross two whole plants to obtain a single gene with beneficial traits that could be used to breed cotton varieties with higher yields. However, with biotechnology procedures, scientists are able to fast track this process by enabling them to pluck out a single gene from a plant, and splice it into another plant or any organism. Biotechnology also allows scientist to make genetic changes between organisms from anywhere in the "tree of life", i.e. a gene from a microbial organism which is at the bottom of this tree could be taken and combined with a cotton plant which is higher on this same tree of life.

[31] "careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment. IPM emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms" (Food and Agriculture Organization, 2002)

[32] These practices are based on a range of principles including the use of best practice crop agronomy, effective sampling for pests and the use of thresholds, conservation of beneficial pests, use of trap crops and communication and sharing of information on these practices with growers

Transgenic cotton was introduced to the Australian cotton industry in a research pilot in 1992. Monsanto and the CSIRO entered into a research partnership and appointed two industry firms, Cotton Seed Distributors (CSD) and Deltapine Australia P/L, as seed partners. Monsanto and CSIRO provided research capabilities to examine the impacts of transgenic cotton in the Australian environment. CSD and Deltapine provided capabilities to breed and grow transgenic cotton varieties for use by cotton growers. Together with these partners and researchers from CSIRO, Monsanto ran breeding and testing programs over a number of years to field test their transgenic cotton variety, called Ingard, for environmental and economic performance in Australia.

These tests showed that, compared to conventional cotton, transgenic cotton produce the same environmental impacts but the Bt gene helps to combat insects in a more targeted manner. Key findings from this research included: evidence that the Bt toxin is not found in the lint or cotton seed oil and only in negligible amounts in pollen and nectar; that there was no difference in the quality of lint and seed; there were no differences in plant diseases, outcrossing with native cotton species is not possible; soil impacts are the same as for natural cotton plants; beneficial pests are not adversely impacted; and Bt toxin has no harmful effects on other living things including humans.

Commencing from the 1992/93 growing season, Ingard transgenic cotton was grown in a research pilot format to examine its performance economically and environmentally in Australian conditions. The field pilot testing was conducted with the approval of the Genetic Manipulation Advisory Committee (GMAC), which is an Australian Government agency responsible for approving the use of transgenic species in Australia. Table 5.3 describes the field pilot testing process leading up to the first commercial release of Ingard cotton in the 1996/97 cotton growing season.

Table 5 Ingard field pilot testing process

Season	Area (ha)	% of total cotton area	Main Activity
1992/3	200 plants	N/A	Assessment of outcrossing risk, field efficacy
1993/4	0.03	N/A	Assessment of outcrossing risk, field efficacy
1994/95	10	N/A	Field efficacy, environmental impacts
1995/96	40 (4 sites)	N/A	Environmental impacts, IPM performance
1996/97	30,000	8	5 year registration, annual review, 1st commercial release

Source: adapted from Fitt, GP, 2003, Implementation and impact of Transgenic Bt Cottons in Australia, Proceedings of the 3rd World Cotton Research Conference, South Africa

The cotton growing season in 1996/7 was the first season where Ingard cotton was commercially grown in Australia – a milestone for the industry. The use of transgenic cotton provided an additional benefit to cotton growers as it established a platform for more effective IPM practices. These improved IPM practices provided a basis for cotton growers to change their operational activities and to reduce their reliance on pesticides.

IPM is a collection of practices designed to enhance the ability of growers to *"shift the advantage back from pests to the grower and crop consultants"* (Ingard brochure, Monsanto, 1995, p14). Integrated pest management (IPM) practices have been used by cotton growers since the early 1980s and have helped to supplement the key practice of chemical control of cotton pests and diseases. This initial focus was referred to as a curative IPM where the focus was on trying to cure cotton farms of cotton pests. IPM practices such as sampling for existence of pests, designing thresholds and refuges, and the recognition and use of beneficial pests to provide natural pest control, have been used. However, their effectiveness has been limited and these IPM practices have not helped to reduce the development of resistance in cotton pests or the harmful effects of pesticides on the natural environment.

A useful and valuable IPM system needed to *"reduce insecticide use, whilst maintaining yield and early maturity and maintaining the susceptibility of cotton pests to new selective insecticides"* (Fitt et al., 2009, p509). This improved IPM system was built on a number of key principles. These principles are documented in Table 6.

Table 6 IPM Principles

- The mere presence of a cotton pest species does not justify action for control
- IPM is about containment of a pest situation, not eradication
- No single control measure can be applied to all pest complexes
- Some acceptable level of damage or loss to crop should be tolerated
- IPM is a system with a collection of practices which provide a diverse array of control options to minimise pest abundance or damage with pesticides used as a last resort
- IPM does not seek to eliminate the use of pesticides but aims to limit the least disruptive options and to reduce the use of pesticides for pest control to the lowest practical levels

Source: adapted from Fitt et al., 2009

The improved IPM system has seven key objectives and a range of practices to support the achievement of each of these objectives. These objectives and practices have been developed from knowledge and information from R&D projects carried out by cotton researchers. Table 5.5 describes these objectives and practices.

Table 7 IPM system objectives and practices

Objective	Practices	Description
Using best practice crop agronomy to grow a healthy crop	Optimal planting time Optimal water management Strategic use of plant growth regulators Defoliation of the crop promptly at maturity Optimisation of fertilizer strategies to avoid excessive plant growth Matching of cotton variety to region and pest complex	IPM is focused on reducing crop losses from pest damage. These crop agronomy practices can help IPM to support improved cotton yields and fibre quality
Effective sampling for pests, beneficial insects and plant damage combined with thresholds	Regular sampling of crops Use of combined pest and damage thresholds	These collection of practices are designed to help growers assess crop damage from pests
Conservation and use of beneficial insects	Preferential use of selective insecticides Site specific pest management Selection of appropriate insecticidal seed treatments Effective use of nursery crops	These collection of practices are designed to enable the use of natural pest control measures with selective use of pesticides
Preventing the development of insecticide resistance	Selective use of insecticides Monitoring the effects of insecticides Destruction of diapausing pupae that are potential reservoirs for resistance genes	These practices are aimed at preventing pest populations developing resistance to chemical and biological control measures
Managing crop and weed hosts of key pests	Selective use of crop rotations Managing weed and cotton regrowth	These practices are designed to prevent the development of hosts for pests, particularly in the off-season
Using trap crops to control	Growing trap crops in	These practices are designed

Objective	Practices	Description
pests	defined areas to help trap and control cotton pests	to help control cotton pests
Communication and training	Communicating information on IPM practices Use of area wide management groups to coordinate IPM practices Training on IPM practices	These management practices are aimed at improving grower knowledge and information on IPM

Source: Adapted from Fitt et al., 2009

Transgenic cotton varieties offer a great potential to dramatically reduce pesticide dependence for control of cotton pests and help to establish a base for improved IPM practices. Ingard played a key role in helping growers implement improved IPM practices by targeted killing of insects, reducing the need for pesticides and associated costs, and reducing the adverse impacts on the environment. Some chemical insecticides and spraying were still needed, but the frequency and volume was greatly reduced. Three managers from different organizations within the industry described the role played by transgenic cotton in establishing a new base for improved IPM practices which helped cotton growers improve their operational activities:

> The transgenic in the end formed the foundation of IPM in cotton because it just allowed a lot more flexibility in terms of thresholds and the monitoring of populations. Everything slowed down in terms of the critical timing factor; once people were more comfortable with managing non-resistant populations, they weren't so trigger happy with the spray ... So the transgenics have been a platform for a huge drop – the reliance basically – that pretty much reflects use on secondary other pests, other than heliothis, that's there, you add probably something for white fly and something for aphids and you'd nearly be at this line, like there might be a spray in there for heliothis, maybe, most years maybe. No one would welcome a return to fully conventional cotton but it would be a very different industry still to the one we had before. (CC1)

> The transgenic cotton has solved a lot of problems with the spraying…That's a good thing, that's a very good thing. If you've only got to spray a crop once or twice then your time discretion of when you can do that should leave very little excuse, if any, for someone transgressing and causing problems to the whole industry. (CEO, CA)

> A good example of that, obviously, is BT cotton. But we had to rely on a massive investment on behalf of Monsanto who went right out on a limb when they did start investing in GM. If they hadn't done that, we'd be still spraying 10 times and our industry wouldn't be nearly as big as it is now. (GM, R&D, CRDC)

The introduction of Ingard cotton required growers to review their operational activities pre-season, during the season and post-harvest to ensure these activities worked together with Ingard and IPM practices to reap maximum benefits. A key benefit from Ingard cotton is that beneficial insects are not harmed. Therefore, the end of season insecticide spraying needed to ensure that these pests were not destroyed and deprive growers of the mechanism for natural control of pests.

The introduction of Ingard cotton did not end the development of resistance to the Bt gene protein in cotton pests. As described in the Ingard brochure (Monsanto, 1995, p19), *"the goal is to delay as long as possible the build up of pest populations that can resist the Ingard toxin, which is to prevent resistance from diminishing the effective life span of Ingard"*. Resistant pests cannot be prevented but their number could be restricted through appropriate practices. These practices were included as part of the IPM collection of practices.

Additional IPM practices were developed to help improve the effectiveness of Ingard cotton and to enable cotton growers to adopt operational practices that helped to facilitate the use of Ingard cotton. Various practices were considered, including developing Ingard cotton varieties with ability to deliver high dose Bt proteins; developing refugia of natural cotton plants which allow cotton pests to feed and remain susceptible to Ingard's Bt protein; and agronomic practices such as crop rotation and monitoring insect resistance through R&D projects. The approach taken was described by Monsanto:

> Our goal is to make Ingard a positive addition to growers' ever decreasing pest control options and to extend effectiveness for many years… this will only happen if everyone involved in growing crops with Ingard works together… Resistance to Ingard would severely affect all of us… our entire investment, including more than 10 years of hard work and billions of research dollar,s rides on the possibility that resistance may arise… . We will do all we can to ensure that Ingard remains effective for the longest period of time… the same commitment will be necessary from the cotton industry… the longer Ingard wins, the longer we all will win. (Ingard brochure, Monsanto, 1995, p23).

The introduction of transgenic cotton and IPM were planned in collaboration with cotton growers and other managers from industry firms in the cotton industry. The Cotton Research Conference held in 1992 provided the first opportunity for interaction between cotton researchers and growers and other industry managers on the topic of transgenic cotton. At the conference, a Forum on Managing Biotechnology was held and chaired by Dr Gary Fitt from CSIRO who had been the leading researcher on the development of transgenic cotton varieties in the cotton industry in Australia. The purpose of the Forum was to brief growers and other industry managers on the evolving search for improved practices for managing ecological issues related to cotton pests and diseases, and to encourage greater engagement of growers in this search. As described by Dr Fitt:

> The Australian cotton industry relies heavily on chemical pesticides for management of a diverse array of pest insects, weeds and diseases. Pesticide use is a major economic and environmental liability for the industry and all measures to reduce this dependence need to be taken…. (Gary Fitt, CSIRO, 1992 Cotton Conference proceedings, p387)

The Forum was seen as the first step in the *"long process to implement a management strategy for Bt toxins in both plants and sprays to ensure their long-term availability"* (Gary Fitt, CSIRO, 1992 Cotton Conference proceedings, p387). The Cotton conference forum was designed to inform growers of the issues related to transgenic cotton and for them to hear from experts in the topic. The focus of the forum was to help growers develop a management strategy for the implementation of transgenic cotton- *"It is essential that growers realise that it is the industry at large who must develop and implement these strategies…..researchers can advise and assist but without a will throughout all sectors of the industry there is little likelihood of success"* (Gary Fitt, CSIRO, 1992 Cotton Conference proceedings, p388).

Following this Forum, a workshop was held in Narrabri, NSW on 4–5 August 1992 to examine the management of transgenic cotton and develop an implementation strategy for its introduction into the Australian cotton industry. This workshop coincided with the first research trials of transgenic cotton in Australia (see Table 5). The workshop involved around 13 different industry firms including CSIRO, NSW Department of Agriculture, biotechnology firms (e.g. Monsanto), ACGRA, Cotton Australia, CRDC, Cotton Consultants Australia Inc., CSD and Australian regulatory agencies. The workshop enabled managers from these industry firms to discuss strategic issues related to transgenic cotton including a management strategy for resistance containment and Bt toxins; management of

economic and environmental impacts of transgenic cotton; and a research strategy to support the management strategy to develop knowledge and information on growing transgenic cotton.

The discussions and interactions at the workshop helped to develop a broad management strategy for transgenic cotton. This strategy covered design of resistance management practices for transgenic cotton and a plan for implementing transgenic cotton. A key outcome from the workshop was the formation of a Bt Management Working Group comprising cotton researchers, growers and other industry managers to oversee the development of the management strategy in greater detail, to coordinate and develop an education programme for cotton growers, and to coordinate transgenic cotton research. The Bt Management Working Group was established as a discussion forum for all relevant sectors of the cotton industry.

The Bt Management Working Group was led by Dr Gary Fitt (CSIRO) and had a focus on discussion, education and sharing of information on transgenic cotton. The Group also provided a forum to share information on the experience of other agricultural sectors with genetically modified varieties. The Working Group met on a bi-annual basis and had specific objectives relating to:

1. strategies for the management of conventional Bt sprays to avoid the development of resistance
2. protocols and guidelines for the release of transgenic varieties of *Helicoverpa* host crops expressing the Bt endotoxin gene or genes and communicate these to relevant regulatory authorities
3. strategies for the management of transgenic varieties of *Helicoverpa* host crops to avoid the development of resistance

A major role for the working group was to educate growers and other stakeholders on management strategies for Bt sprays and Bt transgenic plants.

The administrative mechanisms, such as the Forum at the 1992 Cotton Research conference and the Bt Management Working Group, helped to establish the arrival of transgenic cotton on the agenda for cotton growers. As a consequence, at the Annual General Meeting of the ACGRA in September 1994, growers decided to establish a committee to focus on organic cotton (the term used to describe transgenic cotton at that time). The initial ACGRA committee for organic cotton had a chairman and four other grower members and was mandated to represent cotton growers on all transgenic cotton matters. The minutes of the meeting recorded the establishment of this committee:

> It was noted that at the recent Australian Cotton Conference the need to formulate industry guidelines for organic cotton had been identified. This role would be taken by ACGRA……it was agreed that the ACGRA be proactive in forming a committee

> to discuss and formulate guidelines and then invite selected growers to a meeting…..it was agreed that the ACGRA Committee for organic cotton be Peter Cottle (Convening Chair), Dick Browne, John Stewart, Harley Bligh and Paul McVeigh….It was also agreed that Bruce Pyke (CRDC) be invited to join the committee.

The ACGRA committee for organic cotton was mandated to coordinate actions with the Bt Management Working Group and to take over responsibility for the development and management of the Bt cotton management plan which covered all aspects of growing transgenic cotton. The ACGRA Executive Committee also proposed the establishment of a new group to be known as the Australian Transgenic Cotton Management Group (ATCMG) to *"have the responsibility of preserving the future interest of Australian cotton producers by providing a forum for interested parties and researchers to debate and decide on the best strategies for pre and post transgenic introductions"* (ACGRA meeting minutes Sep 1994). The ATCMG took over responsibility for working with the Bt Management Working Group. The ATCMG was renamed the Transgenic and Insect Management Strategy (TIMS) Committee and held its first meeting in 28 February 1995; the TIMS Committee played a key strategic role in enabling the emergence of transgenic cotton.

TIMS was formed as the premier committee of the ACGRA to manage the development and implementation of a management strategy for the introduction and growing of transgenic cotton. This management strategy included the development of a resistance management strategy. Three key strategic objectives were established for TIMS:

1. To design a management strategy which will preserve current and future insect management systems
2. To correct/change the insect resistance management strategy in accordance with conditions such as chemical shortages or exceptional Heliothis problems
3. To "police" and monitor the application of the strategy and provide clearance for deviations or major changes to the strategy

The committee membership provided an example of industry wide collaboration with five cotton growers from ACGRA, three cotton researchers, one representative from Monsanto, two representatives from CSD, one representative from the Queensland Department of Primary Industry, one cotton consultant and one representative of a chemical company. The committee was

chaired by a cotton grower from ACGRA. The focus of TIMS from the start was on collaborative action to enable the emergence of transgenic cotton:

> It took a couple of meetings convened by ACGRA and the organisational membership of the committee was determined and what its scope would be and what it would do and off it went…That was a pretty big thing for the industry to do but it needed broad support. So that's where the kind of industry committee evolved, so it wasn't Cotton Australia or CRDC telling everyone what to do, it was broad - so the committee tries to operate through negotiated consensus. (CC1)

TIMS provided a platform for cotton growers and researchers and other industry managers to coordinate and share information on transgenic cotton issues. For researchers, TIMS provided a forum for sharing research knowledge and information and to get key decisions on the management of transgenic cotton. An example of these key decisions was in relation to changes to operational activities of growers to improve resistance management. Researchers presented research based information and recommendations which were considered by the committee and adopted. The decisions were communicated to all cotton growers and other industry managers through an industry publication called TRANSACT. TIMS also provided a forum for discussion and agreement of regulatory issues with the Australian government regulatory agencies.

A cotton researcher described this process:

> So there's the main TIMS committee that oversees everything and that's a balanced representation of growers and consultants. There's a few research scientists, it's basically all of the stakeholders. But then there are these satellite or sub panels that feed into the TIMS committee. So the one that I'm most involved with is called the Bt technical panel, So that's almost entirely scientists and we will make decisions about, for instance, whether or not the resistance management plan needs to be changed based on the results that we're finding. Then we'll make a recommendation to TIMS and provide all of the supporting logic and data to go with it. Then they're responsible for making the final decision about what if anything happens. It's good having the TIMS committee which has representatives on it that are going to be impacted practically by any decisions that we might make scientifically. So they can kind of pull us up and say, well, that's all well and good but this means it's impossible for us to follow through on this aspect of our production system. Even on

> the BT tech panel, there are a couple of growers – switched on growers – that appreciate that things have to be done scientifically but are also there to say, hang on a minute, guys, that's just not going to work. So there's sort of checks and balances along the way. It's one of the things that makes the industry so successful is that it does have these panels through which important decisions are made.

The first commercial introduction of transgenic cotton in 1997, together with improved IPM practices, provided cotton growers with the basis to develop and implement firm-level strategy that facilitated the achievement of firm-level strategic objectives related to economic performance and environmental management. These firm-level strategies laid the foundation for the overarching industry environmental and economic objectives, set out by Cotton Australia, to be achieved and helped the industry transform to become a respected agricultural sector in Australia. This was enabled by the development of new information which was set out in industry best practice guidelines (BMP) and made available to all firms and managers for adoption. This development is described in the next section.

These developments were timely as they helped the industry overcome the existential threats that almost forced a shut-down of the industry in the period between 1997 and 1999 following the Endosulfan and Helix related crisis.

5.6 The development of Best Management Practices (BMP)

The information on new and improved cotton growing practices, such as the use of transgenic cotton and IPM which were developed through R&D projects conducted through The Program and similar research programmes, required a mechanism to enable its wide diffusion to cotton growers. This mechanism would provide the basis for individual cotton growers to access the information and to be able develop and implement strategy that enabled achievement of improved environmental and economic performance for firms and the industry.

A best practice based management approach was chosen by the industry managers as it was thought to provide a *"process for benchmarking and where necessary methodical and rational change in management systems and a basis for cultural change"* (Senior Cotton Grower, Pesticide conference address, 1998). This approach was recommended by external consultants who reviewed the work undertaken by industry research programmes such as The Program:

> Emphasis should be shifted to supporting Phase 2 of the research program, i.e. to identify and test potential methods for ameliorating problems by supporting

> proposals for…..development of a comprehensive Best Management Research Project……a Best Management Practices Manual should be developed for use by growers and consultants. (CR Harris, University of Guelph, Ontario, Canada, Independent Program Review, Jan 1996, p4)

Another consultant described the approach of using BMP as providing *"best practices based on legitimate, proven information and knowledge that are relevant to the cotton grower, simple to learn and use and included in a manual that is up to date"* (Doak, J, 1995, Report on scoping project for LWA on developing BMP from research findings of The Program).

Cotton growers also proactively examined options to translate research knowledge and information into a mechanism that could help change grower operational activities. One manager who was the key member of the team that initiated the design of BMP provides an example of how this interaction triggered the development of some aspects of the BMP:

> ……. just sort of came up to me and asked if I'd be interested in developing a best practice manual. So I did and then my whole career ever since has been dominated by it, for 20 years, based on a less than five second conversation" (CC3).

These managers also actively examined approaches taken in other agricultural settings and countries:

> [We] spent some time looking at how you actually implement these things. So that entailed going to where they had similar approaches and they had some quite good, like in Wisconsin, I think they called it – something assist program which was a voluntary scheme. Then Canada, they had something a bit similar…..So we kind of married these concepts together, we got people out from those areas to help us, give us advice. We basically melded that into what became the first version of the BMP Manual. (GM, R&D, CRDC).

The focus of BMP was to provide best practice knowledge and information on transgenic cotton and IPM practices to help cotton growers improve their operational activities. The BMP Manual focused on different areas of practice such as spray application, pre-season planning, application planning, neighbour notification of spraying, use of buffer zones, recycling of tail water, and provided guidelines for best practice. One cotton consultant, describes the focus of BMP:

> So BMP was a response to try and get people to stop and focus on whether their practices were in fact industry expectation for best practice. I think that was its value to start with; now it's much more, viewed as a pathway to information and knowledge about new practice. (CC1)

The adoption of BMP practices was organised by managers at Cotton Australia who helped train and communicate these practices to growers, helped them with the assessment of their current operational practices and helped them to plan for changes to operational practices that were not in line with BMP. A cotton consultant who was involved in this process describes how these teams from Cotton Australia helped growers*:*

> Cotton Australia had a team of people trying to get them to adopt it.... So the sorts of things that happened, from memory back then, were Cotton Australia people getting the growers to do the rankings and self-assessments and do things. (Cotton Consultant)

The BMP Manual provided best practice guidance on a broad range of issues related to transgenic cotton and IPM. More specific support was provided through the production of booklets on specific topics related to cotton growing. These booklets focused on a topic in a holistic sense, bringing relevant knowledge from different disciplines to provide best practice guidance to cotton growers to help improve their operational activities. Best practice guidance on a specific cotton pest might require the integration of information from research knowledge from different disciplines (e.g. entomology, agronomy) and this integrated best practice guidance was provided by these topic based booklets. A manager at Cotton Australia responsible for BMP described the value of developing this topic based information:

> The purpose is to provide resources of practices so that we know what best practice is. So the growers have access to resources. …So you've not only got to have a simple way of finding what you want, you've actually got to have buy in from the people that are on the field…Okay, so now you know better, what do you do better. That's practice. That mind shift that I've now got groups of researchers – there's seven different areas of expertise in there. Where I've got people who are working on herbicide spray drifts, working with entomologists who do insects, working with nitrogen people, working with physiologists with plant growth problems, and when that team put that book together, I can tell you there was significant stress….Because

> they weren't used to working together to put out a publication. No, this is just this. Well, I'm sorry, we're not just going to have a weeds one. This is to do with symptoms in cotton, I don't care whether it's because of herbicide drift or because of an insect. That's a significant nut to crack.

The first version of the BMP Manual was released in 1996 and had 70 pages with a number of operational practices grouped under four major headings. These categories were farm design and management, pesticide application, integrated pest management (IPM), and pesticide storage and handling. The focus of the BMP Manual was on three key issues: how should these best practices be used, how to engage growers to adopt these best practices, and how to monitor compliance. The focus was to ensure that the *"Best Practices Manual really is a manual…that is something that is used (not just read), as the word manual implies"* (CC3, Pesticide conference presentation, 1998).

The use and adoption of practices in the BMP Manual involved a number of stages. First, growers were required to conduct a self-assessment of their individual operational activities in each of the four categories of BMP. Self-assessment worksheets with a series of questions were included for each category of best practices which allowed the grower to assess their operational practices, identify issues and risks. The use of risk ratings (from 1-low risk to 4-extreme risk) allowed the grower to identify high priority areas within their operational activities which required action plans to enable improvements to be made.

Second, for critical issues identified in high risk (3-4 rating) categories, the BMP Manual provided another framework for more detailed farm plans. This framework took the form of hazard identification and analysis and lead to a specific set of best management practices (BMP) tailored for a farm. This framework provides specific actions that can be taken incrementally by the grower to improve his operational practices. The framework focuses on a *"list of activities which occur on a cotton farm and then the hazards associated with these activities and for which best management practices will be developed and applied"* (CC3, Pesticide conference presentation, 1998). Rather than design a prescriptive set of practices, the grower is able to develop *"their own best management practices and to check them against some standard issues included in the Manual… [This process] alerts people to key issues and potential problems while allowing them to develop a set of practices with accompanying monitoring systems which suit their specific circumstances and operations"* (CC3-Pesticide conference presentation, 1998).

The final stage involved the development of actions plans to manage areas identified as high risk (3-4 rating). The solutions, monitoring and review processes to assess if the chosen solution is effective, and the person responsible for the action plan, are all identified in the action plan. To help growers develop action plans, best practice booklets on specific topics and other material are also included in the manual.

The manual provides a flexible framework for managing and improving cotton grower operational activities, recognising the varying environmental, commercial and social conditions faced by cotton growers. The planning framework helps to build flexibility while allowing growers to minimise any negative impacts from their operational activities and helping to demonstrate their commitment to responsible resource management.

The BMP Manual helps growers in three ways. It helps:

1. Objectively assess their current situation
2. Document decisions made to improve situations identified as being potential risk
3. Monitor the effectiveness of those decisions by providing a framework for checking the adoption of BMP

The key lessons from the introduction and use of the BMP Manual has been that the actual practices and the mechanisms used to help the delivery and adoption of best practices are both important for a successful BMP programme.

Key benefits from the introduction of BMP has included providing growers with the flexibility to improve their operational activities by adopting best management practices that recognise their own individual environmental, corporate and social conditions and requirements. It has provided a framework that can be adapted to individual farms yet provides a system that can be monitored for compliance and has inducements for growers to make changes.

BMP has helped to improve grower operational activities. A report commissioned in 2004 by Cotton Australia to evaluate the BMP program provided a key finding- *"BMP had created significant beneficial change in cotton farm practices since the BMP Manual was introduced in 1997…. The change is evident across all modules that are currently in operation…..including Integrated Pest Management"* (Macarthur Agribusiness, 2004, Evaluation of the Australian Cotton Industry BMP Program, p1).

On-farm environmental outcomes have been significantly improved by the adoption of BMP. The most readily identifiable benefits are associated with IPM and the Application of Pesticides modules:

> [They] have played a role in the reduction in the use of pesticides on-farm and the significant increase in the level of professionalism in pesticide application… the result has been a reduction in total sprays, a reduction in the occasions when sprays have not reached the target pest and/or weed, and a reduction in the number of odour and spray drift complaints about spraying practices on-farm. (Macarthur Agribusiness, 2004, Evaluation of the Australian Cotton Industry BMP Program, p1)

Growers have rated BMP as influencing their altered operational activities. Eighty-two per cent of growers surveyed believed that BMP had been effective in changing operational practices on-farm (Macarthur Agribusiness, 2004, Evaluation of the Australian Cotton Industry BMP Program, p45). The report identifies that *"the majority of cotton growers have changed practices on-farm for the better…"* (Macarthur Agribusiness, 2004, Evaluation of the Australian Cotton Industry BMP Program, p3).

The IPM module is rated as the most important module by growers for providing financial returns. IPM practices such as understanding and managing pesticide impacts on beneficial insects and the use of area wide management groups have been adopted by growers and are used in their operational activities. Similarly, BMP practices in the Application of Pesticides module, such as the development of an application management plan, monitoring of weather conditions before spraying, and improved communication between growers, consultants, aerial and ground applicators, and neighbours, appear to have been adopted by growers to improve their operational activities.

BMP enabled cotton growers to self-regulate on environmental matters by demonstrating improved operational activities that safeguard natural resources and protects the environment. BMP has helped cotton growers meet regulatory requirements in relation to the environment (e.g. QLD Environment Code of Practice for Agriculture) and also provided a mechanism for adoption of R&D outcomes. There is a stronger link between a best practice and the reasons behind the practice that makes it best practice. BMP provided a basis for quality certification and required an audit to show compliance by farmers to best practice.

Transgenic cotton and improved IPM practices have changed the approach taken by cotton growers to grow cotton. The new strategic approaches have changed grower operational activities and have enabled cotton to be grown with a lower adverse environmental footprint and improved economic efficiency and costs. It would be an understatement to suggest that these two developments have transformed cotton growing in Australia.

5.7 Chapter summary

This chapter has chronicled key events in the most turbulent period of the Australian cotton industry. The Crisis Years between 1991 and 2004 provided serious challenges to the industry culminating in the Endosulfan related pesticide issues in the late 1990s which threatened the ongoing viability of the industry. However, these ecological issues were not unknown to the industry and cotton growers, cotton researchers and other managers within the industry had been taking actions since the late 1980s to combat the threat posed by grower operational activities related to the use of pesticides. As a first key action, cotton growers and other managers carried out an assessment and stocktake of the pesticide related issues and the impact of grower operational activities on the environment. The Environmental Audit provided information on these impacts and also identified information gaps which needed to be addressed.

Consequently, these managers commissioned the largest and longest R&D programme in the history of the cotton industry to carry out R&D projects to develop new information which could be used to improve grower operational activities. The Program and its key objectives, actions and outcomes were described. The Cotton CRC was established in this period and became an important research firm that provided a basis for extensive research collaboration and enabled R&D projects as part of The Program. The Program and R&D projects conducted within this programme enabled the industry to develop and commercialise two strategic solutions which provided a basis for the development and implementation of firm-level strategy that then facilitated the management of ecological issues related to pesticides. A description of transgenic cotton varieties and IPM and how they were developed and commercialised was discussed.

Finally, the collaboration mechanism established to provide this new information to all cotton growers was described. The BMP system included best practices for cotton growing based on the new information developed through research and provided a basis for sharing this new information with all cotton growers. By the end of this period, BMP had provided the basis for the industry to improve its environmental and economic credentials and established a basis for Australian cotton to

be differentiated as a high quality commodity product. How these developments helped establish the growth phase for the industry beyond 2004 is described in Chapter 6.

Chapter 6 The Growth and Consolidation Years 2005–2014

6.1 Introduction

This chapter covers the period from around 2005–2014 which was a period of Growth and Consolidation for the cotton industry following the pesticide related strategic challenges of the late 1990s. This time period provides evidence of the ongoing conduct of open strategy processes within the industry. For the first time, the cotton industry is considered to be an integral member of the community with sound environmental credentials and is able to use its ecological success as a basis for differentiating and developing Australian cotton and the industry. Key representative firms such as Cotton Australia and the CRDC developed management systems related to strategic planning, R&D investment planning, and began to focus on new strategic challenges such as developing human capital to enable the industry to improve its competitive advantage in the global market place. The key events of this period are discussed and described in this chapter.

Section 6.2 includes a description of key industry issues in this period which continue to provide the basis for antecedent variables that trigger the engagement of firms in the open strategy process. These key issues included ecological issues related to climate change, drought, water access and use, coal seam gas mining, as well as the development of human capital.

Sections 6.3 and 6.4, respectively, describe how Cotton Australia and the CRDC continued to develop their processes and meta-capabilities for open strategy by improving their collaborative mechanisms to provide leadership to the industry in carrying out the open strategy process, and enabling the ongoing development of meta-capabilities required for open strategy. This discussion includes descriptions of how different management control systems (administrative and social) and practices (planning, measurement and feedback) were used to enable this collaboration. Section 6.5 provides a summary.

6.2 Industry issues

A number of issues provided the basis for antecedent factors that continued to trigger the engagement of firms in the open strategy process in the industry. These issues will be discussed in this section. This time period is segmented by the severe drought experienced by cotton growers: stagnant growth in the early years (2005–2008) and a bumper growth segment (2009–2014).

The early years in the period are characterised by stagnant growth of the industry as a result of severe drought, water access and rights issues, and limited resources. In 2003 and 2004, both state governments (NSW and Queensland) and the Australian Government were reviewing and developing their policies on water access and rights and their initial focus was on severely limiting water for cotton growing.[33] Coupled with the severe drought, these policy driven uncertainties were viewed by the industry as a strategic threat and a significant part of Cotton Australia's resources and efforts were directed, during this period, to lobbying governments and related stakeholders to gain favourable policy conditions for the industry. The establishment of the National Water Initiative in 2004, with the inclusion of water trading rights, ownership of water access rights in perpetuity, and the basis for structural reforms and risk bearing in the future, provided the industry with a secure platform for future water reform and reduced the strategic risk for the industry.

BMP continued to be developed as the industry's key environmental management system and helped growers to demonstrate their management of the natural environment and helped secure their "social licence to operate". Major changes were made to the BMP system including addition of new modules such as a module on Land and Water use, greater adoption amongst growers and auditing of this adoption, use and the design of an on-line version of the system, and wider recognition of the system as an environmental management system for the industry by government and other regulatory stakeholders. The second Environmental Audit in 2003 provided confirmation that the BMP system was helping the industry become better stewards of its natural resources.

For representative firms such as Cotton Australia, this early period presented severe challenges but also some successes. The severe drought and smaller crops during this period placed significant strain on the resources available to the firm. Cotton Australia was forced to focus on levy paying growers and narrowing their range of services. Staff numbers were reduced through natural attrition and the firm operated through two regional hubs, in Narrabri and Toowoomba. The successful flagship retail store in Darling Harbour was one example of infrastructure, resourcing and services that had to be curtailed due to the limited resources CA had access to in this period. The ACGRA merged with Cotton Australia to form an expanded firm with a greater focus on R&D and advocacy services for growers. Research panels with growers were established to provide greater grower input into R&D projects. Increased grower engagement and collaboration was made possible through forums such as the Grower Member Advisory Group which, in 2007, provided Cotton Australia with strategic advice to help develop a five year strategic plan to further develop the

[33] Cotton has traditionally been a large user of water but through research and development and improved genetically modified cotton varieties, this use has been reduced.

industry in the future. Also, key staff positions such as the BMP General Manager were established to continue the focus on key initiatives such as the BMP system.

The second part of this growth and consolidation period, represented a time of growth and abundance with bumper harvests and increased profitability. The cotton crop exceeded 4 million bales for the first time in the history of the industry, and peaked at 4.7 million bales in 2012. The severe drought ended and water reform entered a new phase with the establishment of a government agency, the Murray-Darling Basin Authority (MDBA), to manage water access and rights. Australian Government policy on water reform moved to acquiring water rights, previously allocated in perpetuity to irrigators[34], at market price.

Fresh challenges awaited the cotton industry in this period. While, pests and water issues remained important for growers, new challenges relating to human capital development, coal seam gas mining and ecological issues linked to carbon emissions provided a fresh focus for Cotton Australia and cotton growers on the advocacy and policy front. The R&D focus also remained on track for the industry with new technology, such as round bales, creating the need to continue developing knowledge and information to help growers maintain the efficiency and effectiveness of the cotton production system.

These issues created a fresh impetus for industry firms such as Cotton Australia and the CRDC to become focused on long-term strategic planning and establishing mechanisms to maintain and build on the open strategy processes. These processes provided a basis for the industry to develop new information in the 1990s that enabled cotton growers to develop and implement strategy at the firm-level to manage the severe ecological issues that threatened the viability of the industry.

In this period, Cotton Australia developed its firm structures and capabilities, expanding its staffing numbers to provide expanded services to growers and other stakeholders within the industry. Long-term strategic planning became a key focus with Cotton Australia developing its first five year strategic plan for the period 2009 to 2013. Cotton Australia also collaborated with the CRDC to develop a Cotton Industry Vision for 2029, with a focus on being differentiated, responsible, tough, successful, respected and capable. The successful development of Australian cotton as a quality product with high yields and sound ecological credentials provided a basis for the industry to begin a push for a differentiation strategy in order to compete with low cost producers in countries such as India, Pakistan and Uzbekistan. The CRDC also developed a focus on long-term R&D planning,

[34] Cotton growers are usually the largest irrigators in the agricultural sector.

developing five year strategic plans aligned with Cotton Australia's strategic plans. R&D investment was managed on a long-term basis and the focus of this investment was extended beyond the farm-gate to downstream parts of the value chain, including improving ginning capabilities and fibre quality for spinning.

6.3 Strategy development at Cotton Australia

Cotton Australia developed its first five year strategic plan, on behalf of cotton growers, in 2008 for the period 2009 to 2013. The five year strategic plan identified four portfolio areas, in line with the broad remit to facilitate the development of a globally competitive, sustainable and profitable industry which is valued by the communities in which cotton growers live and operate their farms:

1. Member Services and Capacity Building. The focus in this portfolio is to lead and facilitate the development of human capital within the industry and to provide innovative and quality services to cotton growers.
2. Research Direction and Stewardship. The focus of this portfolio is to lead and facilitate the prioritisation of research investment, support the management of projects, and enable the adoption of research outcomes. This focus requires Cotton Australia to work closely with the CRDC.
3. Policy and Advocacy. The focus of this portfolio is to provide a voice to cotton growers through influencing government and other stakeholder policies and positions by advocating grower perspectives and interests.
4. Communication and Engagement. The focus of this portfolio is to actively engage with cotton growers and regional communities to communicate issues, identify issues and concerns, and to promote the industry to key stakeholders.

In the 2009-2013 strategic plan, the vision of Cotton Australia for the industry is described as "*a sustainable Australian cotton industry that is valued for its environmental, economic and social contribution*". The purpose of Cotton Australia is listed as to "*advance the interests of the Australian cotton growing industry*". Organizational values are described as:

1. Respect:"we respect the views, opinions and concerns of others at all times"
2. Openness: " we ensure that information is available and accessible to our members, staff and by all relevant parties"
3. Integrity: "we operate with honesty, decency, consistency and courage".

The strategic plan identified a range of factors affecting the Australian cotton industry (see Table 8).

Table 8 Strategic factors

Strategic factor	Description
People	Attracting and retaining human capital with the right skills and experience is identified as a challenge for the industry
Market access and supply chains	Infrastructure relating to roads, port and rail and trade barriers are identified as potential challenges for the industry.
Accountability to end users through sustainable farming methods	Providing a product that has been grown and produced in an environmentally and ethically sustainable manner is identified as important and a key point of differentiation for Australian cotton. The challenge of operating with a reduced carbon footprint is another challenge. Finally, protecting the use of key natural resources such as water and land and better use of pesticides through improved best management practices is described as key to the "social licence to operate".
Competitiveness	The need for Australian cotton to be globally competitive is identified as important and issues such as costs of production, economies of scale, and adoption of technology are described as key to this competitiveness. Biotechnology is described as a key technology that needs to be harnessed and developed to help the industry retain an edge over global competitors
Capital investment	The requirements for capital investment in R&D to help develop information on improved cotton production systems, on improved knowledge of biotechnology methods and on developing human capital and talent was emphasised.
Government regulation	Cotton Australia identified concerns with government policy and regulation that does not display foresight and empathy with the needs of the agricultural sector or rural communities. Engaging with government policy makers is described as being important for the industry to influence and manage regulation impacting the future strategy and vision of Cotton Australia for the industry
R&D	Cotton Australia identified the changes to the research funding model that the government is introducing which is described as creating uncertainty for the industry. The future of the CRC[35] may have been one of the concerns. R&D has been the key driver of change in the industry and has assisted the industry to overcome challenges of pesticide contamination and water scarcity and to improve production efficiency through new technology and better cotton varieties.

[35] The final CRC (CRC3) was closed in 2012 as the Australian government failed to renew funding commitments.

For each of the portfolio areas, the following items are specified:

1. Strategic objectives. The objectives capture the essence of the outcomes expected to develop the portfolio.
2. Strategic actions. These actions detail what will be done to help Cotton Australia meet the objectives
3. Outcomes. This provides a list of expected achievements.
4. Performance Indicators. These are mainly non-financial performance measures to help determine if the actions have helped to meet the objectives.

The details of each portfolio are described in this section and provide a deeper understanding of how the strategic planning system was used to drive the collaboration within the industry to carry out the open strategy process.

6.3.1 Member services

There are five important strategic objectives under this portfolio. The first objective is the establishment and implementation of a five year strategic plan to provide strategic direction to cotton growers in Australia. The second objective is the development of a human capital and talent management strategy for the cotton industry. The third strategic objective related to the merger of Cotton Australia and the ACGRA and involved promotion of the benefits and value of the merger to cotton growers and other industry stakeholders such as cotton researchers. The fourth objective was to develop and manage leadership programmes to build capacity within the industry. The last objective was focused internally and related to developing and managing an innovative and capable team of staff in Cotton Australia to meet the strategic needs of the cotton industry, particularly cotton growers.

In order to meet these strategic objectives, a range of activities were identified, including developing collaboration forums (e.g. cotton grower workshops) and new organizational roles to provide key services (e.g. policy advisors, regional managers). Key outcomes to be met to help measure progress towards strategic objectives were also identified including demonstration of the value add provided by Cotton Australia and supporting cotton growers to better understand the use of their voluntary levy. Finally, a range of key performance measures were developed and implemented including increased member involvement in Cotton Australia activities and improved human capacity development.

6.3.2 Research direction and stewardship

The Research Direction and Stewardship portfolio had five strategic objectives: directing grower-led research; developing collaboration with research partner firms; developing the Cotton conference as the platform for sharing research findings; directing stewardship initiatives; and securing R&D funding.

A range of strategic activities were identified to enable actions to be implemented to meet these strategic objectives, including an integrated R&D programme, an active research needs analysis process, maintaining collaborative partnerships with CRDC and other research partners, and lobbying governments and private providers to secure R&D funding.

Key outcomes expected included improved returns and accessibility of outcomes from R&D investments; measureable social, economic and environmental outcomes of R&D; and secure and sustainable R&D funding. Finally, key measures of performance were identified including improved R&D adoption rates and increased cost/benefit of R&D investments.

6.3.3 Other portfolios

Similar structure of strategic objectives, strategic activities, key outcomes and performance measures were identified and developed for the other strategic portfolio areas of policy and advocacy, and communication and engagement.

The five year strategic plan was supported by an annual operating plan which identified strategic activities to be carried out in that year to help meet the strategic objectives for each portfolio. In addition to identifying the strategic activities, the operating plan also identified resources, timelines and measures of performance for each of these portfolio strategic activities. The portfolio areas and strategic objectives included in the CA five year plan were aligned with the strategic objectives included in the five year strategic plan of the CRDC and the Cotton Industry 2029 strategic plan.

Cotton Australia established and improved management control systems to provide a basis for the strategy to be implemented, enunciated in the five year strategic plan. The planning systems and practices, such as the strategic and operating plans, were supported and enabled by administrative mechanisms that facilitated the development of the Cotton Australia strategy and provided a basis for this strategy to influence open strategy processes in the cotton industry.

Various administrative mechanisms were established and managed by managers in Cotton Australia to provide a platform for inter-firm collaboration and open strategy processes. An example of a new administrative mechanism is the Australian Cotton Industry Council (ACIC).

This forum provided a platform for inter-firm collaboration between managers from firms such as Cotton Australia, CRDC, cotton growers, cotton researchers, cotton merchants and other managers to discuss industry issues such as BMP, fibre quality and marketing Australian cotton in global markets:

> Then you'll hear about this thing called the Australian Cotton Industry Council, which is really – it's kind of like a talk forum really, more than anything else. It's where all the various industry bodies all come together, it meets twice a year. I used to be a member of it when I was with the CRC. Because the CRC is a member of it as well. So the CEO and the chairs of all these organisations meet twice a year and just talk about the issues they've all got in common. But it doesn't really have any – it doesn't have a lot of imprimatur over it and that's a good sharing forum though. They focus on value chain work … because you have all the players there. You've got the shippers and the ginners and the agronomists and the researchers and Cotton Australia and spray people, a whole lot of them there". (Cotton Consultant)

> So community engagement, political engagement, all of that was very strong. So that worked, at the same time as the CRDC was developing the best practice menu and so through the Australian Cotton Industry Council, we were working hand in glove with them. So I think there was a lot more cooperation between the cotton bodies than there'd been before, because we formed that body and Cotton Australia became the secretariat of it. You had the rest of the industry –the gins and the merchants and the seed people and the research people and everyone sat around the table and everyone was sort of rowing in the one direction at the Australian Cotton Industry Council. (CEO, Cotton Australia)

Another important administrative mechanism is the Cotton Grower Associations (CGA), a regional forum that provides a basis for cotton growers and managers from Cotton Australia to discuss industry issues such as the use of BMP, water use and access issues, human capital issues and fibre quality issues. These CGAs meet on a regular basis to discuss these industry issues and provide Cotton Australia with strategic direction on these matters:

> The CGAs are their way of putting forward their views… They will have a rep, a Cotton Australia rep and some of them are very active and some of them are not or they go up and down. So in terms of representation, they've obviously got active

> committees and then they will hold events and you'll get most of the growers in the area. (Policy Officer, Cotton Australia).

Following the merger with ACGRA, a key administrative mechanism established by Cotton Australia has been the research panels which have provided a platform for cotton growers, cotton researchers and managers from Cotton Australia and the CRDC to discuss research direction and signal R&D project approvals to the CRDC board of directors. There are four research panels: farming systems, value chain, human capacity, and biotechnology. Each panel's theme is aligned to the CRDC five year strategy:

> The kind of way that relationship works is that they have committees, called panels that are set up along the lines of our strategic plan. So we've got three main programs and so they have three panels that growers and others within the industry are the part that Cotton Australia advise. (GM, R&D, CRDC)

Each research panel is facilitated by a Cotton Australia manager. Panel membership is restricted to cotton growers who are drawn from different CGAs to provide a broad representation of the cotton grower population. CRDC program managers with responsibility for relevant strategic themes and R&D investments related to this theme attend and provide advice. The panel members review each R&D project proposal put forward by the CRDC and provide assessments and reviews of the project and its relevance for cotton growers. The panel chair provides a formal summary of R&D projects approved by the panel to the Annual General Meeting of Cotton Australia which is attended by all cotton growers. The CRDC program manager takes back the advice from the panel to the CRDC to inform their recommendations on R&D investments which are provided to the CRDC Board of Directors. The CRDC Board of Directors have responsibility for approving R&D investments as part of the CRDC five year strategy:

> The panels are facilitated by our staff and the six monthly reports. They review the preliminary research proposals, the full research proposals and then the chair and PD of CRDC would report to our general meeting, so all representatives, all members on that AOP, so they're budget decisions in a report, strategic plan processes and any other issues that are important in the whole relationship. They have to try and understand and absorb the strategic goals in their area. Then they have to read and understand the PRPs. Then, as a group, discuss that and understand other viewpoints and ask questions of CRDC program managers. (GM, R&D, CRDC)

6.4 Strategy and project management processes at the CRDC

The CRDC was established with the organizational purpose of enhancing the performance of the cotton industry through investing in R&D and its application. Organizational values are described as leadership and commitment; innovation and impact; rigorous, transparent and accountable results; and connectedness and integration.

The role of the CRDC is to invest and manage a portfolio of research, development and extension projects that seek to enhance the ecological, social and economic values associated with cotton production systems and to increase benefits to all stakeholder groups including cotton growers, regional communities and the wider Australian community. The CRDC funds and coordinates the development of technical and non-technical documents, guides and other information tools, and coordinates workshops, seminars and field days for a range of purposes including research reviews, information sharing, and technology transfer to industry. The organization acts as a formal and informal information source for stakeholders and client groups, and conducts R&D projects in partnership with research providers such as universities, CSIRO, state and federal agriculture agencies, and private research companies.

The CRDC conducts its research and development programme through three streams. First, the Value Chain stream commissions and funds research projects that focus on the post-farm gate value chain of the industry. The aim is to develop a clearer understanding of markets and supply chains and to develop innovations and research applications to improve efficiency and effectiveness of key elements of the value chain such as ginners, spinners and end use customers.

Second, the Farming Systems stream has a focus on projects that are designed to improve the cotton farming systems including water use, soil health and climate variability. A key concern of this research stream is to improve the resilience and capacity of the cotton farming system to overcome bio-security threats. Finally, the Human Capacity research stream is focused on developing human capital in the industry and in the regional communities related to the industry. This stream funds research that examines issues such as training and development of cotton growers, farm workers and other support staff, developing research capacity and talent, and the retention of experienced and skilled staff.

6.4.1 Management control systems: Administrative governance mechanisms

The CRDC used a range of administrative governance mechanisms to influence managerial behaviours towards achievement of the overall strategy of the firm.

The Board of Directors is an important governance mechanism at the CRDC. The Board of Directors are appointed by the Australian Government on advice provided by an independent selection panel. The Board comprises a Chair, Executive Director and five to seven independent directors. Directors are drawn from the cotton industry and from outside the industry and are selected for their business, industry and research expertise. The Executive Director functions as the leader of the management team and is responsible for the operations of the CRDC. The Board is responsible for the strategic direction of the firm and for directing the R&D program of the firm. The Board of Directors are responsible for developing and implementing the strategy for the firm.

6.4.2 Management control systems: Planning systems

The CRDC Board is responsible for developing and implementing the overall business strategy for the firm. This strategy is captured in a five year strategic plan which is developed through wide collaboration and consultation within the cotton industry with different firms and managers. The draft strategy is developed through regular consultation with key stakeholders such as government and cotton growers. The business strategy is focused on R&D investment in key cotton growing areas such as farming systems, supply chain and human capital management.

> We're not as easily able to invest in research that is not for growers. Well, if the industry is going, we don't want you to do that. That's just clear as. Or the government says, that's outside your scope, we're not anticipating you doing it. So those things are very clear. Then after that it's negotiation. (Senior Manager, CRDC)

The strategy is implemented through R&D project investments which are planned through the development of annual operating plans. The annual operating plan sets out the R&D projects that will be scoped and conducted, including the extension of current R&D projects. Each R&D project is linked to key strategic objectives in the five year strategic plan and project outcomes are developed which demonstrate how the R&D project will help meet these strategic objectives.

The CRDC employs program managers who are responsible for guiding the development of R&D projects and are responsible for ensuring the strategic fit of the R&D projects with the five year strategic plan. These program managers are involved in all aspects of the R&D project, from initial call and scoping to ensuring final delivery of agreed project outcomes. In this role, these managers develop relationships with researchers and their research organizations, and also consult widely with other industry firms and managers such as Cotton Australia and their Research panels.

> But given that the CRDC is funding them, obviously we have a role to facilitate how that industry is developing (a) the understanding of what you're all doing and (b) facilitating industry agreeing what it is they actually want. So you get the directions and there's no point in standing along and thinking you're doing something wonderful and after three years the grower saying 'what's that all about?' That's in no-one's interest. (Program Manager, CRDC)

Cotton Australia's Research panels play a key role in the strategic planning of CRDC R&D projects. The program managers from CRDC provide the link between the CRDC, the R&D project and the Research panels and help to provide additional information on the projects as they are considered by the Research panels. The Program managers take the Research panel feedback and comments, along with their own project assessments, back to the CRDC Board for final project selection decisions.

The CRDC Board uses the information provided by Program Managers to make decisions on R&D projects which are included in the annual operating plan. The information provided by the Program Manager includes feedback from growers through the Cotton Australia Research Panels and other assessments such as financial modelling of investment returns, researcher capabilities, commercialisation options for the expected findings, and research methods.

> We've got a series of questions we use that we then rank and produce a kind of a spider graph, the smaller the cluster is around the centre of the spider graph, the better the project is from our point of view. So the board wants to know about things like how does a particular project fit with our strategic direction, what we've said we'd do within our five year plan. What sort of return might we get on the project. Can they see clearly how [the deliverables] will be done. Have we demonstrated to them that we've effectively assessed the project. (Senior Manager, CRDC)

> Obviously the people that have been here longer would have a sense of the past research that's been done or knowledge of the researchers, so you develop an opinion on that research application based on all your internal knowledge. (Program Manager, CRDC)

6.4.3 Management control systems: project management systems

An important management control system utilised by the CRDC is their project management system. Project management is carried out by program managers with experience in project management and with the industry.

The Principal Researcher on each CRDC funded R&D project is required to submit a bi-annual progress report. These reports are provided in standard report templates provided by the CRDC and included information on activities carried out by the research team, an assessment by the research team on progress made against agreed project milestones, objectives and any issues for the consideration of the CRDC program manager.

Project reports are reviewed by CRDC Program Managers. These reports are also made available to members of the Cotton Australia research panels and to managers in Cotton Australia. On project completion, a final report is provided by the Principal Researcher of the research team. This report is widely distributed to industry stakeholders including cotton growers and policy makers.

> It's a combination of things like that. So it sort of says, well, we get six monthly reports on the projects, we're looking at that, we're trying to assess that in terms of what the project said it would do, what it's actually delivering, how we assess that in terms of have we achieve everything we can under this strategy in a plan or is there still stuff that needs to be done. Will it go well beyond the plan in terms of delivery. (Senior Manager, CRDC)

CRDC Program Managers are proactively involved in managing individual R&D projects and have established good business relationships with key researchers and research partner firms (e.g. CSIRO) to ensure projects are appropriately scoped, resourced and conducted.

The CRDC Board of Directors managed the portfolio of R&D commissioned by the firm and assessed the performance of these projects against the CRDC strategic plan. The CRDC Board of Directors provided an annual report on the performance of the R&D portfolio to Cotton Australia and to the Australian government.

> We're always reporting to the Board in terms of the strategic plan, that's kind of how we report to the Board. Board progress reports go through things that are happening and issues that are cropping up within the plan. So what we look into driven by the strategic plan tends to evolve a bit. Our Board asks us where are we up to. So we'll try and look at that as critically – well, I always try and look at it fairly critically –

and say, well, we've achieved that and we haven't achieved that. There are some ways we could fill that gap. (Senior Manager, CRDC)

That's the other thing, I've talked to them and they've talked to us a lot about how they use the document. So essentially 100 per cent of how I put this together is how I expect an officer of DAFF is sitting down trying to interpret what's going on. I spent a lot of time really focusing on what it is that poor guy is going to – where's he going to get this information from so that he can tick his boxes and he can understand – because that's essentially what's got to happen to this. They look at the report and they decide whether CRDC is doing the job. So the other part that certainly [Senior Manager X] and I want to do is we want to be under the radar in every sense. So we have really focused on that. We're in Narrabri, we're a long way from anywhere, we don't want anyone to notice us. We want to get on with the job. (Program Manager, CRDC)

It's a plan, things happen and we generally have an annual review of the plan. We do that with the industry. So we'll have a specific meeting where Program Managers here will get up and present where they think things are going in terms of the plan and investments against the plan versus where we think we're making some progress and where we still think we've got things to do. That's not an easy thing to do but we try to present that, warts and all. There's been some discussion about what's missing, are there any gaps that have appeared since we developed the plan. We do that annually. When we get about half way through the plan we probably give that a slightly bigger focus to say we can still change things if we have to. Otherwise we go another year just about looking at the next one. (Senior Manager, CRDC)

6.5 Chapter summary

This chapter covered the final time period and key events for this thesis which related to the years from 2005 to 2014. This period was one of growth and consolidation as the cotton industry weathered the ecological issues related to pesticide use and the severe drought that impacted on the industry and resulted in lower harvests and profits. Comparatively, this period was more benign than the 1990s but there were still new industry issues relating to climate change and human capacity development that posed strategic challenges for the industry.

This period provided an impetus for key industry firms, such as Cotton Australia and the CRDC, to consolidate their internal strategic planning and administrative systems to position the industry on a path to consolidating their recent successes in growing a high quality cotton product which had good environmental impacts. The focus was on differentiating Australian cotton on the basis of its environmental quality and to build market share and growth.

This chapter is the last of the three data chapters for this thesis and provides the basis for analysing how open strategy processes were carried out in the Australian cotton industry. This discussion and analysis is presented in Chapter 7.

Chapter 7 Open Strategy Processes in the Australian Cotton Industry- an empirically based theoretical analysis

7.1 Introduction

This chapter includes analysis of the field data and the development of theory to explain and provide answers to the three research questions for this thesis: *Why do firms engage in open strategy processes? How can management control systems facilitate open strategy processes? How do meta-capabilities influence firms' engagement in open strategy processes?*

The study adopted an abductive approach where a conceptual framework was developed (refer chapter 2) and taken to the field for further development and refinement. Chapters 4-6 described the data gathered about the Australian cotton industry covering a 52-year period from 1962 to 2014. This data included descriptions of key events shaping the cotton industry, key firms and managers and their role in developing the industry, governance mechanisms used by these firms and managers, and cultural systems such as values and symbols that have influenced managerial behaviours. These issues collectively describe the conduct of an open strategy process which speaks back to the research questions.

The focus of the analysis in this chapter is on *explaining* the operation of an open strategy process. This explanation is developed by using the findings from the data to further refine the conceptual model (chapter 2) and develop theory on the variables related to the open strategy process and the operation of this process. Addressing this issue within the context of the study forms the basis for the contributions of this thesis.

Consideration of the above issues will be undertaken in three major sections of this chapter and is reflected in the conceptual model in Figure 1. In each section, a summary of the empirical findings will be described and then theory will be developed to explain the findings and how they contribute to the literature. Section 7.2 includes a discussion of antecedent factors and will consider how external factors (ecological and economic issues) operate as antecedents that provide incentives for firms to engage in open strategy processes.

Open strategy processes involve collaboration. How management control systems operate as industry-level[36] management control systems to establish the context for this collaboration, and how they enable coordination and resourcing of open strategy activities is explained in the

[36] This term is defined in Section 7.3

discussion in Section 7.3. Section 7.4 includes a discussion of meta-capabilities that provide the basis to facilitate the open strategy process. These meta-capabilities include strategic insight and resource fluidity. I explain how these are enabled, deployed and used in open strategy activities. Section 7.5 provides a summary.

7.2 Antecedent factors

Empirical findings

This section includes a discussion of external factors that impact on firms. This discussion will also describe how and under what conditions these external factors operate as antecedents, providing incentives for firms to engage in open strategy processes.

As discussed in Chapters 4 and 5, ecological issues faced by the cotton industry relate to cotton pests, diseases and biological resistance. These ecological issues were managed, inadequately, by individual cotton growers through operational activities related to the use of pesticides. These pesticides damaged the natural environment around cotton growing areas by polluting waterways and biological ecosystems which hosted beneficial insects that were able to provide biological control of cotton pests. The use of pesticides also increased biological resistance in cotton pests which then required the application of more stringent chemical formulations of pesticides. This vicious ecological cycle, where stronger pesticides were required and applied in greater frequency to combat cotton pests, had serious unwanted consequences for individual cotton growers.

First, the increased use of pesticides created higher production costs for cotton growers. As documented in Chapter 4, aerial and ground spraying of pesticides placed a huge cost burden on individual cotton growers. The increased production costs made Australian cotton uncompetitive in the global market where it had to compete with low cost producers from countries such as India, Pakistan, China and Uzbekistan. As a commodity product, Australian cotton's value proposition was providing high quality product at the lowest possible competitive cost which was not possible due to high production costs.

Second, cotton pests and pesticides had a detrimental effect on cotton yields due to damage caused by these pests and pesticides on the cotton lint. Australian cotton was running the risk of being a high cost, low yield and low quality commodity product which could not compete in global markets. According to a Cotton Researcher,

> Disease was a big problem and so there was a lot of effort put into diseases as well… transgenics were going to be the way in which you were going to make an order of magnitude change in the use of pesticide rather than the host plant resistance that we worked on prior to that, was taking away 10 per cent of the - or reduced the amount by 10 per cent of pesticide use rather than by 80 per cent which is what Bt (transgenic cotton) can do.

The operational activities of individual cotton growers in relation to pesticides were also creating a far bigger issue. To combat these ecological issues, cotton firms carried out operational activities such as the spraying of pesticides as part of their operational strategy. In reality, these operational activities at an individual cotton firm level were ineffective in managing the impact of the ecological issues. As described in Chapter 4, the use of pesticides was not able to control cotton pests as the chemicals used in these pesticides tended to kill all insects, indiscriminately, including beneficial insects that were predators of cotton pests and which could provide biological control of these cotton pests. The ineffectiveness of the operational activities of cotton growers was confirmed by the findings of the Environmental Audit as described in Chapter 5. A key outcome from the Environmental Audit, as described in Chapter 5, was the identification of the gap in knowledge in how to improve these cotton grower operational activities. It was clear from the audit findings that individual firms in the cotton industry did not have the knowledge or the strategic assets to engage in strategic activities such as R&D and innovation to develop an improved understanding of how to combat cotton pests.

There are two reasons for this ineffectiveness. First, operational activities were not effective as the pesticides were not chemically capable of containing the ecological issues related to cotton pests and were also harmful to the surrounding environment and ecosystems around cotton farms. A key factor at play here was the development of biological resistance to chemicals by cotton pests which is difficult to prevent. Second, the operational activities related to spraying of pesticides to manage cotton pests had to be done by all cotton firms and in a similar manner for the management of these ecological issues to be effective. The operational actions of an individual cotton firm to combat cotton pests was unlikely to help if adjoining cotton firms didn't carry out matching operational actions. Cotton pests are unlikely to respect farm boundaries.

The increased use of pesticides by individual cotton growers contributed to a consolidated ecological issue at an industry-level which raised community and regulatory concerns. Isolated local and regional incidents related to pesticide use, as documented in Chapters 5 and 6, built up

community concerns and created regulatory demands which could not be ignored by the Australian Government. These regulatory demands included a strong call for the banning of specific chemicals used in pesticides and for operational standards to limit and monitor cotton growing operational activities. These pressures increased the impact of ecological issues related to pests and pesticides on individual cotton growers and the cotton industry.

The empirical evidence from this research study suggests that ecological and economic factors are linked and have mutual influence. External factors (e.g. ecological issues) combined with firm-level factors (production costs and production yields) to provide adverse impacts which were experienced in a similar manner by all firms in the cotton industry. The operational activities of individual firms to combat these ecological factors, through the use of pesticides, were also similar and aggregated to an industry-level to magnify the impact of these ecological factors on firms. These firms, individually, were unable, with their existing activities and resources, to manage these impacts.

Theory development

As discussed in Chapter 1, we have limited understanding of the factors that influence firms to engage in open strategy processes. From the management and strategy (Porter, 1985) and management accounting literatures (Chenhall, 2003), we understand that a firm identifies and assesses external factors (STEEP factors) to develop its competitive and operational strategies. This literature includes a description of how these factors influence strategic choices made by a firm, such as strategic positioning and the structure of operational activities, designed to help the firm achieve its competitive strategy and build competitive advantage and firm performance. However, we have limited understanding of if and how these factors influence firms to engage in open strategy processes. This research study provides some insights on the question of why firms are influenced to engage in open strategy processes. These insights extend our understanding of strategy processes in the management and strategy and management accounting literatures.

From my analysis of the empirical data, I have observed that external factors and their impacts operate as antecedents to influence and incentivise a firm to engage in open strategy processes. I have identified two theoretical conditions that must be satisfied for these external factors to function as antecedents.

The first condition is the existence of external factors which have *similar impacts* on a number of firms in an industry (such as the impact of ecological issues related to cotton pests as described in

my case study). External factors can have impacts on a firm, individually or collectively. These impacts influence the strategic choices made by the firm. These external factors impact a firm through their effect on a firm's operational activities and firm-level factors such as production costs and production yields (such as the increased cost of pesticide application and lower yields due to crop destruction). As described in Chapters 4 and 5, the existence of cotton pests and diseases were external ecological issues which impacted on a firm through their effects on firm-level operational activities and revenue yields and production costs. The operational activities were not capable of managing these external factors and therefore, magnified the impact of these external factors by increasing production costs and reducing revenue yields.

As part of the firm-level strategy process, the operational activities of the firm are designed to help the firm achieve its competitive strategic positioning by managing the impacts of external factors. Due to incomplete strategic information on how to manage the impacts of external factors, the current set of operational activities carried out by the firm may be limited. Firm-level factors, such as production costs and production yields, may be adversely impacted by these external factors due to these inappropriate operational activities. Hence, these operational activities may limit the firm's ability to achieve its competitive strategic positioning. When a number of firms in an industry have inappropriate operational activities, these activities may be contributing, in an aggregated manner, to compounding the impacts of these external factors on all firms. These external factors, in this context, become antecedents. Therefore, firms may be influenced and provided with an incentive to collaborate in open strategy processes to develop strategic information to improve their operational activities and to prevent these activities from magnifying the impact of external factors on firm-level factors.

The second condition is the *limited strategic assets* of an individual firm which can be used to manage the impacts of external factors. A firm requires a range of strategic assets (R&D and innovation, commercialisation skills) to help it develop new strategic information. This information is required to improve operational activities and to enable the firm to manage the impacts of external factors. These strategic assets are highly valued and an individual firm may not have an adequate supply of these assets. As a consequence, firms are influenced to share and pool these strategic assets to enable the creation of new strategic information which can benefit all firms. Therefore, the limited strategic assets of a firm which can be used to develop information to manage the impacts of external factors provide an incentive for firms to engage in open strategy processes.

When these two conditions exist, a firm is influenced to explore collaboration opportunities outside the firm boundary through engaging in strategic activities to develop strategic information that can be used to develop improved firm-level strategy. The impact of the external factors cannot be managed by existing firm operational activities and requires new strategic information. To develop this new strategic information, a firm needs to use its strategic assets but these assets may be inadequate for the task. Therefore, the firm is influenced to reach out to other firms who also similarly impacted and are open to collaboration and to engage in open strategy processes.

These open strategy process activities may focus on sharing and pooling strategic assets to carry out R&D and innovation, and to commercialise the outcomes from these activities, to develop new information that can be used to improve firm-level operational activities. These improved operational activities can be used to implement competitive strategic objectives and positioning that help the firm to manage the challenging external factors.

This theoretical development has provided some insights into the factors that influence firms to engage in open strategy processes. Two conditions have been identified which operate to transform external factors into antecedents that provide incentives for firms to engage in open strategy processes. This understanding extends current knowledge of strategy processes in the management and strategy and management accounting literatures and helps explain why firms engage in open strategy processes. How these antecedents provide incentives for firms to engage in these open strategy processes and how management control systems and meta-capabilities enable these processes are depicted in the model in Figure 1. This model represents a development and confirmation of the conceptual model described in chapter 2.

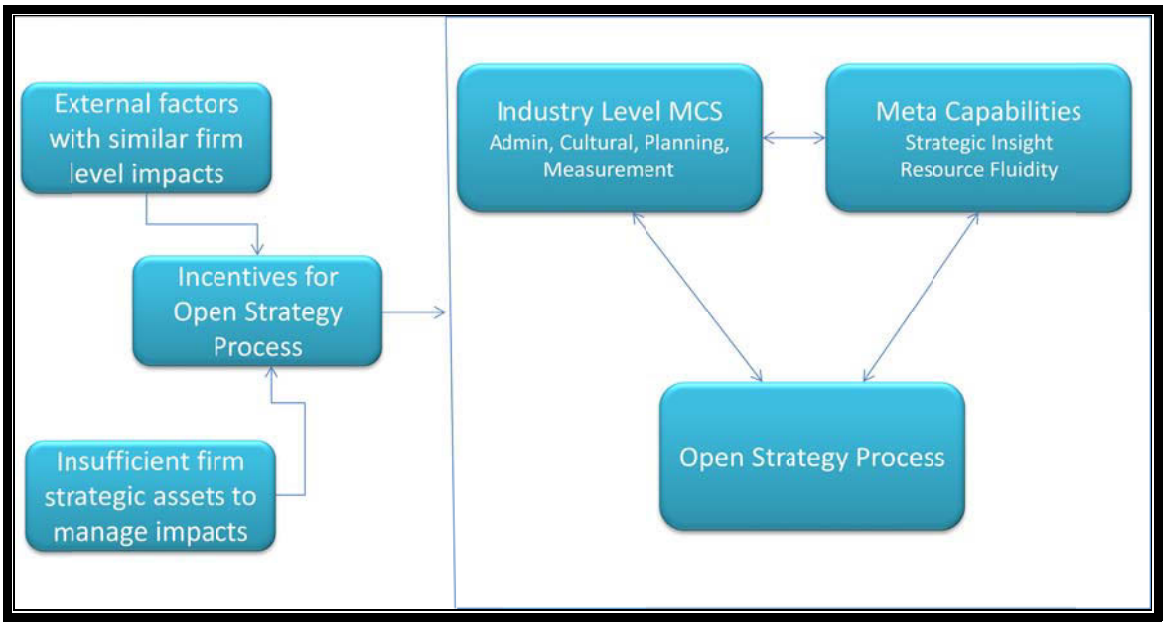

Figure 1 Conceptual Model

7.3 Collaboration mechanisms

This section includes a discussion of the processes that facilitate the conduct of open strategy. These processes are identified as collaboration mechanisms that facilitate open strategy by enabling cooperation between firms and managers, enabling coordination of strategic activities between these firms, and enabling appropriate resource appropriation to support these strategic activities. These collaboration mechanisms are industry-level[37] management control systems which are defined, for this thesis, as control systems and practices that operate *between* firms and at an industry-level to facilitate the conduct of open strategy processes (refer Figure 1). These industry-level management control systems include administrative systems (industry firms and governance mechanisms), cultural systems (values, symbols and clans), and planning (strategic plans and operational plans) and measurement (environmental audits and annual reports) systems.

7.3.1 Administrative systems

Administrative systems are a category of management control systems (Abernathy & Chua, 1996; Malmi & Brown, 2008) and consist of three related types of systems: firm structure and design, governance mechanisms, and procedures and policies.

Firm structure and design

Empirical findings

[37] Johnson et al (2005) described an industry as consisting of producer firms making the same product or service and supply firms that provide similar input services (R&D) to these producer firms. This thesis uses this definition of industry.

As discussed in Chapter 4, the pioneer managers in the cotton industry established key industry firms such as Cotton Australia, CRDC, ACGRA and Cotton CRC. Each of these firms provided specialised services. Cotton Australia focused on strategy and policy, ACGRA provided strategic direction on R&D projects, CRDC focused on R&D project management and funding, and Cotton CRC provided R&D capabilities and project management.

These firms enabled managers in production and supply firms to move beyond their firm boundaries to connect and build relationships. Managers from these firms were able to move seamlessly across these boundaries to cooperate and coordinate their activities. Two examples are useful to illustrate this issue. The regional meetings of the CGA, as part of Cotton Australia, provided a basis for cotton growers to interact with other managers such as cotton researchers, administrators and policy makers, and cotton consultants to share ideas and information. Furthermore, as discussed in Chapter 4, the ACGRA provided a basis for inter-firm coordination of activities as managers from different firms participated in sharing ideas and information and making decisions related to research into cotton growing activities.

These firms also provided a basis to scale up the smaller producer and supply firms[38] that existed in the Australian cotton industry as well as support larger firms. Cotton Australia provided a basis for cotton growers from different regional areas to connect through the regional CGAs. As a consequence, Cotton Australia provided a platform for individual cotton growers to develop scale to promote the search for solutions to external factors such as ecological issues which could not be resolved with the resources of individual firms. Similarly, the ACGRA provided a platform for cotton growers to build scale to provide strategic direction on R&D projects that would benefit individual cotton growers. On their own, a cotton grower, operating as a small firm, was unable to achieve this influence and impact.

Theory development

As discussed in Chapter 1, we have a limited understanding of the processes or collaboration mechanisms that firms use to engage in open strategy processes. We have an understanding of the collaboration mechanisms that are used *within* firms to facilitate the firm-level strategy process which include a range of management control systems (administrative, cultural, and planning and measurement systems and practices). But when the strategy process spans the firm boundary (as in an open strategy process), we have limited understanding of what mechanisms are used to facilitate

[38] Chapter 3 describes these different types of firms

these open strategy processes. This research study provides some insights on how firm structure and design has been used to develop industry firms as collaboration mechanisms in the open strategy process. These insights extend our understanding of strategy processes in the management and strategy and management accounting literatures.

From my analysis of the empirical data, I have identified how firm structure and design has been used as a collaboration mechanism to facilitate the open strategy process. The empirical data from this case provides evidence of how firm structure and design has been used to establish industry firms which have operated *between* firms as industry-level management control systems.

Industry firms have been established to focus on strategy and policy advocacy, to provide strategic direction for industry R&D, to fund and manage industry R&D programmes, and to develop a collaborative network of research partners to carry out industry R&D projects. These industry firms have functioned *between* firms to establish the context for collaboration in the open strategy process.

These industry firms, as industry-level management control systems, have played two important roles. First, these industry firms have enabled functional specialisation. Particularly, for small producer firms, the existence of industry-level firms specialising in key strategic areas such as strategy and policy, R&D direction, R&D funding, and R&D resource and skills provision, provided scale and a collective forum for raising strategic issues. These industry firms provided a platform for the distribution of the strategic information developed through the open strategy process, to individual firms within the industry. This is essential in an open strategy process where the new information developed needs to be accessed and used by individual firms in their firm-level strategy processes for the benefit of all firms in the industry.

The second important role of industry firms is the networks and relationships that they enable and develop. Each industry firm is able to draw into its fold individual firms and managers, through shared membership of the firm or through other means of involvement such as secondments, and enables these managers to develop networks and relationships outside their firm boundary. Particularly, for small producer firms, this ability to build networks and relationships that span firm boundaries was an invaluable resource. These networks and relationships provided the basis for managers from different firms to develop their meta-capability relating to strategic insights by enabling strategic dialogue and the sharing of ideas (which I will expand on in Section 7.4).

The design and use of industry firms as industry-level management control systems that operate *between* firms to enable the conduct of open strategy processes extends our current knowledge of management control systems as firm-level systems. This extension provides a broader understanding of these management control systems as collaboration mechanisms that operate to facilitate the conduct of open strategy processes by helping to establish the context for collaboration through functional specialisation and networks and relationships.

Governance mechanisms

Empirical findings

The data in Chapters 4-6 described a range of different governance mechanisms[39] (workshops, conferences and committees) that have been employed in the cotton industry to help managers meet to discuss strategic issues, make strategic decisions, and coordinate strategic activities. As an example, the Australian Cotton Conference has been used as a governance mechanism to enable managers from different firms to meet and coordinate activities. This governance mechanism has been an "*instrument used to overcome geographical and social challenges by bringing communities together, sharing ideas and research and uniting growers"*[40]. At this conference, managers from R&D firms presented their project findings to managers from cotton producer firms who were able to evaluate, discuss and understand the implications of these project outcomes. The shared discussions provided opportunities for these project outcomes to be assessed and developed into new strategic information which was developed into best practice procedures and incorporated into the BMP system. Similarly, the TIMS[41] Committee provided a basis for managers from different firms to join together to develop information to design strategy for the introduction of transgenic cotton into Australia. Managers were able to meet with a shared agenda, discuss issues, develop ideas and agree coordinated actions.

These governance mechanisms enabled the coordination of activities by having a shared agenda. The agenda for the cotton conference provided a basis for managers from different firms to focus on specific agenda items. This agenda enabled managers to share ideas and information, assess R&D findings with potential to deal with the strategic challenges related to cotton pests and pesticide use, and develop information to facilitate firm-level strategy development and information that would "*address industry-wide matters"*(Cotton Grower). The design of the shared agenda, as

[39] As discussed in Chapter 2, mechanisms such as workshops, conferences and committees provided a forum for governance to be enacted. This is done through a shared agenda and a chairperson role which enables managers to meet, discuss issues, develop ideas and agree coordinated actions.

[40] CRC report: "A historical geography of cotton farming in NSW and QLD: adaptation and adoption, p15-Appendix C

[41] Transgenic and Insect Management Strategy (TIMS) committee which is organised by Cotton Australia

discussed in Chapter 4, which involved a range of different managers, was also an exercise in cooperation and coordination. Similarly, the TIMS Committee's agenda focused these managers on developing R&D projects to understand the impacts and challenges of transgenic cotton, to understand the regulatory issues, and to plan for the deployment of this new technology. Cotton breeding researchers were able to present their findings on transgenic cotton at this committee to get feedback and assessment of their project findings.

The record of discussions and actions from these meetings provided a basis for understanding what activities will be carried out, who will be involved and responsible for these activities, the timing of these activities, the interdependence between activities, and the resourcing required for the activities. The minutes of the TIMS Committee meetings provided a basis for the coordination of activities and for the allocation of resources to support activities related to transgenic cotton. The minutes of the ACGRA Executive Committee meeting provided documentation of a range of strategic activities relating to the approval of R&D projects, the development of transgenic cotton and other technologies, the design of integrated pest management practices, and the design of BMP.

Another feature of the operation of these governance mechanisms, such as the Australian Cotton Conference and the TIMS Committee, was the role of the chairperson. This role was usually taken up by a senior and respected manager with a track record of collaboration who possessed strategic thinking skills and sound industry knowledge. The role of chairperson at the ACGRA Executive Committee (as described in Chapter 4) was carried out for many years by pioneers of the modern industry who provided strong leadership and exhibited an equally strong collaborative culture. The role of chairperson at the TIMS Committee has been held by a senior cotton grower with strong collaborative and strategic credentials. The role of chairperson at the Australian Cotton Conference has also been held by senior managers from the industry. These chairpersons helped to develop and run the shared agenda, drove the strategic discussions, and helped other managers to become more collaborative and focused on taking coordinated actions to manage and overcome the strategic challenges faced by the industry.

Theory development

As discussed in Chapter 1, we have a limited understanding of the processes or collaboration mechanisms that firms use to engage in open strategy processes. We have an understanding of the collaboration mechanisms that are used *within* firms to facilitate the firm-level strategy process which include a range of management control systems (administrative, cultural, planning and measurement systems and practices). But when the strategy process spans the firm boundary (as in an open strategy process), we have limited understanding of what mechanisms are used to facilitate these open strategy processes. This research study provides insights into how governance mechanisms are developed and used as collaboration mechanisms in the open strategy process. These insights extend our understanding of strategy processes in the management and strategy and management accounting literatures.

From my analysis of the empirical data, I have identified how governance mechanisms are used to facilitate the open strategy process. The empirical data from this case provides evidence of how these mechanisms have been used as industry-level management control systems which have operated *between* firms to enable formal and informal lines of authority and to coordinate strategic activities in an open strategy process.

Governance mechanisms relate to a firm's board structure and composition and its management and project teams. Governance includes formal lines of authority and accountability within a firm, as well as systems which are used to ensure that managers from different functions meet to coordinate operational activities. Different types of meetings (workshops, committees and conferences) provide the basis for managers to meet and coordinate activities.

Governance mechanisms operated as industry-level management control systems in two important ways. First, these mechanisms (workshops, conferences and committees) enabled formal and informal lines of authority and accountability through the organizational role of the chairperson and through a shared agenda. The chairperson played an important role in bringing different firms and managers together to discuss strategic issues and to find solutions. Having a respected industry manager in this role also enabled this to be a key management control mechanism *between* firms as this industry manager is able to attract other important managers and firms to be active participants in these governance mechanisms.

The shared agenda is also an important facet of the operation of this industry-level management control system as the agenda items provided a strategic focus for the discussions and decision

making processes, and enforced authority and accountability on the industry participants. This shared agenda directed the behaviour of these managers by focusing their strategic dialogue on key agenda items that were related to the strategic challenges that had to be managed by all firms.

Second, these industry-level governance mechanisms enabled the expansion of networks and relationships beyond the firm boundary. This was made possible by inviting a wide range of managers and firms to be involved in these industry workshops, conferences and committees to take part in discussions and decision making processes. This interaction type helped to develop connections and relationships between managers from different producer and supply firms in the industry. These networks and relationships provided a basis for managers to maintain a strategic dialogue during these meetings and also outside these meetings. These governance mechanisms provided a platform for managers to develop their strategic insights into key strategic issues through the dialogue and interaction that took place.

Administrative governance mechanisms have been developed and used innovatively as industry-level management control systems. These governance mechanisms (workshops, conferences and committees) have operated together with industry firms as industry-level management control systems to facilitate the conduct of open strategy processes. These governance mechanisms have helped to extend networks and relationships beyond the firm boundary and have helped managers from different producer and supply firms to engage in strategic dialogue, to discuss strategic ideas and to experiment with strategic solutions through R&D projects, and to share and pool strategic assets to develop new strategic information. These governance mechanisms have also helped to extend the formal and informal lines of authority and accountability beyond the firm boundary through the chairperson role by having a shared agenda for discussions.

The design and use of governance mechanisms as industry-level management control systems that operate *between* firms to enable the conduct of open strategy processes extends our current knowledge of management control systems as firm-level systems. This extension provides a broader understanding of these management control systems as collaboration mechanisms that operate to facilitate the conduct of open strategy processes by helping to establish the context for collaboration through broadening formal and informal lines of authority and accountability, and networks and relationships beyond the firm boundary.

Procedures and policies

Empirical findings

As discussed in Chapter 5, the information on new and improved cotton growing practices, such as the use of transgenic cotton and IPM which were developed through R&D projects, required a mechanism to enable its wide diffusion to cotton growers. This mechanism provided the basis for individual cotton growers to access the information and to be able to develop and implement strategy that enabled achievement of improved environmental and economic performance for firms and the industry. This is particularly important in the cotton industry where firms faced different geographical (climatic and water issues) and physical conditions (soil conditions) within their cotton production systems.

The focus of BMP was to provide best practice knowledge and information on transgenic cotton and IPM practices to help cotton growers improve their operational activities. The BMP Manual focused on different areas of practice such as spray application, pre-season planning, application planning, neighbour notification of spraying, use of buffer zones, and recycling of tail water, and provided guidelines for best practice. A Cotton Consultant described the focus of BMP:

> So BMP, I think, was a response to try and get people to stop and focus on whether their practices were in fact what industry expectation for best practice [was]. I think that was its value to start with - now it's more viewed as a pathway to information and knowledge about new practice.

The adoption of BMP practices was organised by managers at Cotton Australia who helped train and communicate these practices to growers, helped them with the assessment of their current operational practices, and helped them to plan for changes to operational practices that were not in line with BMP. A Cotton Consultant who was involved in this process described how these teams from Cotton Australia helped growers:

> Cotton Australia had a team of people trying to get them to adopt it. That's about when I started to get involved. … Cotton Australia people getting the growers to do the rankings and self-assessments and things.

The use and adoption of practices in the BMP Manual involved a number of stages. First, growers were required to conduct a self-assessment of their individual operational activities in each of the four categories of BMP. Self-assessment worksheets with a series of questions were included for each category of best practices which allowed the grower to assess their operational practices,

identify issues and risks. The use of risk ratings (from 1-low risk to 4-extreme risk) allowed the grower to identify high priority areas within their operational activities which required action plans to enable improvements to be made.

Second, for critical issues identified in high risk (3-4 rating) categories, the BMP Manual provided another framework for more detailed farm plans. This framework took the form of hazard identification and analysis and lead to a specific set of best management practices (BMP) tailored for a farm. This framework provides specific actions that can be taken incrementally by the grower to improve his operational practices. The framework focused on a *"list of activities which occur on a cotton farm and then the hazards associated with these activities and for which best management practices will be developed and applied"* (Cotton Consultant-Pesticide conference presentation, 1998). Rather than design a prescriptive set of practices, the grower was able to develop *"their own best management practices and to check them against some standard issues included in the Manual"* (Cotton Consultant-Pesticide conference presentation, 1998). This process *"alerts people to key issues and potential problems while allowing them to develop a set of practices with accompanying monitoring systems which suit their specific circumstances and operations"* (Cotton Consultant-Pesticide conference presentation, 1998).

The final stage involved the development of actions plans to manage areas identified as high risk (3-4 rating). The solutions, monitoring and review processes to assess if the chosen solution is effective and the person responsible for the action plan are all identified in the action plan. To help growers develop action plans, best practice booklets on specific topics and other material are also included in the Manual.

The BMP Manual helped growers in 3 ways:

1. Objectively assess their current situation
2. Document decisions made to improve situations identified as being potential risk
3. Monitor effectiveness of those decisions by providing a framework for checking adoption of BMP.

Theory development

As discussed in Chapter 1, we have a limited understanding of the processes or collaboration mechanisms that firms use to engage in open strategy processes. We have an understanding of the collaboration mechanisms that are used *within* firms to facilitate the firm-level strategy process

which include a range of management control systems (administrative, cultural, and planning and measurement systems and practices). But when the strategy process spans the firm boundary (an open strategy process), we have limited understanding of what mechanisms are used to facilitate these open strategy processes. This research study provides some insights on how procedures and policies have been developed and used as collaboration mechanisms in the open strategy process. These insights extend our understanding of strategy processes in the management and strategy and management accounting literatures.

From my analysis of the empirical data, I have identified how procedures and policies facilitate the open strategy process. The empirical data from this case provides evidence of how these mechanisms have been used as industry-level management control systems which have operated *between* firms to enable new strategic and operational information to be shared with all firms involved in the open strategy process.

Procedures and policies are a type of administrative management control system which provide rules and regulations that govern strategic and operational activities. This system, in the context of this case study, provided a basis for sharing information on these rules and regulations with a wide range of managers.

This mechanism provided coordination and sharing of new information in a number of ways. First, new information from R&D projects were developed into best management practice procedures. These procedures were based on this new information and also on cotton growing practices in other cotton production systems. These procedures were reviewed and discussed by managers from different firms at forums such as the CGA and Cotton Australia's general member meetings. This interaction enabled collaboration, coordination and sharing of new information.

Second, individual firms and managers were able to access new information for use in firm-level strategy development and implementation. The new information was translated into best management practices and made available to all firms through procedures and policies in a systematic manner. This mechanism to share new information in a systematic manner with all firms involved in open strategy processes was helpful to enable these firms to benefit from their involvement in carrying out these open strategy activities.

Third, this mechanism provided a basis for individual firms to assess their operational strategy and operational activities, to identify gaps for improvement, and to plan for the development and implementation of new strategy. Firms were able to use this best practice information to improve

their current operational activities taking into account their local operating environment and related issues. Finally, this mechanism provided a basis for assessing and managing operational risks at the firm-level by enabling firms to identify and prioritise the gaps between their current strategic and operational activities and these best management practices, and enabled these firms to plan for the development and implementation of revised strategic and operational activities.

Procedures and policies were developed as a holistic management control system at the industry-level and *between* firms to provide a basis for collaboration in the open strategy process; they were also used to operate as a linking mechanism between the industry-level open strategy process and the firm-level strategy process. New information which was useful for strategy development and implementation at the firm-level was developed through the strategic activities carried out as part of the open strategy process and translated into best management practices made available to all firms through the industry-level procedures and policies mechanism. Managers in individual firms were able to access this best management practice information and use it to benchmark their current strategic and operational activities and to identify gaps and improvements that were required to improve their firm-level strategy processes. The use of this industry-level management control system enabled open strategy process information to be accessed and used by individual firms to improve their strategy processes.

The design and use of procedures and policies as industry-level management control systems that operate *between* firms to enable the conduct of open strategy processes extends our current knowledge of management control systems as firm-level systems. This extension provides a broader understanding of these management control systems as collaboration mechanisms that operate to facilitate the conduct of open strategy processes by helping to share new strategic information in a customised fashion with different individual firms taking into account their specific operating environment.

7.3.2 Cultural systems

Empirical findings

As discussed in Chapter 4, the cotton pioneers were a group of diverse individuals, from different professional, ethnic and social backgrounds. This group included cotton growers from Australia and America, cotton researchers from Australia and Europe, and other managers such as cotton consultants, R&D program managers, administrators and policy makers from within the industry. These pioneer cotton growers faced serious challenges in growing cotton in the Narrabri region due to the prevalence of cotton pests and diseases; this was something not experienced in other cotton

production systems, particularly in America. The soil conditions were also different to US conditions and required different operational activities.

Despite their diverse backgrounds, this group of managers shared a common set of values and culture which placed an important emphasis on collaboration and cooperation. These managers spanned firm boundaries to cooperate and work together in partnerships to develop information to improve cotton growing practices. A manager from a cotton firm who was involved with this group of cotton pioneers described this approach to business in the following manner:

> I think some of the early leaders in the industry basically identified that the only way that they could make progress was to work together. So there was that collaborative aspect right from the outset.

Cotton growing in Australia was challenging and required managers to adapt to the local conditions to grow a complex and difficult crop. All cotton growers faced the same challenges with cotton pests and diseases and the eventual vexed issue of biological resistance. As described by a cotton consultant, the "*barriers were the same for everybody which actually changes the kind of power distribution and therefore politics"*.

The common strategic challenge of cotton pests and the threat to yields and costs focused the attention of managers on cooperation. Cotton growers knew they had to engage with cotton researchers as these researchers were involved in R&D which provided a realistic basis to develop new information to improve cotton growing practices. Managers in producer firms knew they did not have capabilities, such as R&D and innovation, to conduct these R&D projects on their own.

Cultural systems were used to establish shared values and culture which provided a basis for cooperation. These values were established in mission and value statements developed by industry firms (eg: Cotton Australia, ACGRA) which were shared with all managers in firms within the industry. These values and cultures influenced the behaviour of managers, providing a basis for inter-firm cooperation which enabled the establishment of an appropriate context for open strategy processes. The core group of managers used these values and culture, focused on collaboration and partnerships, to influence the behaviour of other managers in the different firms in the cotton industry, by recruiting managers with similar values to sit on industry committees and workshops. As discussed above, this influencing was made possible by the development and use of industry firms (Cotton Australia, CRDC and CRC) and governance mechanisms (cotton conference, workshops and committees) which helped to spread these shared values and culture.

The success of R&D projects carried out by cotton researchers, starting from the Hungarian-born pioneer Nicholas Derera, provided practical outcomes for growers and a basis for the mutual relationship between growers and researchers. In the words of a cotton researcher, the relationship was based on "*real tangible successes the industry could point to, the value it received from investing in the research"*. This success provided a basis for a common culture and values, based on research, to enable cooperation between managers in firms within the industry.

The co-location of cotton growers and researchers in the same physical location has also been used to develop a collaborative culture and values. The physical proximity and co-location of cotton growers and cotton researchers and other managers such as cotton consultants, R&D administrators and program managers, and R&D funding managers in the Narrabri region has helped these managers to develop networks and relationships. The physical proximity has helped to reduce the intellectual space between growers and researchers and has helped to develop and maintain networks and relationships which have benefited inter-firm cooperation.

The co-location of different types of cotton researchers such as cotton breeders, soil researchers and plant pathologists has also provided a basis for discipline and organizational barriers to be spanned and has enabled researchers to focus holistically on cotton growing practices. The co-location has provided cotton growers and cotton researchers "*a real sense of the industry"* (Cotton Consultant) and has made collaboration and cooperation easier to develop and maintain.

As discussed in Chapter 4, the co-location has also provided a basis for R&D findings to be easily shared between growers and researchers, for these findings to be "road tested" and improved, and for practical outcomes to be developed and translated into best practices for use by growers. Cotton researchers had the opportunity to visit cotton growers in the field to share research findings and to get feedback which provided a basis for useful and practical outcomes. The networks and relationships developed by cotton growers and cotton researchers sharing the same physical space at Narrabri provided a basis for cooperation, for sharing information and for developing common outcomes.

Finally, the common values and culture and the physical proximity has also provided a basis for professional groups to develop within the cotton industry. Various professional groups exist including cotton growers, cotton researchers and cotton consultants. Each group has enforced these shared values and culture focused on collaboration among its membership which has provided a

basis for these managers to use a similar lens to understand the impacts of the antecedent factors and to engage in open strategy processes.

In summary, cultural systems (values, symbol-based systems and clans) have been used to guide managerial behaviour, to provide direction and to develop the context to enable cooperation between firms and managers. Different firms and managers (cotton growers, cotton researchers, cotton consultants and policy makers) have been encouraged and influenced to develop networks and relationships which display similar values and culture, focused on collaboration in open strategy activities.

Theory development

As discussed in Chapter 1, we have a limited understanding of the processes or collaboration mechanisms that firms use to engage in open strategy processes. We have an understanding of the collaboration mechanisms that are used *within* firms to facilitate the firm-level strategy process which include a range of management control systems (administrative, cultural, and planning and measurement systems and practices). But when the strategy process spans the firm boundary (in an open strategy process), we have limited understanding of what mechanisms are used to facilitate these open strategy processes. This research study provides some insights on how cultural systems can function as collaboration mechanisms in an open strategy process. These insights extend our understanding of strategy processes in the management and strategy and management accounting literatures.

From my analysis of the empirical data, I have identified how cultural systems facilitate the open strategy process. The empirical data from this case provides evidence of how these mechanisms have been used as industry-level management control systems which have operated *between* firms to enable shared values and culture which have established the context for cooperation in open strategy process activities.

Cultural systems are a category of management control system consisting of values, symbols-based systems (dress codes, co-location of managers) and clans (professional groups of managers organised by functional specialities). These systems enabled a common set of values and culture to be shared by managers within firms which helped to influence their behaviour and actions.

As discussed in Chapter 2, cultural systems (values, symbols-based systems and clans) provided the basis for establishing the context for collaboration within firms. Values helped to establish this

context by developing beliefs which provided direction and purpose and influenced behaviours. These values are communicated through mission and vision statements and in statements of principles set out by key industry firms (eg: ACGRA). Managerial behaviour is influenced by these values as managers with similar values are recruited to sit on industry committees and workshops and are socialised and encouraged to adopt these values, to realign their beliefs, and to carry out operational activities in accordance with these values. Symbols-based systems include co-location of managers from different firms in the same physical locations which helped to visibly signal to managers the shared values and culture expected of them. The co-location enabled managers from different firms to communicate more freely and share ideas to maintain a strategic dialogue. Co-location is useful as a mechanism to enable managers to develop strategic insight as a meta-capability through this ongoing strategic dialogue.

Professional groups of managers, organized along functional specialities, operate as clans which have values and beliefs which are aligned to broader belief systems. Through co-location, these professional groups of managers are able to share information and ideas and to maintain a strategic dialogue which helps them develop strategic insight as a meta-capability. This helped these managers to engage in open strategy processes.

In an open strategy process, there is a requirement for managers from different firms to have similar social values and beliefs in order to enable cooperation and collaboration between these managers. Industry-level management control systems (industry firms and industry governance mechanisms) provided a platform for these common cultural systems to be extended beyond the firm boundary and to be shared more broadly.

Industry firms provided the platform for a common set of values setting out a strategic direction to be shared with managers from different firms within the industry. The industry-level governance mechanisms such as workshops, conferences and committees, which hosted managers from different firms, provided an extended platform for these values to be shared and taken back into the individual firms for dissemination. Through their mission and value statements, these governance mechanisms (eg: TIMS committee) helped to spread a shared set of values to managers from different firms who participated in these industry committees. Through these industry management control systems (industry firms and governance mechanisms), other elements of the cultural systems such as symbol-based controls (co-location) and clans were also elevated to become *between* firm and industry-level management controls. These industry-level management control systems provided a platform for the symbols-based systems such as co-location to encourage different groups of managers to engage in strategic dialogue to help develop new strategic information as part of the open strategy process.

Cultural systems (values, symbols and clans) have been developed and used as industry-level management control systems. These systems have been extended beyond the firm boundary through the platform offered by other industry-level management control systems (industry firms and governance mechanisms) to facilitate the conduct of open strategy processes. These cultural systems have facilitated the establishment of the context for collaborative open strategy process activities by helping to shape common and shared values, by developing networks and relationships through symbols-based systems such as co-location, and by developing professional groups of managers as clans.

The design and use of cultural systems as industry-level management control systems that operate *between* firms to enable the conduct of open strategy processes extends our current knowledge of management control systems as firm-level systems. This extension provides a broader understanding of these management control systems as collaboration mechanisms that operate to facilitate the conduct of open strategy processes by helping to establish the context for collaboration through shared values and beliefs and the propagation of these shared values and beliefs through networks and relationships that are enabled by co-location and professional clans.

7.3.3 Planning and Measurement systems

Empirical findings

Planning systems and practices (strategic plans, operational plans) have been used extensively in the cotton industry by firms and provided a basis for coordinating activities in three ways. Planning

practices helped in the coordination of activities through development and alignment of strategic objectives. The first strategic objectives developed by Cotton Australia in 1989, as discussed in Chapter 4, provided a basis for managers in different firms to focus on external factors (ecological issues) which were a strategic threat to all firms. The involvement of managers from different firms in the design of these objectives provided a basis to influence actions and behaviours of managers.

Planning systems and practices also focused attention of managers on actions required and the expected behaviours. The overarching strategic objectives of Cotton Australia focused managers in the industry to identify actions that needed to be taken to improve operational activities. Managers used these strategic objectives as a basis to conduct an assessment of their current operational activities and their impacts, and to identify issues that needed to be fixed. This assessment provided a basis for R&D projects to develop new information on improved cotton growing practices.

Finally, planning provided a basis for coordinated actions. The formal strategic objectives and the measurement of current operational activities of cotton growers provided a basis for managers from different firms to plan and implement actions required to improve these activities. Two empirical examples are documented in Chapters 4 and 5.

First, as discussed in Chapter 4, managers carried out planning actions related to identifying and scoping R&D projects to assess the impacts of current operational activities and then, as a second step, developed a major R&D programme to carry out R&D to develop information that could be used to improve these operational activities. Second, as discussed in Chapter 5, planning practices were also employed by the TIMS Committee. The interactions and discussions carried out by managers at this committee provided a basis for strategic objectives focused on developing and implementing a strategy focused on using transgenic cotton as the main cotton variety in Australia. In order to action this item, managers planned R&D projects to develop information on transgenic cotton varieties and on integrated pest management practices that supported these varieties.

Measurement systems and practices such as environmental audits provided a basis for assessment of current performance, identification of variances and their causal factors, and feedback and discussion which enabled managers to identify strategic options and actions for performance improvements. As discussed in Chapter 5, the environmental audit provided the first formal basis for managers in firms within the cotton industry to assess and measure performance of their operational activities in relation to the use of pesticides. The information from the audit identified how these operational activities were carried out and provided a basis for identifying how these

operational activities could be improved. The audit report provided the basis for identifying specific areas of concern for cotton growing, such as understanding how chemicals drifted into waterways, that required more investigation and information.

Other measurement systems and practices included annual reporting of performance of firms such as Cotton Australia, CRDC, and the CRC, which provided a basis for managers to assess firm performance and to identify variances and their causes. Cross-reporting provided a basis for managers from different firms to carry out this assessment. The cross-reporting of CRDC's annual performance to the ACGRA Executive Committee and subsequently to the members of Cotton Australia at the annual members' meetings provided a basis for managers from these firms to jointly measure the performance of the CRDC, particularly in relation to R&D projects and investments and to identify variances and their causes.

Measurement systems and practices also enabled feedback to be provided to managers on performance. Feedback provided two important benefits. First, feedback provided direction through information that enabled corrective action. As discussed in Chapter 5, the audit provided the basis for managers to meet at workshops, to carry out an assessment of the information developed by the audit, to identify areas for further investigation, and to plan R&D projects to develop new information relating to these performance gaps and issues. The audit identified that chemicals were spilling into the river systems around cotton farms but how this was occurring was not understood; new research had to be conducted to provide this information.

Second, feedback provided the basis for managers to carry out improved actions for the promise of future rewards. The audit identified that operational activities had to be improved. Feedback carried out by managers, including holding workshops to meet and discuss this information, provided a basis to understand that if new information was developed, these operational activities could be improved and the ambitious economic and environmental strategic objectives of Cotton Australia could be achieved.

As R&D projects were scoped and carried out, managers were able to meet to share information and provide feedback using governance mechanisms such as the Australian Cotton Conference. At this conference, cotton researchers presented research findings which were assessed by cotton growers. Managers provided feedback on the usefulness of these research findings which provided a basis for new information which could be used to design best practices. Other governance mechanisms such as the ACGRA Executive Committee and TIMS provided similar opportunities

for feedback practices to be used to develop new information. The feedback practices provided affirmation to managers from different firms that best practice information could be used as a basis for strategy development and implementation that could enable firms to improve their ability to manage these ecological issues.

In summary, planning (strategic and operational plans) and measurement (performance measurement, annual reports) systems have been used to facilitate the coordination of open strategy process activities.

Theory development

As discussed in Chapter 1, we have a limited understanding of the processes or collaboration mechanisms that firms use to engage in open strategy processes. We have an understanding of the collaboration mechanisms that are used *within* firms to facilitate the firm-level strategy process which include a range of management control systems (administrative, cultural, and planning and measurement systems and practices). But when the strategy process spans the firm boundary (as in an open strategy process), we have limited understanding of what mechanisms are used to facilitate these open strategy processes. This research study provides some insights on how planning and measurement systems and practices are used as collaboration mechanisms in the open strategy process. These insights extend our understanding of strategy processes in the management and strategy and management accounting literatures.

From my analysis of the empirical data, I have identified how planning and measurement systems facilitate the open strategy process. The empirical data from this case provides evidence of how these mechanisms have been used as industry-level management control systems which have operated *between* firms to enable planning, coordination and assessment of strategic and operational activities related to open strategy processes.

Industry firms, operating as *between* firms and industry-level management control systems, have used planning systems (strategic and operational planning) to establish strategic direction in a number of key areas (strategy, R&D) which have been developed through coordinated discussions, decisions and actions between managers and firms who have collaborated through the platform provided by industry governance mechanisms such as workshops and conferences.

Similarly, measurement systems (environmental audits and annual reports) have been used as industry-level and *between* firm management control systems to assess performance and to identify

key variances and options which have provided strategic information for the open strategy process. Other industry-level management control systems (industry firms and governance mechanisms) have provided the platform for these measurement systems to be extended and used by enabling the sharing of performance information and assessments.

Planning and measurement systems have been used to coordinate open strategy process activities by helping to plan strategic activities, to provide direction through strategic objectives and monitoring performance of these strategic activities, and to identify performance gaps which required further strategic action. These planning and measurement systems have been extended beyond the firm boundary through the platform offered by other industry-level management control systems (industry firms and governance mechanisms) to facilitate the conduct of open strategy processes.

Planning systems have helped carry out open strategy processes through development and alignment of strategic objectives, alignment of behaviours of managers to strategic actions required and programming and scheduling of these actions. This has provided a common focus to managers from different firms. Industry-level management control systems (industry firms and governance mechanisms) have facilitated the extension of these planning systems beyond the firm boundary.

Measurement systems have helped carry out open strategy process activities by helping to assess current performance, identify gaps and actions to fill these gaps, and enabled feedback and discussion to develop new strategic actions and information. This has provided a common focus to managers from different firms. Industry-level management control systems (industry firms and governance mechanisms) have facilitated the extension of these measurement systems beyond the firm boundary.

The design and use of planning and measurement systems as industry-level management control systems that operate *between* firms to enable the conduct of open strategy processes extends our current knowledge of management control systems as firm-level systems. This extension provides a broader understanding of these management control systems as collaboration mechanisms that operate to facilitate the conduct of open strategy processes by helping to coordinate strategic activities by helping to plan, measure and analyse how these activities are carried out and to improve the development of new information from these activities.

7.3.4 Summary of industry-level MCS

In summary, the theoretical developments in this section (Section 7.3) have focused on the design and use of management control systems *between* firms and as industry-level management controls. Administrative systems, cultural systems, planning systems and measurement systems have been theorised to explain how they have been used to operate as industry-level management control systems *between* firms.

These findings and related theorisation also demonstrated that these industry-level management control systems have operated as complements (refer Figure 1). These systems operated in combinations as industry-level packages of management control systems. Industry firms and governance mechanisms were combined and operated as a package of controls to establish the context for open strategy processes by enabling the development of functional specialisations and networks and relationships that spanned firm boundaries. Cultural systems operated in combination with industry firms and governance mechanisms to foster the development of open strategy processes by providing purpose and direction and by enabling deeper networks and relationships through symbols such as physical co-location and the development of professional groups. This understanding of industry-level management control systems operating as a package of controls also provides an extension to our current knowledge of management control systems. The explanation of how these industry-level management control systems operate in combination as collaboration mechanisms enabling the carrying out of strategic activities in an open strategy process extends our understanding of how management control systems function as a package at a firm-level.

7.4 Meta-capabilities

This section includes a discussion of meta-capabilities required for open strategy processes. Two meta-capabilities are identified: strategic insight and resource fluidity. A theoretical development of these meta-capabilities and how they are deployed and used to enable open strategy processes are presented in this section (refer Figure 1).

7.4.1 Strategic insight

Empirical findings

As discussed in Chapter 4, in the late 1980s, Cotton Australia developed two important strategic objectives which were designed to challenge cotton growers. These objectives related to economic performance and environmental management.

"Create a positive profile of the Australian cotton industry as reliable producers of high quality product, as a major Australian agricultural export industry earning in excess of A$ 750m export revenue and as a valuable natural fibre in the domestic fashion, homewares and industrial sectors"

"Foster, educate and influence growers, consultants, aerial operators, processors, chemical manufacturers, farm input suppliers and other industry organizations and partners in responsible practices in land care, chemical and water use and in other related practices that support and maintain a sustainable base for cotton growing"

These strategic objectives were ambitious, "stretching" and almost impossible to achieve with the current operational activities of producer firms in the cotton industry. The current operational activities were also contributing to the ecological issues faced by these firms. These activities were unable to reduce the impact of cotton pests and diseases on production yields and production costs. With the use of harmful pesticides (Endosulfan), these operational activities were actually contributing to the destruction of beneficial insects that provided biological control of cotton pests. These operational activities were also increasing biological resistance in cotton pests to these pesticides. Consequently, these overarching objectives forced managers to take action as it highlighted and brought to the fore the problems with current operational activities. These objectives provided a signal for firms and managers that fresh thinking and action was needed.

Managers in firms in the cotton industry also used R&D and innovation as a tool to help develop new approaches to managing cotton pests and to find better ways to improve the performance of operational activities. As discussed in Chapter 4, the pioneer group of managers had already identified research and development as a priority. R&D was understood as providing the basis for this experimentation and testing out new ideas. Cultural systems, such as values and symbols, reinforced this common view in favour of R&D. Cultural systems such as co-location of cotton growers and cotton researchers provided a practical basis and framework to enable this focus on R&D.

Trialling new ideas using R&D was undertaken in two different ways. First, R&D was used to monitor current activities and their impacts. As discussed in Chapter 5, R&D projects were scoped and carried out to monitor the impact of operational activities such as the use of pesticides on the natural environment around cotton farms. Some R&D projects examined the impact of chemicals on river systems. Others examined the impact of current pest management activities on beneficial

pests and their ecosystems. These monitoring projects provided a basis to gather evidence on the impact of current activities.

Second, trialling was conducted by scoping and developing R&D projects to develop new information relating to cotton growing practices. R&D projects were scoped and conducted to examine new cotton varieties and their ecological impacts. Other projects were scoped and developed to examine different aspects of pest management practices such as the management of beneficial pests and their ecosystems and different transport mechanisms for the run off of chemicals from cotton farms into river systems. These projects were scoped based on current knowledge with the expectation that new information would become available which could help improve cotton growing operational activities. Ex-ante, managers in firms within the industry, including cotton researchers, were not able to predict the outcomes from these projects and if any outcomes would provide practical and useable information.

Managers from different firms also engaged in an ongoing conversation on strategic issues and challenges. These strategic conversations were conducted on the basis of a shared agenda which provided managers with a common basis to think about these strategic issues, to collect ideas and information, to challenge these ideas and information, and to stretch their collective understanding and knowledge. The insight from these discussions provided a basis for managers to improve their understanding of problems, solutions proposed, and provided these managers with the ability to agree and develop information which was used to improve firm-level strategy development and implementation.

Collaboration mechanisms were used to develop challenging strategic objectives, to carry out trials of new ideas with R&D, and to engage different managers in an ongoing conversation about new strategic ideas and approaches. Industry-level management control systems (industry firms, governance mechanisms, planning and measurement systems and practices) were employed for this purpose. These systems afforded an industry-level platform for managers from different firms to engage in strategic discussions, to identify problematic operational activities, and to develop approaches to resolving these strategic challenges.

Challenging strategic objectives were established by Cotton Australia using planning systems (strategic plans and operational plans). These strategic objectives were developed by managers in Cotton Australia through discussions with other managers, such as cotton researchers and cotton consultants. These strategy discussions were conducted through the platform afforded by industry-

level management control systems such as industry firms (Cotton Australia, ACGRA) and governance mechanisms (CGA meetings, ACGRA Executive Committee). The governance mechanisms provided a basis for these managers to meet, discuss issues, develop new ideas, and coordinate their strategic activities to develop new strategic information.

Planning systems were used to meet the strategic objectives and performance was assessed using measurement systems such as the environmental audit. This performance assessment was carried out using the platform afforded by industry-level management control systems (industry firms and governance mechanisms). These industry-level management control systems provided the opportunity for managers from different firms to engage in these performance assessments by sharing information and ideas and to coordinate their activities.

R&D was used as the basis for trialling new ideas and these projects were developed using planning systems; progress was managed and monitored through governance mechanisms such as the Executive committee of the ACGRA and subsequently through Cotton Australia's R&D panels. Measurement systems such as the anvironmental audit and annual reports were employed to assess performance of these R&D projects.

Industry-level governance mechanisms were also useful in developing and maintaining the ongoing conversations between managers from different firms. As discussed in Chapter 6, the Cotton Australia grower panels provided a mechanism for different managers, including cotton growers and cotton researchers, to enter into conversations related to the types of R&D projects that were required. These mechanisms also helped these managers to evaluate their progress in developing useful information. The review of individual project proposals, the discussions between cotton growers, CRDC program managers and cotton researchers, provided the basis for all managers involved to improve their insights on how better information could be developed for use by firms and managers.

Cultural systems such as values and symbols-based systems were used to engage managers from different firms in an ongoing conversation about strategic ideas and approaches. The value systems developed by the pioneers (as discussed in Chapter 4) were used to influence other managers in the industry, particularly, cotton growers and cotton researchers, through their engagement in industry firms, such as Cotton Australia, and governance mechanisms, such as the regionally based Cotton Grower Associations. The general meetings of these associations provided a platform for these value systems to be used by the pioneers to influence other managers.

Co-location of cotton growers and cotton researchers in the same region (in Narrabri) provided a platform for these managers to engage in ongoing conversations. Cotton researchers were able to take their R&D project outcomes to the cotton farms and were able to engage cotton growers in a conversation to assess the practical value of these research outcomes. R&D project scope and outcomes were adjusted based on these conversations.

An example of how collaboration mechanisms were used to develop engagement between managers from different firms is outlined in Chapter 5. The design of the BMP system provided an example of how the interaction between managers was developed and deployed. As discussed in Chapter 5, the pioneer group of managers understood that they needed new information which could be used to develop new operational activities but they also understood they needed a process "*for benchmarking and where necessary methodical and rational change in management systems and a basis for cultural change"* (Cotton Grower).

As discussed in Chapter 5, a new system was required to provide the basis for individual firms to be able to access information, benchmark their current activities against this best practice information, and to plan for improvements. The BMP system was designed flexibly to take into account the different geographical and physical conditions faced by individual cotton firms. By developing the BMP system and providing for the flexible adoption of these best practices, these managers demonstrated a capability to develop new strategic information which could be used in firm-level strategy processes, particularly to improve operational activities. The use of best practices and an approach that allowed for customised adoption also demonstrated how these insights were used to develop an industry level management control system; this could be used to align the behaviour of different managers to the overarching strategic objective of improving ecological performance in the cotton industry.

Theory development

As discussed in Chapter 1, we have limited understanding of the meta-capabilities required by firms to engage in open strategy processes. Strategic insight has been identified in the management and strategy literature as a useful meta-capability for firms which can be developed to carry out improved strategy processes (Doz & Kosonen, 2010). However, there is limited understanding in this literature of how this meta-capability is developed and deployed for use in carrying out open strategy processes.

The empirical evidence from this research study provides some understanding of how this meta-capability is developed and deployed for use in open strategy processes. This understanding extends our knowledge of strategy processes in the management and strategy and management accounting literatures.

From my analysis of the empirical data, I have observed and explained how strategic insight is developed and deployed for use in open strategy processes. The development of strategic insight takes place through three activities and my analysis explains how this is carried out. The development and deployment of this meta-capability is enabled by collaboration mechanisms and my analysis explains how this is achieved.

Strategic insight is developed by carrying out three key activities: challenging strategic objectives, experimenting with new ideas, and engaging in strategic dialogue. Strategic insight and how it is developed is not particularly new. How this meta-capability is developed across a number of firms around the same time in an open strategy process, and how collaboration mechanisms are used to support its development and deployment for use, is new; this contributes to an improved understanding of this meta-capability in the management accounting research literature.

Challenging strategic objectives provided a signal to managers that fresh strategic thinking and information is required to develop actions to meet these objectives. Current operational strategy and related operational activities are incapable of guiding actions to meet these strategic objectives. Faced with the influence of antecedent factors (as discussed in Section 7.2), these challenging strategic objectives also indicated that individual firms did not have the strategic assets to develop operational activities to meet these objectives.

The second activity important to the development of strategic insight is experimenting with new ideas to develop options to improve operational strategy to better position the firm to achieve strategic objectives. This experimenting can take many forms but a significant way to carry out this experimenting is by undertaking R&D projects. Experimenting also required firms and managers to collaborate as in-firm experimenting was of limited value; the lack of strategic assets highlighted the need to work collaboratively to develop options and solutions that all firms and managers could "own" and therefore implement.

Finally, the third activity that enabled strategic insight was the maintenance of a strategic dialogue between managers from different firms. The collaborative focus for the development of new information through experimenting with new ideas, supported by shared strategic assets, placed a

requirement on managers to establish and maintain a strategic dialogue. The strategic dialogue between different groups of managers provided a sound basis for new ideas to arise and to be investigated which lead to new information that was used to improve firm-level operational strategy and related operational activities.

Strategic insight was developed and deployed with the help of collaboration mechanisms. Industry-level management control systems (industry firms, governance mechanisms, and planning and measurement systems) were employed for this purpose. Industry firms provided a platform to bring managers from different firms together to develop strategic insight. Governance mechanisms provided a platform for these managers to meet, discuss and develop challenging strategic objectives, to experiment with new ideas by scoping and approving R&D projects, and to carry out strategic dialogue to understand key strategic issues.

The industry-level management control systems also enabled the use of cultural systems (values and symbols) to develop and deploy strategic insight. Industry firms and governance mechanisms provided a platform for values developed by the pioneer managers to be shared with other managers to influence and shape behaviours. These industry-level systems also enabled symbols-based systems (co-location) to be used to bring different groups of managers together to develop and deploy strategic insight through a shared value system and open communication. Co-location enabled these managers to maintain a strategic dialogue on an ongoing basis and helped them to share information and ideas, and to learn from each other.

I have also sought to explain how the presence of strategic insight shapes how controls operate, causing a cyclical recursive relation with controls systems. The identification of strategic insight and engagement with strategic activities causes new learnings that re-cast the way in which controls might operate. This reflects in the way policies and procedures within Cotton Australia morphed as a result of the strategic thinking of key managers, the very cultural norms within the cotton industry changed upon the development and deployment of transgenic cotton. Finally, planning and measurement systems were transformed (communications with farmers and operating practices) as a result of the insights obtained.

This theoretical development has provided some understanding of how strategic insight, as a meta-capability, is developed and deployed for use in open strategy processes. This development has provided knowledge of the three activities involved in developing strategic insight and how industry-level management control systems are used to support the development and deployment of

this meta-capability. This understanding extends our current knowledge of strategic insight and its role in open strategy processes in the management and strategy and management accounting literatures.

7.4.2 Resource fluidity

Empirical findings

In open strategy processes, capital funds to resource strategic activities are required to be made available by all participating firms in an appropriate manner. The ability to aggregate individual firm contributions, and to be able to use these aggregated funding pools to attract further matched investments from other capital providers including government and private sources, is also important.

As discussed in Chapter 4, the cotton industry has put in place a flexible mechanism to allocate capital funds for investment in R&D programmes. This mechanism provided a basis for individual firms to contribute capital funds based on an agreed percentage of revenue per bale of cotton which is collected by ginning firms on behalf of cotton grower firms and provided to the CRDC for R&D investment. These capital funds are matched by similar dollar value of Australian Government funds from taxpayers which are pooled on a consolidated basis to form a substantial R&D investment pool which can be used to fund immediate and long-term R&D projects. Similarly, voluntary levies paid by cotton growers fund and support industry firms such as Cotton Australia.

For open strategy processes to function, people resources are required to be released from firms to work on open strategy activities. Firms involved in open strategy processes need to have the ability to deploy people with appropriate skills and experience to activities and projects. The flexible deployment of people resources is important as it enables firms to share key people without losing them to in-firm activities and projects. This deployment involves key managers being released from functional control within firms to work on open strategy activities whilst still retaining a firm-specific role.

As described in Chapter 4, key members of the pioneer group of managers in this industry have been deployed on a flexible basis to serve on different industry governance mechanisms such as the ACGRA Executive Committee and the Cotton Australia R&D panels. Industry firms such as Cotton Australia, ACGRA and CRDC were able to use the same managers in different governance roles to facilitate the development of new information. As discussed in Chapter 5, the Cotton CRC provided a robust governance mechanism that enabled different cotton researchers from different

research firms to be deployed together on R&D projects to provide research capabilities that provided a basis for new information.

Collaboration mechanisms have been used in the cotton industry to deploy capital and people resources from individual firms to work on open strategy process activities. Industry firms such as the CRDC were used to manage flexible capital allocation mechanisms to enable capital funds for investment in R&D programmes to be collected from all producer firms within the industry.

These industry-level management control systems (industry firms and governance mechanisms) were also used to enable the flexible deployment of people to open strategy process activities. As described in Chapters 4–6, the inclusion of key managers in workshops and conferences (Cotton Australia planning workshops and the Cotton conference) enabled these managers to be deployed to take part in ongoing conversations whilst retaining their firm-level functional roles. These managers were able to engage in a range of open strategy process activities which helped develop new strategic information. The inclusion of key managers in governance mechanisms such as the CRDC board of directors and the ACGRA Executive Committee provided flexible deployment of key people resources who continued to maintain their functional roles within individual firms.

Theory development

As discussed in Chapter 1, we have limited understanding of the meta-capabilities required by firms to engage in open strategy processes. Resource fluidity, which is the capability to deploy capital and people resources, has been identified in the management and strategy literature as a useful meta-capability for improved strategy processes (Doz & Kosonen, 2010). But there is limited understanding in this literature of how this meta-capability is deployed for use in carrying out open strategy processes.

The empirical evidence from this research study provides some understanding of how this meta-capability is deployed for use in open strategy processes. This understanding extends our knowledge of strategy processes in the management and strategy and management accounting literatures.

From my analysis of the empirical data, I have observed how resource fluidity is deployed for use in open strategy processes. Resource fluidity is focused on capital and people resources and how these resources are deployed to support open strategy processes. The deployment of this meta-capability is enabled by collaboration mechanisms and my analysis explains how this is achieved.

Collaborative mechanisms are used in the deployment of capital and people resources in an open strategy process. Industry-level management control systems (industry firms and governance mechanisms) have enabled resource fluidity to support open strategy processes.

Industry firms provided the basis for capital allocation mechanisms to be deployed. The industry firm for R&D funding and management enabled the aggregation of capital funds from individual firms into R&D investment pools which were then used to attract other funding. This industry firm was able to secure matching funds from other sources (mainly, from the Australian Government) to develop an investment funding pool which was used to resource R&D projects. These projects provided research outcomes which were developed into new strategic information that was made available to all firms participating in the open strategy process.

These industry firms and governance mechanisms (workshops and conferences) were also used to enable the modular deployment of people to open strategy process activities. Industry firms have been used to bring people with specific research skills together to work on R&D projects. The industry firm for R&D capability provision has provided a platform to bring people resources from different R&D partners together and for them to be co-located in the same region. This modular deployment of people resources has enabled open strategy process activities.

The inclusion of key managers in workshops and conferences enabled strategic dialogues, sharing of information and execution of a range of actions to develop new information for operational strategy development. The inclusion of key managers in these governance mechanisms enabled the modular deployment of people resources who continued to maintain their functional roles within individual firms.

This theoretical development has provided some understanding of how resource fluidity, as a meta-capability, is deployed for use in open strategy processes. This development has provided knowledge of how capital and people resources are deployed in a flexible and modular basis and how industry-level management control systems are used to support this deployment. This understanding extends our current knowledge of resource fluidity and its role in open strategy processes in the management and strategy and management accounting literatures.

I also observed the recursive impact of resource fluidity on controls. When resources are seamlessly shared beyond the firm, we enable the capacity for controls to subsequently enact, contributing to attributes of the open strategy process more generally. For example, the free

movement of resources enabled the construction of industry level firms, a key administrative structure driving the development of open strategy process.

In summary, Figure 1 provides a conceptual model which describes the operation of an open strategy process. As depicted in this model, antecedent factors provided an incentive for firms to engage in open strategy processes. These incentives arose due to similar firm-level impacts of external factors and the insufficiency of firm strategic assets to manage these impacts. Industry-level management control systems operated as collaboration mechanisms to facilitate the conduct of the open strategy process. Administrative systems such as industry firms, governance mechanisms and procedures and policies provided the context for firms to collaborate and engage in these open strategy process activities. These management control systems provided a basis for other systems such as cultural, planning and measurement systems to enable cooperation between firms, coordination of strategic activities and resource appropriation in the open strategy process. Meta-capabilities such as strategic insight and resource fluidity provided the resourcing required by firms to engage in the open strategy process.

7.5 Chapter Summary

This chapter has included a discussion on the operation of an open strategy process. This discussion commenced with a focus on external factors that operated as antecedents to the open strategy process. The discussion included an explanation of these factors, how they impacted individual firms and how they operated as antecedents to provide incentives for firm engagement in open strategy processes. This discussion is included in Section 7.2.

Section 7.3 included a discussion on collaboration mechanisms and how these mechanisms facilitated the operation of the open strategy process. MCS were positioned as these collaboration mechanisms and how they functioned, as industry-level management control systems, to establish the context for open strategy processes; how they facilitated the programming and operation of open strategy process and related activities was explained. Section 7.4 included a discussion of meta-capabilities for open strategy processes. Strategic insight and resource fluidity were identified as two meta-capabilities for open strategy processes and how these meta-capabilities were developed, deployed and used to provide a basis for open strategy processes was explained. Collectively, the discussions and theorising in these sections provide the basis for the two theoretical contributions of this thesis.

This analysis and theory development highlights a number of answers to questions related to open strategy processes in the management accounting literature. These issues will be included in the discussion in the final chapter (Chapter 8) which forms the conclusions for this research study. Chapter 8 will also include future areas for research and the limitations in this research study.

Chapter 8 Conclusions and Implications

8.1 Introduction

The research objective for this thesis was to develop an understanding of open strategy processes and how they operate. In order to develop this understanding, the thesis examined three research questions: *Why do firms engage in open strategy processes? How can management control systems facilitate open strategy processes? How do meta-capabilities influence firms' engagement in open strategy processes?*

Chapter 1 included a review of management accounting research into strategy and MCS. This stream of research has focused on firm-level strategy processes (Chenhall, 2003) with a focus on the design and use of MCS to control strategy implementation (Langfield-Smith, 2007) and, to a lesser extent, on the use of MCS to enable strategy formation (Simons, 1995). It was also argued, in Chapter 1, that empirical evidence of open strategy processes was emerging in many industries which challenged this traditional focus on firm-level strategy processes. These open strategy processes involved multiple firms collaborating, sharing strategic assets to develop information which provided a basis for firm-level strategy development and implementation (Chesbrough & Appleyard, 2007). It was also argued in Chapter 1 that very little research has been done on building knowledge and understanding about these processes, particularly in the management accounting literature. This knowledge would be useful and important for managers operating in the current globally interconnected business environment where strategy processes cannot be contained within firm boundaries. Firms are required to collaborate, beyond firm boundaries, and share strategic assets to develop new information to improve their strategy processes to build competitive advantage and business performance (Langfield-Smith, 2005).

The management and strategy literature has provided limited theoretical guidance on the variables relating to open strategy processes. There have been limited empirical studies. As discussed in Chapter 2, this literature has identified collaboration mechanisms as important to support the operation of open strategy processes (Chesbrough & Appleyard, 2007) and has also described meta-capabilities which are important for these processes (Doz & Kosonen, 2010, 2008). Other relevant issues such as why firms engage in open strategy processes (i.e. what are the antecedent factors that provide incentives for engagement), and how open strategy processes are conducted, have also received little attention in the management and management accounting literatures.

The approach taken in this thesis was to carry out a conceptual development of the elements of the open strategy process (Chapter 2) and to undertake a field-based case study in an industry setting (Chapters 4-7) to establish the validity of this conceptual framework. The case study involved developing an empirical and theoretical understanding of the three variables of the open strategy process: antecedent factors, collaboration mechanisms and meta-capabilities, and how these variables combined to enable the operation of the open strategy process.

8.2 Conclusions, contributions and implications

This section includes a discussion of how the theoretical and empirical work carried out in this thesis makes a contribution to furthering our understanding of open strategy processes. Furthermore, this section also includes a discussion of how the findings of this thesis can be extended in future research and what implications can be drawn from this work for practice.

8.2.1 Conceptual development of an open strategy process

Problems and conclusions

As discussed in Section 8.1, there are two problems related to open strategy processes: limited empirical or theoretical understanding of open strategy processes in the management accounting literature, and the absence of a framework to explain the operation of open strategy processes.

These two issues relate to the two contributions of this thesis which addresses the definition of the open strategy process and framework with three variables that help to explain the operation of these processes. This was presented in Chapter 2.

In order to examine the validity of the conceptual development of the open strategy process and related elements, this theoretical framework was used to analyse the data from the case study. The data from the case study provided the basis to examine the open strategy process in the industry case setting. This helped to understand how antecedent factors provided incentives for engagement in this process, how different MCS were used as collaboration mechanisms *between* firms to enable the process and related activities, and how the meta-capabilities were developed and used to support the process. The data provided a basis to understand the theoretical conditions (similar impact on a range of firms and insufficient firm strategic assets to manage these impacts) in which antecedent factors (e.g. ecological factors) provided incentive for engagement in open strategy processes. Management control systems (industry firms, governance mechanisms, and planning and measurement systems and practices) were designed and used as industry-level systems *between* firms to enable collaboration in open strategy processes. These systems established the context for

cooperation and provided mechanisms to programme and schedule open strategy process activities. Finally, meta-capabilities such as strategic insight and resource fluidity enabled firms and managers to engage in the open strategy processes and were deployed through the industry-level management control systems. The data analysis provided a basis to understand how these meta-capabilities were developed and deployed.

Implications for research and practice

The open strategy process and related variables developed in this thesis provide a basis for other researchers to understand open strategy processes. This research can be extended in a number of ways. First, the conceptual development of the open strategy process and its variables can be extended by examining other industry settings to understand how open strategy processes are constructed and operated and what variables are involved. This work can be undertaken by more detailed field work to establish the types of open strategy processes used and what types of variables are involved in these different industry settings. This research can be complemented by more longitudinal field studies of open strategy processes in specific industries where the survey data identify contrasting variables involved in these processes.

A broad research question to examine, which would be of interest, would be to understand *how open and collaborative are open strategy processes*? There has not been a consideration of boundary conditions, limits and challenges that relate to these processes. Interesting questions which could form part of future research include: *What are the barriers to open strategy for a firm? Where and under what circumstances would engagement in an open strategy process be detrimental to firm performance? How can a firm sustain long-term engagement in open strategy processes?* And *What are the unintended consequences of open strategy processes for a firm?* These questions could be examined through further field based case study research. A multiple case study design could be employed with two or three firms chosen to provide contrasting perspectives on these issues.

Second, the findings from this thesis can be used to explore practices used by managers to engage in open strategy processes. Strategy-as-practice research, a sub-stream within the management and strategy literature, has long focused on understanding how "strategizing" is undertaken by managers (Jarzabkowski & Spee, 2009; Paroutis & Pettigrew, 2007; Whittington, 2006, 1996). The focus of this stream of research has been on understanding the different types of strategy practices used by managers in strategy development and implementation. According to Whittington (2006), strategy practices exist at the industry level and at the firm-level, have mutual influence and shape

each other through usage. As described in Chapter 7, management control systems can be designed and used as industry-level systems which enable these industry-level strategy practices to influence firm-level strategy practices. We have limited understanding in the management accounting literature on how these industry strategy practices impact and influence firm-level strategy practices. An examination of these issues would provide a useful extension of the findings of this thesis.

Finally, an underspecified area of research in management accounting is the relationship between MCS and operational risk management (Miller & O'Leary, 2005; Soin & Collier, 2013). A range of issues relating to the role of MCS and operational risk management remain to be explored including an understanding of operational risk management in an inter-firm context (Miller & O'Leary, 2005) where firms are engaged in activities to develop information for use in their strategy processes. This issue is of interest also in the context of open strategy processes where firms need to be able to understand and manage operational risks in order to benefit from their engagement in these processes. A field-based case study of how these interdependent operational risks are managed using industry-level MCS mechanisms would be a useful extension of the findings of this thesis.

The practice implications in this section are based on the information provided by the thesis findings for firms and managers to develop a more comprehensive understanding of strategy processes. Managers are trained in university business schools to be strategists using traditional approaches to strategy which focus on firm-level strategy development and implementation. In business, these managers are faced with the reality of developing and implementing strategy in an environment where external industry-level factors pose strategic challenges which cannot be managed at a firm-level. Managers are required to build networks and relationships, and share and pool resources to collaborate with other managers and firms. Managers are encouraged by these challenges to engage in open strategy processes but have limited understanding of these processes and the mechanisms required to facilitate these processes. This research study provides empirical and theoretical evidence of these open strategy processes and the role of MCS mechanisms. The thesis provides knowledge of how management control systems can be designed as industry-level control systems and used *between* firms to facilitate the open strategy process.

8.3 Limitations

The use of a field-based case study within an industry setting to study open strategy processes is a key strength of this research study. As the open strategy process spans a firm's boundaries and

involves multiple firms and managers, this setting provided a unique opportunity to examine issues related to this process. However, the case study approach also brings with it a range of limitations. These limitations relate to three areas: the research method, the case setting, and the research itself.

In Chapter 3, the discussion focused on the choice of the case study as a method as it was argued that it was appropriate for an exploratory study. The limited understanding of open strategy processes provided the basis for a field-based case study to explore issues related to open strategy processes in depth. The opportunity to access the research setting through an industry-funded research project was also helpful in this regard. However, the exploratory study is the first step in a stream of research to develop improved understanding of open strategy processes; therefore, other methods have been suggested to extend this research study. Many of the extensions suggested in the prior section are based on understanding whether the findings of this single case study hold in other settings. Other research methods, including surveys and multiple case study designs, would help develop more understanding of open strategy processes and related issues.

There are a number of limitations relating to the case setting. As discussed in Chapter 3, the case setting is the cotton industry in Australia. The unit of analysis for the case is the open strategy process which spans firm boundaries and involves multiple firms and managers. Despite this broad setting, the characteristics of the open strategy process observed in this industry might be quite unique to this setting. The extent to which these characteristics are unique to this setting provides a limitation as these characteristics may not be evident in open strategy processes in other settings. One of the extensions suggested to this research was to examine open strategy processes and the elements of the process developed in this study in other industry settings; this might provide more information on the relevance of these findings to other settings.

Another limitation relates to the development of the Australian cotton industry which provided a unique context for this study. The pioneer managers, referred to in Chapters 4–7, were focused on developing a viable and sustainable industry. They faced a serious ecological challenge in relation to cotton pests and established mechanisms to develop collaboration and resource R&D to develop new information which provided the basis for improved strategy. These managers were not consciously engaged in an open strategy process, they were carrying out activities which they considered to be important for the future viability of the cotton industry and their livelihoods. These managers engaged in an open strategy process as a by-product of managing a strategic challenge that provided an existential threat to the viability of their industry. This higher purpose was embedded in the cultural systems, such as values and culture, which established the context for

open strategy process engagement (Chapter 7). Their activities in this process were driven by this higher purpose and not, solely, by the desire to engage in a new type of strategy process. This higher purpose, related to strategic survival, operates similar to antecedent factors, prompting engagement in open strategy processes; the role of these higher purposes in triggering open strategy processes could also be an extension to this work.

There are several limitations to the conduct of the research itself. First, data collection and analysis was conducted as part of an industry research project (see Chapter 3) and was carried out over a period of two years. Therefore, the constructs under examination were constantly subject to change which had an impact on the reliability of findings. Second, the research study was a longitudinal study, covering a period of 52 years; hence, data collection was focused on understanding key events and issues across this time period which limited the researcher's ability to go into detail to investigate specific events and issues. Semi-structured interviews were conducted with a range of managers from firms within the industry spanning this longitudinal time period but access to some key managers were limited due to the passage of time and human mortality. Interviews were conducted until data saturation was reached but it was still not possible to explore issues (other types of antecedent factors, collaboration mechanisms and meta-capabilities) in depth due to the constraints discussed above. The longitudinal time period also limited the extensive use of observations of meetings and other managerial interactions as it was not possible to go back in time to collect data through this method. Finally, archival records provided an important source of data for the study. The Australian cotton industry has an enviable practice of maintaining detailed archival records relating to key events, issues and decisions which has been extremely useful for this research. While, much reliance has been placed on these archival records to develop an understanding of open strategy processes in this setting, the reliability of these records to portray events, issues and decisions in an unbiased manner is limited. Where possible, this archival data has been cross-checked with interview data and other public sources for corroboration.

The limitations discussed above do not detract from the significance of the findings of this research study. To the researcher's best understanding, this study is the first comprehensive empirical and theoretical examination of open strategy processes in the management accounting literature. Many of the limitations discussed in this section provide a basis for extending the findings through the use of other methods such as surveys and more field-based case studies including multiple case designs.

8.4 Conclusions

This research study has provided a preliminary examination of open strategy processes in an empirical setting. The findings of the study provided an understanding of three variables of an open strategy process and demonstrated the operation of this process in one industry setting. The findings indicated that the open strategy process is complex with each of the variables, antecedent factors, collaboration mechanisms and meta-capabilities, operating together in a complementary manner to influence firms and managers to carry out activities related to the process. Some of these activities appear to be carried out in isolation but have downstream impacts, which enable the open strategy process.

As an exploratory study, the findings of this research provide an understanding of open strategy processes but also raise some important issues which lay the ground work for more research in this area. There are many issues related to these processes that need more understanding, including the extent of openness in these processes, the barriers and limitations faced by individual firms in engaging in open strategy processes, and the implications of open strategy processes for firm performance and competitive advantage. It is hoped that this study and its findings provide a basis for increased focus and research on this topic in management accounting research.

Appendix A
List of Interviews

Stage	Interviewee	Type	Method	Duration
Familiarisation/ preparation	1. Policy officer, Cotton Australia	Face to face	Taped	1 hour
	2. Independent consultant	Face to face		2 hours (two interviews)
	3. Senior Executive, CRDC (CC2)	Face to face		1 hour
	4. Senior Executive, Cotton Australia	Face to face		1 hour
	5. Research Manager, Cotton Australia (CC1)	Face to face		1 hour
Primary data collection	1. Senior Manager Cotton Firm	Face to face	Taped	1 hour
	2. Senior Manager CRDC		Taped	2 hours
	3. BMP Officer, CMA/CRDC		Taped	40 minutes
	4. Cotton Consultant		Notes	1 hour
	5. Senior Executive & Senior Manager, Cotton Firm	Face to face -group interview	Taped	1.5 hours
	6. Marketing Manager, Cotton Firm	Face to face	Taped	2 hours
	7. Human Geographer/Researcher, UNSW	Face to face	Notes	1 hour
	8. Program Manager, CRDC	Face to face	Notes	2 hours
	9. Regional Executives 1 & 2, Cotton Australia	Face to face -group interview	Notes	2 hours
	10. Regional Executives 3 & 4, Darling Downs, Cotton Australia	Face to face -group interview	Notes	1 hour
	11. Senior Marketing Executive, QLD Cotton Firm	Face to face	Taped	1 hour
	12. Program Manager, Cotton	Face to face	Taped	1 hour

Stage	Interviewee	Type	Method	Duration
	CRC			
	13. Senior Executive (CC2), CRDC	Face to face	Taped	2 hours (2 interviews)
	14. Senior Operations Executive, Cotton CRC	Face to face	Taped	2 hours
	15. Senior Executive, Cotton CRC	Face to face	Taped	2.5 hours (three interviews)
	16. Education & Extension Program Leader, Cotton CRC	Face to face	Taped	1 hour
	17. Project Management Officer, Cotton CRC	Face to face	Taped	1 hour
	18. Board member 1, Cotton CRC	Face to face	Taped	1 hour
	19. Board member 2, Cotton CRC	Face to face	Taped	1 hour
	20. Managers 1 & 2, Cotton CRC	Face to face -group interview	Taped	1 hour
	21. Program Leader, Cotton CRC	Face to face	Taped	1 hour
	22. Board member (DA), Cotton CRC	Face to face	Taped	1 hour
	23. Research Manager, Cotton Australia (CC1)	Face to face (over 2 days)	Taped	4 hours (two separate interviews)
	24. Ex-Senior Executive, Cotton Australia	Face to face	Taped	2 hours
	25. Senior Executive, Cotton Australia	Face to face	Taped	1 hour
	26. Senior Executive, CRDC	Face to face	Taped	1 hour
	27. Program Manager (CC3), CRDC	Face to face	Taped	2 hours

Stage	Interviewee	Type	Method	Duration
	28. Directors (1&2), Public Accounting Practice	Face to face -group interview	Taped	1.5 hours
	29. Senior Manager, CRDC	Face to face	Taped	1 hour
	30. Senior Executive, Cotton Seed Firm	Face to face	Taped	1 hour
	31. Research Scientist, CSIRO	Face to face	Taped	1 hour
	32. Principal Research Scientist, CSIRO	Face to face	Taped	1 hour
	33. Project Officer, NSW Dept of Primary Industry (DPI)	Face to face	Taped	1 hour
	34. Senior Research Scientist, NSW DPI	Face to face	Taped	1 hour
	35. Research Program Leader, CSIRO	Face to face	Taped	1 hour
	36. Director & Principal Research Scientist, NSW DPI	Face to face	Taped	1 hour
	37. Research Agronomist, NSW DPI	Face to face	Taped	1 hour
	38. Team Leader, CSIRO	Face to face	Taped	1 hour
	39. Retired Research Scientist, CSIRO	Face to face	Taped	2 hours
	Total Interviews & hours	**54**		**59 hours 10 minutes**

Appendix B
Interview Questions

General background questions

Describe your role in terms of key responsibilities and accountabilities

Describe your firm in terms of its role and functions in the cotton industry

Describe the characteristics of the cotton industry in terms of key stakeholders (firms and managers), key strategic issues and challenges and major achievements

External industry environment

What are the major operating factors in the environment that have impacted firm strategy processes?

How have these factors been identified and managed?

What have been factors that have operated as antecedents providing triggers for firms to collaborate within the industry?

Strategy processes

Describe your firm's competitive strategy process?

Describe your firm's operational strategy process?

Collaboration mechanisms

Describe the processes involved in how you carry out collaborative activities with managers from other firms in the industry?

Describe and provide examples of collaborative activities and your role in these activities?

Describe mechanisms that have been employed to enable collaboration between firms and managers?

Who was instrumental in establishing the mechanism?

Who was involved in using the mechanism?

What were the outcomes?

Firm-level MCS

What systems and practices do you use and are involved with in your firm to manage?

Describe each type of system and practices?

How they are used?

Who uses it?

What is the history of the system or practice?

What have been the challenges in using the system or practice?

Cultural systems

What are these systems?

How are they used?

Who was involved?

What were the outcomes of their use?

What were the problems with their use?

How did they enable collaboration between firms and managers?

Administrative systems-firm design and structure

What are these systems?

How are they used?

Who was involved?

What were the outcomes of their use?

What were the problems with their use?

How did they enable collaboration between firms and managers?

Administrative systems-governance mechanisms

What are these systems?

How are they used?

Who was involved?

What were the outcomes of their use?

What were the problems with their use?

How did they enable collaboration between firms and managers?

Administrative systems-procedures and policies

What are these systems?

How are they used?

Who was involved?

What were the outcomes of their use?

What were the problems with their use?

How did they enable collaboration between firms and managers?

Planning practices

What are these practices?

How are they used?

Who was involved?

What were the outcomes of their use?

What were the problems with their use?

How did they enable collaboration between firms and managers?

Measurement practices

What are these practices?

How are they used?

Who was involved?

What were the outcomes of their use?

What were the problems with their use?

How did they enable collaboration between firms and managers?

Feedback practices

What are these practices?

How are they used?

Who was involved?

What were the outcomes of their use?

What were the problems with their use?

How did they enable collaboration between firms and managers?

Research and Development (R&D) processes and practices

Describe the research call processes and practices?

Who is involved?

How are they managed?

How is research funded?

How are projects scoped and allocated?

How are these R&D projects linked to strategy processes?

What are the outcomes from R&D projects?

How are outcomes translated and made available to cotton growers?

Appendix C

List of Archival Records Examined

Industry reports/ publications/news articles

1. Cotton Pest Control in Australia Before and After Bt cotton: economic, ecologic and social aspects, David Murray, Department of Primary Industries, Toowoomba
2. Management of pyrethoid and endosulfan resistance in Helicoverpa armigera in Australia, Bulletin of Entomological Research, Supplement Series, September 1998
3. Impacts of Bt Transgenic Cotton on Integrated Pest Management, Steven Naranjo, Journal of Agricultural and Food Chemistry, 2010
4. Review of Insecticide Resistance Management Principles in the Australian Cotton Industry, NSW Department of Primary Industries and Australian Cotton CRC
5. Prevention and management of Insecticide Resistance in Vectors of Public Health Importance, Insecticide Resistance Action Committee, 2011
6. Communication Plan, Discussion Paper, TransFact, April 1994
7. Economic, Environmental and Social Sustainability Indicators of the Australian Cotton Industry, Guy Roth, 2010
8. The Australian cotton water story, A decade of Research & Development 2002-12, Cotton Catchment Communities CRC Limited
9. A historical geography of cotton farming in NSW and QLD-adaptation and adoption, Wendy Shaw, UNSW, 2012
10. Report on a Scoping Project for the Land and Water Resources Research and Development Corporation on an Overview of the R&D program: Minimising the Impact of Pesticides on the Riverine Environment using the Cotton Industry as a model, James Doak, 1995
11. Minimising the Impact of Pesticides on the Riverine Environment: key findings from research with the cotton industry-1998 conference, Occasional Paper 23/98, Land & Water Resources R&D Corporation
12. Independent Program Review: Minimising the Impact of Pesticides on the Riverine Environment using the cotton industry as a model, Land & Water Resources R&D Corporation, CR Harris, 1996
13. Managing the environmental impacts of cotton growing-an Australian perspective, ACGRA, Alan Williams

14. Case study: Development of the Australian Cotton Industry Best Management Practice (BMP) Program, WWF-Australia, 2005
15. Evaluation of the Australian cotton industry Best Management practices program, Macarthur Agribusiness, Brisbane, 2004
16. Minimising Riverine Impacts of Endosulfan used in Cotton Farming-A Science into Practice Environmental Success Story, Nick Schofield, Alan Williams, Rachel Holloway and Bruce Pyke, Land & Water Australia and CRDC
17. Advances with Integrated Pest Management as a Component of Sustainable Agriculture: The Case of the Australian Cotton Industry, Gary Fitt, CSIRO, 2009
18. 1991 Environmental Audit Recommendations and industry responses, The Australian Cotton Grower, November/December issue
19. The Impact of Pesticides on the Riverine Environment with specific reference to Cotton Growing, Barrett Purcell & Associates Pty Limited, December 1991
20. Action Plan for the Australian Cotton Industry-a response to the Environmental Audit 1991
21. An Environmental Audit of the Australian Cotton Industry, Gibb Environmental Sciences & Arbour International, October 1991
22. External Review: Australian Cotton Industry Best Management Practice Audit Program, CRDC report 276, 2006
23. The development and assessment of the Cotton BMP program into a comprehensive Environmental Management System through the development of a Land and Water module-Final report, Cotton Australia
24. Case Study 4: Best management practice in the Australian cotton industry, 2005
25. The Cotton Model: a model for Minimising the impact of Pesticides on the Riverine Environment, Land & Water Resources R&D Corporation, 1998
26. Implementation pathways for BMP, James Doak, Land & Water Resources R&D Corporation, June 1998
27. A Time Series of the Australian Cotton Industry, 1962 to 2009, Janine Powell, Research Economist, Industry & Investment NSW
28. Evaluation of the Impact of Research Projects Relating to Australia's Natural Resources, Temtac Pty Limited, June 2000
29. Research's contribution to the evolution of the Australian cotton industry, Greg Constable, CSIRO, 2004
30. 10 Years of GM Cotton-where to from here? Jeff Bidstrup, Outlook Conference 2006

31. Taking Responsibility for our future: The Australian cotton industry action response to the Second Australian cotton industry Environmental Audit 2003, Report published in 2005
32. Disease ratings: Another management tool for cotton growers, Greg Salmond, Cotton CRC, 2003
33. Second Australian Cotton Industry Environmental Audit: Executive Summary, CRDC, 2003
34. Fostering best management practices in natural resource management-towards an environmental management system in the cotton industry, A&A Williams Pty Limited, 2001
35. Cotton Pesticides in Perspective, Cotton CRC, 2000
36. Extracts of news articles on pesticide contamination issues between 1998-1999 from the Sydney Morning Herald, Australian Associated Press, Herald Sun, Daily Telegraph and cotton industry specific news publications
37. A snapshot of the Cotton Australia TIMS Committee in 2009, Australian Cotton Grower, April/May issue.
38. Cotton: Focus on BMP, Cotton Australia, May 2004
39. An Australian approach to IPM in cotton: integrating new technologies to minimise insecticide dependence, Gary Fitt, Crop Protection Journal, 2000
40. Integration of Bt Cotton in IPM systems: An Australian Perspective, Gary Fitt & Lewis Wilson, Second International Symposium on Biological Control of Arthropods

Annual Reports

1. Cotton CRC, Annual Reports, 1994-2012
2. CRDC, Annual Reports, 1991-2013
3. Cotton Australia, 40th Anniversary Report and Timeline, 2011/2012
4. Cotton Australia, Annual Reports 1990-2013

Strategic Plans

1. CRDC Strategic Plan, 1998-2003, 2004-2009, 2009-2013, 2014-2019
2. CRDC Annual Operating Plans, 1998-2013
3. Cotton Australia, Strategic Objectives and Plan, 1989/90
4. Cotton Australia, Strategic Plan, 2009-2013, 2013-2018
5. Cotton Australia, Annual Operating Plans, 2009-2013
6. Cotton CRC, Strategic Plans, 1994-2012
7. Cotton Sector Research Development and Extension Final Strategy, June 2011

Governance documents/Minutes of Meetings

1. ACGRA Executive committee meeting minutes-February 1994-July 1997
2. ACGRA Executive committee meeting minutes- April 1988-March 1993
3. ACGRA Constitution
4. The New Research & Development Corporation for Cotton, Richard Williams, ACGRA, 1990
5. Australian cotton conference agenda and proceedings, 1990-1996
6. Memorandum by Chair of ACGRA on Transgenic cotton issues to cotton growers, March 1994

Appendix D

Field Observation Data

Date/Duration/ Location	Group	Purpose	Data collected
17 April 2012 2 Hours 50 minutes CRDC office, Narrabri, NSW	Project Steering committee-3rd Environmental Audit	The role of the committee was to manage the Audit process and to review the preliminary findings Participants on the committee included managers from Cotton Australia, CRDC, Cotton CRC, cotton consultants and cotton growers.	Audit process Coverage of cotton growers Audit questions Audit responses Emerging issues and trends Problems with the Audit process
5-7 August, 2012 24 hours Broadbeach, Gold Coast, Australia	Australian Cotton conference	Bi-Annual industry conference providing a forum for cotton growers, cotton researchers and other industry stakeholders to meet, discuss and share information.	R&D projects and outcomes Industry information and knowledge Contacts for further interviews and data access
20 November, 2012 2.5 hours Swiss Grand Hotel, Bondi Junction	Cotton Australia Research Panel: Human Capacity	The panel is one of 4 research panels set up to call, review and approve R&D projects for the cotton industry. Membership on the panel included cotton growers, cotton researchers and managers from Cotton Australia and CRDC	R&D approval & monitoring process Details on specific R&D projects Links between R&D projects and strategy process Problems with R&D projects New R&D project ideas
20 November, 2012 2 hours Swiss Grand Hotel, Bondi Junction	Cotton Australia Research Panel: Bio Security	The panel is one of 4 research panels set up to call, review and approve R&D projects for the cotton industry. Membership on the panel included cotton growers, cotton researchers and managers from Cotton	R&D approval & monitoring process Details on specific R&D projects Links between R&D projects and strategy process Regulatory issues Problems with R&D projects

Date/Duration/ Location	Group	Purpose	Data collected
		Australia and CRDC	New R&D project ideas
21 November, 2012 2 hours Swiss Grand Hotel, Bondi Junction	Cotton Australia General Members meeting	General meeting of cotton grower members of Cotton Australia. Forum for updating members on key strategic and operational issues Participants included cotton growers, managers from CRDC and Cotton CRC, cotton consultants and cotton researchers	Strategy process update including key strategic issues and challenges R&D project approval and monitoring updates Information and ideas on new issues and challenges Regulatory and stakeholder issues Marketing and value chain issues

Bibliography

Abernathy, M, Chua, W, 1996, A field study of control system 'redesign': The impact of institutional processes on strategic choice, *Contemporary Accounting Research*, 13(2), 569-606.

Abernathy, M, Brownell, P, 1999, The role of budgets in organizations facing strategic change: An exploratory study, *Accounting, Organizations and Society*, 24, 189-204

Ahrens, T, Chapman, C, 2007, Management accounting as practice, *Accounting, Organizations and Society*, 32, 1-27.

Ahrens, T, Dent, J, 1998, Accounting and organizations: Realizing the richness of field research, *Journal of Management Accounting Research*, 10, 1-39.

Alvesson, M, Karreman, D, 2004, Interfaces of control: Technological and socio-ideological control in a global management consultancy firm, *Accounting, Organizations and Society*, 29, 423-444.

Ansoff, H, 1965, *Corporate Strategy*, McGraw Hill: NY.

Auzair, SM, Langfield-Smith, K, 2005, The effect of service process type, business strategy and life cycle stage on bureaucratic MCS in service organizations, *Management Accounting Research*, 16(4), 399-421.

Barney, J, Wright, M, Ketchen, D.J. 2001, The resource based view of the firm: Ten years after 1991, *Journal of Management*, 27, 625-641.

Baxter, JA, Chua, WF, 1998, Doing field research: Practice and meta-theory in counterpoint, *Journal of Management Accounting Research*, 10, 69-88.

Blomqvist, K, Hara, V, Koivuniemi, J & Äijö, T 2004, Towards networked R&D management: the R&D approach of Sonera Corporation as an example, R&D Management, 34(5), 591-603.

Brown, D, 2005, Management control systems as a coupled package: An analytical framework and empirically grounded implications, University of Technology, Sydney: Sydney.

Caglio, A, Ditillo, A, 2008, A review and discussion of management control in inter-firm relationships: Achievements and future directions, *Accounting, Organizations and Society*, 33, 865-898.

Carpenter, M, Sanders, W, 2009, *Strategic Management: A Dynamic Perspective*, Pearson-Prentice Hall.

Chenhall, R, 2003, Management control systems design within its organizational context: Findings from contingency-based research and directions for the future, *Accounting, Organizations and Society*, 28, 127-168.

Chenhall, R, Langfield-Smith, K, 1998, The relationship between strategic priorities, management techniques and management accounting: An empirical investigation using a systems approach, *Accounting Organizations and Society*, 23(3), 243-264.

Chesbrough, HW, Appleyard, MM, 2007, Open innovation and strategy, *California Management Review*, 50(1), 57-76.

Chesbrough, H, Crowther, AK, 2006, Beyond high tech: Early adopters of open innovation in other industries, *R&D Management*, 36(3), 229-236.

Chesbrough, H, 2007, Why companies should have open business models, *MIT Sloan Management Review*, Winter issue, 48(2), 22-28.

Chesbrough, H, 2006, *Open Business Models: How to Thrive in the New Innovation Landscape*, Harvard Business School Press: Boston, Massachusetts.

Chesbrough, HW, 2003, The era of open innovation, *MIT Sloan Management Review*, Spring issue, 35-41.

Chua, WF, 1986, Radical developments in accounting thought, *The Accounting Review*, LX1(4)

Chua, WF, 1996, Issues in substantive areas of research: Field research in accounting, in A Richardson (ed.) *Research Methods in Accounting: Issues and Debates*, Research Monograph No.25, CGA-Canada Research Foundation, 209-228.

Cohen, WM, Levinthal, DA, 1990, Absorptive Capacity: A New Perspective on Learning and Innovation, Administrative Science Quarterly, 35, pp 128-152

Dahlander, L, Gann, DM, 2010, How open is innovation? *Research Policy*, 39, pp 699-709.

Daniel, SJ, Reitsperger, WD, 1991, Linking quality strategy with management control systems: Empirical evidence from Japanese industry, *Accounting, Organizations and Society*, 16(7), 601-618.

Davila, A, 2005, The promise of management control systems for innovation and strategic change, in CS Chapman (ed.), *Controlling Strategy-Management Accounting and Performance Measurement*, Oxford University Press: Oxford, UK.

Davila, A, Foster, G, Oyon, D, 2009, Accounting and control, entrepreneurship and innovation: Venturing into new research opportunities, *European Accounting Review*, 18(2), 281-311.

Dekker, HC, 2004, Control of inter-organizational relationships: Evidence on appropriation concerns and coordination requirements, *Accounting, Organizations and Society*, 29, 27-49.

Dekker, HC, 2003, Value chain analysis in interfirm relationships: A field study, *Management Accounting Research*, 14, 1-23.

Dent, J, 1991, Accounting and organizational cultures: A field study of the emergence of a new organizational reality, *Accounting, Organizations and Society*, 16(8), 705-732.

Doz, YL, Kosonen, M, 2010, Embedding strategic agility: A leadership agenda for accelerating business model renewal, *Long Range Planning*, 43, 370-382.

Doz, YL, Kosonen, M, 2008, *Fast Strategy: How Strategic Agility Will Help You Stay Ahead Of The Game*, Wharton School Publishing: NY.

Dubois, A, Gadde, Lars-Erik, 2002, Systematic combining: An abductive approach to case research, *Journal of Business Research*, 55, 553-60.

Eisenhardt, KM, 1989, Building theories from case study research, *Academy of Management Review*, 14(4), 532-550.

Enkel, E, Gassmann, O, Chesbrough, H, 2009, Open R&D and open innovation: Exploring the phenomenon, *R&D Management*, 39(4), 311-316.

Flamholtz, E, 1996, Effective organizational control: A framework, applications and implications, *European Management Journal*, 14(6), 596-611.

Flamholtz, E, Das, T, Tsui, A, 1985, Toward an integrative framework of organizational control, *Accounting, Organizations and Society*, 10(1), 35-50.

Forrester, NW, 1993, Management of pyrethoid and endosulfan resistance in H.armigera in Australia, Bulletin of Entomological Research Supplement Series, Supplement No 1, September

Gibb Environmental Sciences and Arbour International, 1991, An Environmental Audit of the Australian Cotton Industry

Govindarajan, V, Fisher, J, 1990, Strategy, control systems and resource sharing: Effects on business-unit performance, *The Academy of Management Journal*, 33(2), 259-285.

Govindarajan, V, 1988, A contingency approach to strategy implementation at the business unit level: Integrating administrative mechanisms with strategy, *Academy of Management Journal*, 31(4), 828-853.

Govindarajan, V, Gupta, A, 1985, Linking control systems to business unit strategy: Impact on performance, *Accounting, Organizations and Society*, 10(1), 51-66.

Grafton, J, Mundy, J, 2012, Managing tensions in co-opetitive inter-organizational relationships: Co-operation, competition and control, Working Paper

Granlund, M, 1997, The challenge of management accounting change: Essays on a longitudinal in-depth case study of the interplay between management accounting, change and stability, Unpublished Thesis

Gupta, AK, Govindarajan, V, 1984, Business unit strategy, managerial characteristics, and business unit effectiveness at strategy implementation, *Academy of Management Journal*, 25-41

Hakansson, H, Lind, J, 2007, Accounting in an interorganizational setting, in CS Chapman, AG Hopwood, MD Shields (eds), *Handbook of Management Accounting Research*, Elsevier: UK.

Hamel, G, 1996, Strategy as revolution, *Harvard Business Review*, July/August, 69-82.

Hart, SL, 1995, A natural-resource-based view of the firm, *Academy of Management Review*, 20(4), 986-1014.

Henri, J, 2006, Management control systems and strategy: A resource-based perspective, *Accounting, Organizations and Society*, 31, 529-558.

Holland, B, 2008, Justice and the Environment in Nussbaum's "capabilities approach": Why sustainable ecological capacity is a meta-capability, Political Research Quarterly, 319-332

Huston, L, Sakkab, N, 2006, Connect and develop-inside Procter & Gamble's new model for innovation, *Harvard Business Review*, March, 1-8.

Ittner, CD, Larcker, DF, 1997, Quality strategy, strategic control systems, and organizational performance, *Accounting, Organizations and Society*, 22(3), 293-314.

Jarzabkowski, P, Spee, A, 2009, Strategy-as-practice: A review and future directions for the field, *International Journal of Management Reviews*, 11(1), 69-95.

Johnson, G, Scholes, K, Whittington, R, 2005, *Exploring Corporate Strategy: Text and Cases*, vol. 7, Financial Times Prentice Hall.

Jorgensen, B, Messner, M, 2010, Accounting and strategising: A case study from new product development, *Accounting, Organizations and Society*, 184-210

Kakkuri-Knuuttila, ML, Lukka, K, Kuorikoski, J, 2008, Straddling between paradigms: A naturalistic philosophical case study on interpretive research in management accounting, *Accounting, Organizations and Society*, 33, 267-291.

Keating, PJ, 1995, A framework for classifying and evaluating the theoretical contributions of case research in management accounting, *Journal of Management Accounting Research*, Fall, 66-86.

Khandwalla, PN, 1972, Environment and its impact on the organization, *International Studies of Management & Organization*, 2(3), 297-313.

Kober, R, Ng, J, Paul, B, 2007, The interrelationship between management control mechanisms and strategy, *Management Accounting Research*, 18, 425-452.

Langfield-Smith, K, 2007, A review of quantitative research in management control systems and strategy, in CS Chapman, AG Hopwood, MD Shields (eds), *Handbook of Management Accounting Research*, Elsevier Limited:, London.

Langfield-Smith, 2005, What do we know about management control systems and strategy? in CS Chapman (ed.) *Controlling Strategy-Management Accounting and Performance Measurement*, Oxford University Press: Oxford, UK

Langfield-Smith, K, 1997, Management control systems and strategy: A critical review, *Accounting, Organizations and Society*, 22(2), 207-232.

Lichtenthaler, U, 2011, Open innovation: Past research, current debates and future directions, *Academy of Management Perspectives*, February, 75-93.

Lichtenthaler, U, Lichtenthaler, E, 2009, A capability-based framework for open innovation: Complimenting absorptive capacity, *Journal of Management Studies*, 46(8), 1315-1338.

Lukka, K, Modell, S, 2010, Validation in interpretive management accounting research, *AOS*, 35, 462-477.

Macarthur Agribusiness, 2004, Evaluation of the Australian Cotton Industry BMP Program, p1

Mahama, H, Chua, WF, 2005, Making strategic supply relationships work: Struggling with accounting numbers, Working Paper.

Malmi, T, Granlund, M, 2009, In search of management accounting theory, *European Accounting Review*, 18(3), 597-620.

Malmi, T, Brown, D, 2008, Management control system as a package: Opportunities, challenges and research directions, *Management Accounting Research*, 19, 287-300.

Martin, S, Scott, JT, 2000, The nature of innovation market failure and the design of public support for private innovation, *Research Policy*, 29, 437-447.

Matzler, K, Fuller, J, Hutter, K, Hautz, J, Stieger, D, 2014, Open strategy: Towards a research agenda, Working Paper.

Merchant, KA, Van der Stede, WA, 2012, *Management Control Systems: Performance Measurement, Evaluation and Incentives*, Third edition, Pearson Education Limited: UK.

McHugh, S, 1996, *Cottoning On: Stories of Australian Cotton-Growing*, Southwood Press Pty Limited: Marrickville, NSW, Australia.

McKinnon, J, 1988, Reliability and validity in field research: Some strategies and tactics, *Accounting, Auditing and Accountability Journal*, 1(1), 34-54.

Miles, RW, Snow, CC, 1978, *Organizational Strategy, Structure, and Process*, McGraw Hill: NY.

Miles, MB, Huberman, AM, 1994, *Qualitative Data Analysis: An Expanded Sourcebook*, Sage.

Miles, RE, Snow, CC and Miles, G, 2000, The Future.org, Long Range Planning, 39, 300-321

Miller, PB, O'Leary, T, 2005, Capital budgeting, coordination and strategy: A field study of interfirm and intrafirm mechanisms, in CS Chapman (ed.), *Controlling Strategy-Management Accounting and Performance Measurement*, Oxford University Press: Oxford, UK.

Miller, D, Friesen, PH, 1982, Innovation in conservative and entrepreneurial firms: Two models of strategic momentum, *Strategic Management Journal*, 3(1), 1-25.

Monsanto, 1995, Ingard Brochure

Murray, D, 1979, Cotton Pest Control in Australia Before and After Bt cotton: economic, ecologic and social aspects, Conference paper

Neuman, WL, 2000, *Social Research Methods: Qualitative and Quantitative Approaches,* 4th ed., Allyn and Bacon: London.

Newstead, B, Lanzerotti, L, 2010, Can you open-source your strategy? *Harvard Business Review*, October.

Nilsson, F, 2002, Strategy and management control systems: A study of the design and use of management control systems following takeover. Accounting & Finance, 42(1), 41-71.

Nussbaum, MC, 2000, Women and Human Development: The Capabilities Approach, Cambridge University Press, Cambridge, Mass.

Otley, DT, Berry, AJ, 1998, Case study research in management accounting and control, *Accounting Education*, Supplement, 7(4), 105-128.

Paroutis, S, Pettigrew, A, 2007, Strategizing in the multi-business firm: Strategy teams at the multiple levels and over time, *Human Relations*, 60(1), 99-135.

Paton, MQ, 2002, *Qualitative Evaluation and Research Methods*, 3rd ed., Sage Publications: Thousand Oaks, CA.

Porter, M, 1991, Towards a dynamic theory of strategy, *Strategic Management Journal*, 12, 95-117.

Porter, M, 1985, Competitive Advantage: Creating and Sustaining Superior Performance, Free Press: New York.

Porter, M, 1980, *Competitive Strategy: Techniques for Analysing Industries and Competitors*, Free Press: New York.

Silverman, D, 2010, *Doing Qualitative Research*, 3rd edition, Sage Publications: London.

Simons, R, 2000, *Performance Measurement and Control Systems for Implementing Strategy*, Prentice Hall: NJ.

Simons, R. 1995, *Levers of Control: How Managers Use Interactive Control Systems to Drive Strategic Renewal*, HBS Press: Boston, MA.

Simons, R, 1994, How new top managers use control systems as levers of strategic renewal, *Strategic Management Journal*, 15, 169-189.

Simons, R, 1991, Strategic orientation and top management attention to control systems, *Strategic Management Journal*, 12(1), 49-62.

Simons, R. 1990, The role of management control systems in creating competitive advantage: New perspectives, *Accounting, Organizations and Society*, 15(1-2), 127-143.

Simons, R. 1987, Accounting control systems and business strategy: An empirical analysis, *Accounting, Organizations and Society*, 12(4), 357-374.

Snow, C. C, Miles, R. E, & Miles, G, 2005. A configurational approach to the integration of strategy and organization research, Strategic Organization, 3(4), 431-439

Soin, K, Collier, P, 2013, Risk and risk management in management accounting and control, *Management Accounting Research*, 24(2), 82-87.

Stieger, D, Matzler, K, Chatterjee, S, Ladstaetter-Fussenegger, F, 2012, Democratizing strategy: How crowdsourcing can be used for strategy dialogues, *California Management Review*, 54(4), 44-68.

Sundin, H, Granlund, M, Brown, DA, 2010, Balancing multiple competing objectives with a balanced scorecard, *European Accounting Review*, 19(2), 203-246.

Teece, D, Pisano, G, Shuen, A, 1997, Dynamic Capabilities and Strategic Management, *Strategic Management Journal*, 18(7),

Tsoukas, H, 1998, Introduction: Chaos, complexity and organization theory, *Organization*, 5(3), 291-313.

Van der Stede, WA, 2000, The relationship between two consequences of budgetary controls: Budgetary slack creation and managerial short-term orientation, *Accounting, Organizations and Society*, 25(6), 609-622.

Weick, K, 1989, Theory construction as disciplined imagination, *Academy of Management Review*, 14, 516-531.

Whetten, DA, 1989, What Constitutes a Theoretical Contribution? Academy of Management Review, 14, 490-495

Whittington, R, Cailluet, L, Yakis-Douglas, B, 2011, Opening strategy: Evolution of a precarious profession, *British Journal of Management*, 22, 531-544.

Whittington, R, 2006, Completing the practice turn in strategy research, *Organization Studies*, 27(5), 613-634.

Whittington, R, 1996, Strategy as practice, *Long Range Planning*, 29(5).

Yin, R, 2003, *Case Study Research*, Sage Publications: Thousand Oaks, CA.

Zahra, SA, George, G, 2002, Absorptive capacity: A review, reconceptualization and extension, *Academy of Management Review*, 27(2), 185-203.