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Te Whare Wānanga o te Ūpoko o te Ika a Māui

Critical success factors for research collaborations between firms and research institutes in New Zealand

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Abstract

Ongoing discussions and changes in the New Zealand innovation system have underlined the need to improve the level of co-operation between firms and the Crown Research Institutes (CRIs) in New Zealand. This study contributes to this discussion by assessing the critical success factors for research co-operations between firms and CRIs. Alongside the practical value of this study, it also contributes to the development of relationship marketing theory, where empirical insights into research co-operations between firms and research institutes is lacking. Specifically, a case study methodology was utilised to test a conceptual model developed from existing literature in the context of research co-operations between universities and firms. To do so, similarities and contrasts between two successful research co-operations and two less successful research co-operations were examined in the light of 12 previously developed propositions.

Findings from this study highlight the strong similarity of success factors for research co-operations between firms and universities with those of firms and research institutes. However, additional themes emerged from this study, notably the concepts of group diversity and the multidimensionality of trust. The emergence of these additional themes might be explained by the unique characteristics of the New Zealand innovation system (remoteness and small size of firms), and the study methodology, which enabled additional insights.

Overall, this study contributes empirical data and conclusions from a new context to relationship marketing literature. From a managerial point of view, this study highlights the importance of a good balance between trust and distrust, a strong bond between the boundary spanning managers, and satisfactory communication as major determinants of successful research co-operation between firms and CRIs.

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1 Introduction

1.1 Background to the research

In New Zealand the Crown-funded research institutes, the so-called Crown Research Institutes (CRIs), are an important element in the National Innovation System (NIS). In the financial year 2008/2009 the eight CRIs employed a combined staff of 4400 and accounted for around 25% of all research expenditures in the country (MoRST, 2010). This investment is justified by the Government with the belief that collaboration between firms and CRIs is of fundamental importance in order to secure the technology advance and future success of New Zealand firms and the New Zealand economy as a whole (Mapp, 2010).

It is not only in New Zealand that research co-operations are perceived to be of importance for firms. Globalisation, fast technology change and shorter product life cycles have increased the pressure on firms to introduce more radical product innovations to market (Etzkowitz, Webster, & Healey, 1998). This need for innovation can not fully be addressed with in-house R&D facilities. As stated by Burnside & Witkin (2008, p.27): "*The 'go-it-alone' approach to innovation and development is no longer valid. Today the complexity of problems and the need for multidisciplinary approaches requires interaction, the flow of ideas and knowledge exchange"*.

However, knowledge transfer between public research organisations and firms is not without problems (Plewa, Quester, & Baaken, 2005). In New Zealand, for example, the innovation system is characterised by a lack of knowledge exchange between its elements (MoRST, 2010; OECD, 2007). It is argued that it is not a system but rather a collection of islands of excellence which co-exist (Marsh, 2003). Measures have been put in place by the Government (Mapp, 2010) to change this and increase collaboration and knowledge exchange between the CRIs and the private sector.

Although the New Zealand innovation system is reviewed quite regularly (e.g. Marsh, 2003, 2004; MoRST, 2010; OECD, 2007), research which specifically looks at co-

operations between CRIs and the New Zealand private sector is limited. This thesis addresses the shortage of research exploring such co-operation.

1.2 Research problem and contribution

The research problem addressed in this study is:

> *What are the critical success factors for research co-operations between firms and CRIs in New Zealand?*

The major bodies of theory reviewed to address the research problem are relationship marketing (RM) and the resource based view of the firm (RBV). Most importantly, literature about critical success factors for co-operation in general (Buchanan & Gillies, 1990; Palmer, 1994; Reicheld, 1996; Rust, Zahorik, & Keiningham, 1996) and research co-operations in particular (Daniel, Hempel, & Srinivasan, 2002; Mora-Valentin, Montoro-Sanchez, & Guerras-Martin, 2004; Plewa & Quester, 2007; Plewa, et al., 2005; Santoro & Bierly, 2006) are reviewed.

Problems have been identified in the literature in relation to research co-operations between independent parties. These include issues caused by different research objectives, different time orientations, different reward systems, disagreements in the negotiation of intellectual property (IP) rights, and uncertainty within the collaborating firm. Additional factors have been identified in the literature as likely to affect the success of an outcome. In particular these include matters of trust, commitment, quality of the social bond between the boundary spanning managers, quality of communication, mutual objectives, and experience.

Twelve specific propositions are developed in the above described context as likely affecting the nature of the co-operation and its outcome. This study evaluates these propositions, and concludes that a good balance between trust and distrust is the key for successful research co-operations in New Zealand. It is further concluded that to achieve

such an optimal balance, satisfactory communication and a good relationship between the boundary spanning managers are crucial.

1.3 Justification for the research

This research is of importance from a theoretical and practical viewpoint.

From a theoretical viewpoint this research addresses a gap in relationship marketing literature which looks at relationships between partners which operate in fundamentally different organisational environments. As stated by Plewa, et al. (2005, p.435) *"an examination of RM beyond private enterprise and consumer markets may contribute to our understanding of, and further theoretical development in, this area"*.

Much of the published research explores the nature of relationships in a firm-university context (e.g. Santoro, Bierly, 2006; Betts and Santoro, 2009; Plewa and Quester, 2005; Plewa and Quester, 2007, Philbin, 2008), which reflects the easy access to such institutions for scholars. However, in many European countries like Germany (Keck, 1993) or France (Chesnais, 1993), or outside Europe in New Zealand (OECD, 2007), governmental research institutes play a greater role in the National Innovation Systems than university research alone. This study contributes to the development of relationship marketing by explicitly evaluating research co-operations between firms and research institutes, and the effectiveness or otherwise of such relationships.

From a practical point of view this study is of interest because it examines the linkage between CRIs and firms in New Zealand. As noted above such collaborations are of importance to secure technology advance and future success for New Zealand (Mapp, 2010). Recent reforms have been put in place to increase and improve co-operation between firms and CRIs (Mapp, 2010). This study provides valuable insights into successful and unsuccessful co-operation between firms and CRIs and highlights best practice.

1.4 Methodology

This thesis utilises a case study methodology to test theory. Specifically, two successful and two unsuccessful research co-operations between New Zealand firms and a CRI were analysed and compared with each other to evaluate 12 developed research propositions. Additional themes emerged during the analysis of the data.

Data was collected by means of formal interviews and informal discussions. In addition, secondary data was collected to get a detailed understanding of the cases. The formal interviews were transcribed and analysed using data reduction and data display techniques suggested by Miles & Huberman (1994). Several measures suggested by Yin (2009) were applied to secure validity (multiple sources of evidence, key information has reviewed a draft of case study report) and reliability (case study protocol and database, detailed description of cases) of findings.

1.5 Outline of this thesis

This thesis is constructed of five chapters. Following the introduction is the literature review (Chapter 2), methodology (Chapter 3), findings and discussion (Chapter 4), and the conclusion (Chapter 5). These are briefly described in turn below.

The literature review in Chapter 2 introduces the parent theories of this study which are relationship marketing and the resource based view of the firm. In this context success factors for co-operation are reviewed in depth with emphasis on the concept of trust. Next, the contextual setting of this research is introduced which is to be found in the field of national innovation systems and specifically research co-operations within these systems. Research co-operation specific issues and critical success factors for such co-operation are examined as part of this review. Furthermore, the New Zealand innovation system with focus on the New Zealand business sector and the CRIs are described. At the end of Chapter 2 the research problem and contribution of this study are discussed and a conceptual model with 12 propositions is developed.

The methodology of this study is introduced in Chapter 3. First, the case study research methodology chosen for this research is justified. The requirement for prior theory will be explained along with the process of case selection for this study. Next, the process of data collection is described including the interviewer, the pilot study, and the main study. In addition, data analysis and reliability and validity in data analysis are discussed. At the end of Chapter 3 ethical considerations are outlined.

Chapter 4 on the research findings and discussion begins with assessing the perceived success or failure of the four cases of this study. Next the 12 propositions are evaluated in the context of research specific issues and success factors. Additional themes which emerged are discussed alongside these propositions. Specifically, these are the multidimensionality of trust, group diversity, team tenure, and kind of experience.

At the end of this thesis is Chapter 5 which draws conclusions from this research in the context of the developed research propositions and research problem. Further, implications for relationship marketing theory and managerial implications are considered. At the end are the limitations of this research and further research directions.

2 Literature Review and Conceptual Framework

2.1 Introduction

This second chapter introduces and describes the literature and theoretical concepts underpinning this research and highlights the research problem and contribution of this study. In total the literature review consists of three sections.

In the first section the parent disciplines of this study are described. These parent disciplines are in the overall field of relationship marketing and the resource-based view of the firm. Special attention is given to success factors for collaboration. At the end of the first section is a summary of these parent disciplines.

The second section sets the contextual scene for the research problem area which belongs to the broad concept of national innovation systems. Public research organisation-firm relationships within the New Zealand innovation system are specifically studied. The second section is concluded by a brief summary.

The third section states the research problem, justifies this research and outlines the contribution of this study. Next, the conceptual framework and propositions for this study are developed. A conclusion is at the end of this chapter.

2.2 Parent theories of thesis

The parent disciplines of this study are relationship marketing (RM) and the resource based view of the firm (RBV). First, the development of RM will be described, beginning with its first appearance in marketing literature in the work by Berry et al. (1983). Special emphasis is given to the two streams of RM: the narrow approach (focus on customer relationships) and the broad approach (consideration of all company relationships). The second parent theory is RBV. In this context emphasis will be given to networks as a source of competitive advantage. A third section discusses the success factors for inter-firm collaborations. As part of these success factors the concept of trust is reviewed in

more depth because it is the one of the main pillars of the conceptual model presented for this research.

2.2.1 Relationship Marketing (RM)

"Relationship marketing is a new old concept" (Berry, 1995, p.236) which some refer to as reaching as far back as to ancient times (Gronroos, 1994).

This century-old focus on good customer relationships changed partly during the industrialisation era which commenced at the beginning of the 19th century. Mass production allowed companies to focus on short-term market transactions over long-term relationships (Sheth & Parvatiyar, 2000). However, this approach changed again in the late 1970s/early 1980s with growing interest among practitioners and marketing scholars in the establishment and maintenance of relationships between firms and their customers. This reflected a growing realisation that networks are important, particularly in business to business (B2B) markets. It also reflected a greater emphasis on customer retention as markets matured and levels of competition increased.

Academic research on RM grew mainly out of the field of service marketing (Mattsson, 1997) as early contributors such as Berry, Gronroos and Gummesson specialised in service marketing. However, as discussed further below, relationship marketing is viewed differently by different scholars.

The first to specifically mention the term 'relationship marketing' were Berry et al. (1983). It was defined as *"…attracting, maintaining and – in multi-service organisations – enhancing customer relationships" (Berry et al, 1983, p. 25).* This early definition of RM highlights one major stream of relationship marketing research, which is entirely focussed on customer relationships.

This stance differs from the view of a second early contributor to the concept of relationship marketing which came from the Nordic School of Services. The Nordic school approach originated from service marketing research in Scandinavia and Finland

and fast gained international recognition for its broader approach towards RM (Berry & Parasuraman, 1993). Relationship marketing was considered more important than just customer relationships alone.

Although the research focus of this group has always been relationship-oriented, the term 'relationship marketing' was not specifically used until the end of the 1980s (Gronroos, 2000). The term 'relationship marketing' was introduced to underline the overlapping parts of service marketing research with research in the field of business networks (Gronroos, 2000).

Before the term 'relationship marketing' was introduced terms such as 'interactive relationships' were used to underline the interactive nature of marketing (Gummesson, 1987). Service marketing was viewed as fundamentally important in building and maintaining relationships (Gronroos, 2000). In this context Gronroos (1996) coined the term 'service competition' which highlights that companies can enhance products with good service (e.g. prompt service and maintenance) or they can destroy value with bad service (e.g. late delivery, unsuccessful maintenance). Good service is a central and necessary condition to build good relationships.

One important distinction of services in comparison with products is that its consumption is typically a long-term process, rather than a single event, as is the case when a product is purchased without consecutive services (Gronroos, 2000). Interactive marketing refers to the management of such service processes in order to establish good customer relationships.

Because of this interactive nature of services it was argued that the marketing of services required a different approach from the pure marketing of products (Mattsson, 1997). In this context the prevailing functional view of marketing in the marketing mix approach was criticised (Gronroos, 1994). It was argued that marketing should not solely be the responsibility of the marketing function or the marketing department, but rather the responsibility of everyone within the organisation (Gronroos, 1994).

The expression 'part-time marketer' coined by Gummesson (1987) underlines the holistic approach the Nordic School of Services advocates for (relationship) marketing. The term 'part-time marketers' refers to all employees who are in contact with customers but are not necessarily employed in a sales or marketing position directly. According to the Nordic School of Services, marketing moves from identifying potential customers (by the marketing function only), to establishing, maintaining and enhancing relationships with them (by the whole organisation).

As this highlights, the central relationship in the view of the Nordic School of Services is still the one between the seller of goods or services and the buyer of such goods and services (Gronroos, 2000). This is consistent with the view of Berry et al (1983) that relationship marketing should first and foremost be focussed on managing customer relationships. They add, however, that other relationships, for instance with suppliers or distributors, have to be managed equally successfully in order to deliver superior customer value (Gronroos, 2000). This is where the view of the Nordic School of Services differs from that of Berry et al. (1983), and where the Nordic School has a view in common with the research of business networks.

Although the most basic relationship is the one between a supplier and its buyers: *"[Companies and] their managers are now working in a world that consists not simply of markets and firms, but of complex relationships with a variety of other organisations" (Gummesson, 1995, p.10).*

The Nordic School argues that a company should focus on core competencies which can be unique products or services, or its ability to develop new technologies (Gummesson, 1995). Relationships are required around this core competency which in turn helps to establish and maintain strong customer relationships. Gummesson (2005) describes in this context a total of 30 possible relationships (30R) which may need to be managed carefully. These relationships, which can be inside or outside the company, are not, however, equally important for all organisations. The author suggests giving a monetary

value to the relationships to gain a better overview of the contribution to profit that each relationship makes.

In short, it can be said that unlike the above-stated definition of Berry et al. (1983), whose definition of RM was quite narrow and mostly referring to end-customers, the Nordic School of Services defines (relationship) marketing in a broader way that extends beyond customer alone: "*Marketing is to establish, maintain, and enhance relationships with customers and other partners, at a profit, so that the objectives of the parties involved are met" (Gronroos, 1990, p.138).*

This broader network view of relationship marketing overlaps with research conducted by the Industrial Marketing and Purchasing Group (IMPG). The IMPG, with research centres in Sweden, Great Britain, France, Germany, and Italy, developed in the late 1970s around research into industrial marketing (Parvatiyar & Sheth, 2000). Specifically, research was conducted on buyer-seller relationships in business markets (Hakansson & Snehota, 2000). It was argued that such relationships are not transactional and therefore existing marketing theory, with its transactional focus, cannot be used to understand such relationships (e.g. Arndt, 1979).

The dissatisfaction with existing marketing theory initiated the first major research project of the IMPG (IMP1) which focussed on buyer/seller relationships (Hakansson & Snehota, 2000). Empirical and theoretical conclusions were drawn within IMP1 (Hakansson & Snehota, 2000). A rich descriptive database was provided which described in depth buyer/seller relationships in industrial settings (Hakansson & Snehota, 2000).

Conceptually, the 'interaction model of buyer/seller relationships' (Hakansson & Snehota, 2000) is the most noticeable outcome of IMP1. This model conceptualises four elements which can be part of an exchange between a buyer and a seller. These four elements are a product/service, money, information and sociality. The inter-firm exchange of these elements can become routine behaviour with clear responsibilities and expectations on both sides. In the long run, such behaviour leads to adaptation by both

parties. In brief, it can be said that the interaction model of buyer relationships is a function of three basic processes: exchange, co-operation and adaptation.

Whereas IMP1 focussed on a buyer/seller relationship dyad, the second research project of the group, IMP2, had more of a network focus. As in IMP1, empirical and conceptual contributions emerged from this research. It was concluded that firm relationships are part of a *"wider economic organisation that takes a network form" (Hakansson & Snehota, 2000, p.79).* This means that it is impossible to evaluate such relationships in isolation because changes within one relationship will have an impact on another. In such networks *"the actors…are rather strongly and mutually dependent on each other for effective coordination of their activities and their resources" (Mattsson, 1997, p.455).* As in the Nordic School approach, all organisational functions were found to be part of such an exchange, not just the marketing or sales department (Mattsson, 1997).

However, neither the NSS nor the IMP group claimed universal application for their new ideas in the context of relationship marketing and networking. Broader acceptance of the academic relationship marketing field came with growing interest in this topic among senior US marketing professors (Mattsson, 1997).

One of these professors was Frederick E. Webster, who highlighted inter-firm networks similar to the approach applied by the IMPG (Webster, 1992). Webster argued (1992) that inter-firm networks are the result of immense international competition which pressured companies to move away from the traditionally preferred 'I do it all' approach, towards a focus on core competencies and relationship building. Consistent with the views of the IMPG and the Nordic School of Services, Webster (1992) criticised the transactional view of marketing. Everyone in a company must understand customer needs and contribute to delivering value to them (Webster, 1988). Rather than just focusing on marketing transactions, customers must become partners in a long-term relationship. To ensure such partnerships, a firm must deliver superior value to its customers.

Even though Webster (1992) stresses that companies have to focus on producing such superior value to the end consumer, this cannot be achieved single-handedly. The outcome is rather the result of the efforts of *"a network of strategic partnerships among designers, technology providers, manufacturers, distributors, and information specialists" (Webster, 1992, p.14).* The ability to link such different players is the key responsibility of marketing personnel and may even be the key resources of a company (Webster, 1992).

Overall, Webster (1992, p.15) concluded that *"the market-driven strategy will require skills in designing, developing, managing, and controlling strategic alliances with partners of all kinds, and keeping them all focussed on the ever-changing customer in the global marketplace".*

As the above discussion highlights, what is meant by the term 'relationship marketing' may differ from scholar to scholar. Although the importance of relationship marketing became better accepted in recent years, its scope is still under debate. Coote (1994) distinguishes between the Nordic approach, the North American approach, and the Anglo-Australian approach. The North American approach originally defined RM as customer relationships, whereas the other two schools of thought apply relationship marketing more broadly. Other scholars draw a distinction between customer relationship marketing and relationship marketing (Payne, 2000), or between a narrow functional marketing perspective of RM and a broad, pragmatic orientation (Parvatiyar & Sheth, 2000). All of these approaches essentially divide relationship marketing between narrow relationships (to customers only) and a broader approach (relationships to a variety of partners within a network).

The broad view is criticised by some as being outside the domain of marketing (Peterson, 1995). They suggest that RM is more meaningful if it is limited to relationships on the level of customer relationships (Parvatiyar and Sheth, 2000). However, to achieve mutually beneficial relationships with their customers, firms typically need to collaborate with other partners along the value chain.

In this study the broader conceptualisation of RM is seen as being more appropriate to the research problem under investigation because companies seek collaborations with external research institutes in order to serve the increasing customer demands for innovative products. As will be discussed below in more depth, in order to build sustainable customer relationships a company needs to maintain a variety of additional external relationships.

The resource-based view of the firm (RBV) highlights how successfully-managed external relationships (networks) can increase customer satisfaction and lead to a competitive advantage.

2.2.2 Resource-Based View of the Firm (RBV)

The resource-based view of the firm is *"one of the latest strategic management concepts to be enthusiastically embraced by marketing scholars" (Fahy & Smithee, 1999, p. 1).* It was originally borrowed from the field of strategic management and is about competitive advantage and the role of key resources (Wernerfelt, 1984). Competitive advantage is defined as *"The unique position an organisation develops vis-à-vis its competitors through its patterns of resource deployments" (Hofer & Schendel, 1978, p.25).* However, resources only become a competitive advantage if they are turned into value for the end customer (Kay, 1993).

The origin of the RBV can be found in the early work of Penrose (1959) who highlighted a broad set of key resources beyond the traditional factors of production (labour, capital, and land). Having the right key resources (e.g. technical know-how) can lead to unique capabilities and competitive advantage. Penrose argued a firm can only expand its business within the boundaries of its existing or newly-acquired resources in the market place.

The term 'resource-based view' was not coined until the 1980s in the work of Birger Wernerfelt (1984). Unlike the product view, the resource-based view looks at competitive

advantage from a resource perspective. Resources were defined as *"anything which could be thought of as a strength or weakness of a given firm" (Wernerfelt, 1984, p.172).*

Such resources in order to be advantage-creating must be valuable, rare, unique, and not able to be substituted (Barney, 1991). In any case these resources must improve a company's competitive advantage by better addressing the customers' needs (Barney, 1991). Such resources can be, for instance, brand names, technological in-house expertise, trade contacts etc. In order to secure sustainable success from such resources a firm needs to develop 'resources barriers' to prevent competitors gaining market entry (Wernerfelt, 1984).

Resource barriers are most effective *"when competitors do not comprehend the competencies on which the advantage is based" (Reed & DeFillippi, 1990, p.90).* In the context of such competencies, tacitness, complexity, and specificity are described as sources of advantage and ambiguity which preclude competitors from market entry. These three competencies are briefly described below.

Tacitness refers to knowledge which is not published in journals or the like. It can be described as knowledge which even skilled personnel are unable to codify in any form. As stated by Wagner & Sternberg (1985, p.439): *"[Tacit knowledge is] probably disorganised, informal, and relatively inaccessible, making it potentially ill-suited for direct instruction".*

Complexity describes the large variety of resources which need to be combined in order to be successful. The combination of diverse in-house resources such as technologies, organisational routines, or staff experience is not easily understood by individuals from outside the organisation (Reed and DeFillippi, 1990).

Specificity refers to the unique resources within the special boundaries of an organisation. These are hard to replicate in another organisational setting. *"The business actions that result from resource and skill deployment (competencies) can be highly*

specific and interdependent with the firm's internal or external transaction partners" (Reed and DeFillippi, 1990, p. 92).

In addition to the above-described 'ambiguity competencies' as ways to protect key resources, others described in the literature are secrecy (Grant 1991), IP protection, or simply the high financial cost of replicating key technology (Fahy and Smithee, 1999).

Management has an important role in maintaining competitive advantage (Williams, 1992). As stated by Fahy & Smithee (1999, p.1), *"The RBV emphasises strategic choice, charging the firms management with the important task of identifying, developing and deploying key resources to maximise return".*

Management has to match their own resources with market need and if necessary adjust them. Important tasks in this context are, for example, the identification, development, protection and deployment of the resource base (Amit and Schoemaker 1993). External relationships are essential when it comes to the identification and development of key resources. However, such relationships must always be converted into value for the customer (Williams, 1992)

2.2.2.1 Networks as a resource of competitive advantage

In the context of the development of such key resources, Gulati et al. (2000) highlight the importance of a firm's network of relationships as a source for the creation of unique value-generating resources. A firm's network allows it to access key resources from its environment, such as information, market access, capital, goods and services etc. that have the potential to maintain or enhance a firm's competitive advantage (Gulati, Nohria, & Zaheer, 2000).

Morgan & Hunt (1994) describe a variety of relationships that are part of such a network. Some partnerships are with suppliers (goods suppliers and services suppliers) but there are also lateral partnerships with competitors, non-profit organisations and the government. Although the relationship with the direct costumer is of fundamental

importance, such relationships cannot be maintained without taking the other external relationships required for resource development into account. Such resources are required to deliver superior products to the actual customers.

Take, for example, the increasing customer demand for 'green' products (Michael, 1997). A company may not have the required internal skill set (resources) to develop such products. Relationships with universities or research institutes may be necessary in order to develop the key technologies required to meet changing customer requirements.

Concepts of the IMP Group underpin this example by arguing that the different kind of relationships a company has are interwoven and cannot be viewed in isolation (Hakansson & Snehota, 2000). Before a relationship with a university can deliver the right technologies (resources) it must first consider the customer relationships and their requirements. However, all resources must ultimately lead to value creation for customers and consequently to company stakeholders. Value creation for customers will lead to superior performance measured in terms of market share and customer satisfaction (Bharadway, Fahy, & Fahy, 1993).

Based on the above discussion, the approach towards relationship marketing in this study again favours the broader approach. Relationship marketing is in this context helpfully defined as all *"activities directed towards establishing, developing, and maintaining successful relational exchanges" (Morgan and Hunt, 1944, p.22)*

2.2.3 Success factors for collaborations

Because successful relationships are so important for a firm's success, many research papers highlight the critical factors leading to such relationships (Berry, 1995).

Success factors in the context of inter-firm collaborations are usually assessed in the context of relationship objectives. Qualitative research often measures them in terms of the perceived success or failure of relationships (e.g. Plewa, Quester, & Baaken, 2005)

whereas quantitative research provides more of an objective measure when assessing success or failure. Probably the most objective way to measure the success of relationships is in the context of economic benefits. A relationship becomes economically attractive in the long term because of cost benefits (Jarillo, 1988) or the avoidance of switching costs (Heide and Weiss 1995). Between firms a relationship can become economically attractive because it enables access to new resources (Ganesa, 1994) and reduces uncertainty (Morgan, 2000).

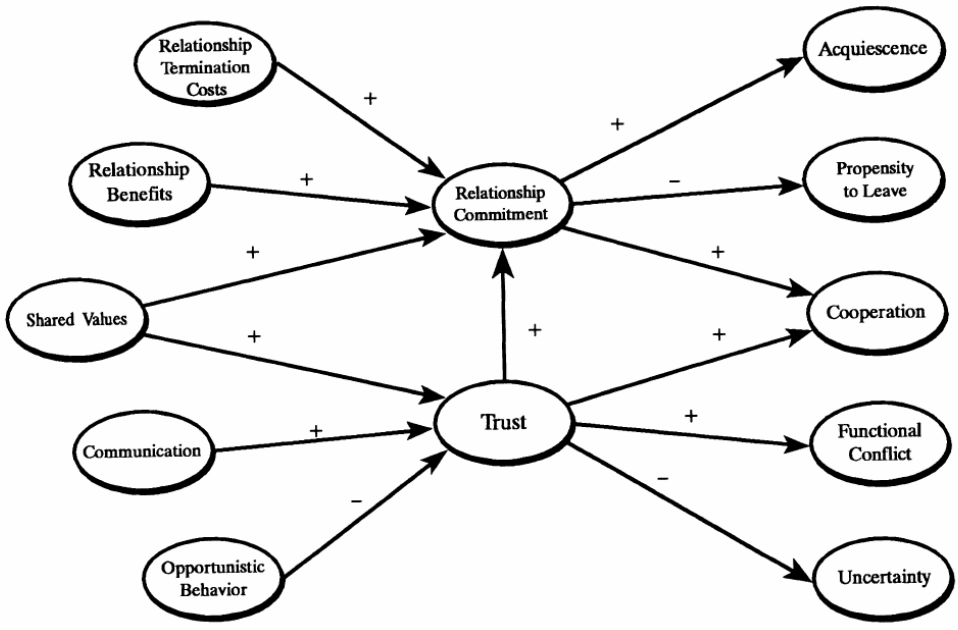
Measures within customer relationships are, for example, to increase customer loyalty (Palmer, 1994; Reicheld, 1996), and satisfaction (Rust, Zahorik, & Keiningham, 1996), and reduce customer loss (Buchanan & Gillies, 1990; Dawkins & Reicheld, 1990) and reduce uncertainty (Morgan & Hunt, 1994).

In the context of inter-firm relationships, power was traditionally seen as crucial for success. Thorelli, (1986, p.380) defines power as: *"the ability to influence decisions or actions of others"* and considers it as the central concept for inter-firm collaborations. Andersen & Narus (1990) found that the more influence a company has over its collaborative partner, the less conflict it encounters and the more satisfied it is with the collaboration. Morgan and Hunt (1994) included power post-hoc in their renowned model of the commitment-trust theory of relationship marketing. However, they state that even though power assists in the understanding of relationship failures, it cannot be the central construct of relationship marketing because that focus should be on enablers of relationship success.

The so-called key mediating variable model (KMV) of Morgan and Hunt (1994) set a milestone in relationship marketing research because it found commitment and trust to be the key when managing successful relationships. Although other research highlighted the importance of these two variables (e.g. Andersen & Narus, 1990; Dwyer, Schurr, & Oh, 1987; Mohr & Spekman, 1994), commitment and trust were never placed in such a central position as in the KMV model.

Figure 1 illustrates the KMW Model with the concepts of commitment and trust in the centre of it. In response to power as the central concept Morgan & Hunt (1994, p.22) state: *"Commitment and trust is central to successful relationship marketing, not power and its ability to condition others"*.

Figure 1: The KMV Model of Relationship Marketing



Source: Morgan & Hunt (1994, p.22)

Commitment in this model is defined as *"[the belief of an exchange partner] that an ongoing relationship with another is so important as to warrant maximum efforts at maintaining it" (Morgan and Hunt, 1994, p.23).* Dwyer, Schurr, and Oh (1987, p.23) refer to it as *"the highest stage of relational bonding"*. Others who consider the concept of commitment are, for example, Mohr & Spekman (1994).

The other key construct of the KMV model is trust, which is defined as the confidence of one party *"in an exchange partner's reliability and integrity" (Morgan and Hunt (1992, p. 23).* Others who consider the concept of trust as crucial for relationships are for example Andersen & Narus (1990), Dwyer et al. (1987), and Mohr & Spekman (1994).

Morgan and Hunt (1994) argue that commitment and trust are key concepts because in promoting co-operation and the importance of long-term rewards over short-term benefits, and preventing opportunistic behaviour, they encourage lasting relationships.

Communication is an important part of the commitment-trust theory of relationship marketing (Morgan and Hunt, 1994). Communication is defined as *"the formal as well as informal sharing of meaningful and timely information between firms" (Andersen & Narus, 1990, p. 44)* and is part of many models which involve relationship success. Mohr & Spekman (1994) refer to three aspects of communication behaviour: communication quality, extent of information sharing, and participation in planning and goal setting. Others who found communication to be important for relationship success are for example Moorman, Zaltman, & Deshpande (1992), Andersen & Weitz (1992) and Dwyer et al. (1987).

Having shared values is another important enabler of commitment and trust (Dwyer et al., 1987; Morgan & Hunt, 1994). This is defined as *"the extent to which partners have beliefs in common about what behaviours, goals, and policies are important or unimportant, appropriate or inappropriate, and right or wrong" (Morgan and Hunt, 1994, p. 25).*

Other enablers of commitment and trust are a company's culture (Bucklin and Sengupta, 1993), company values (Morgan & Hunt, 1994), personal characteristics of individual staff members (Galaskiewicz, 1981; Bucklin and Sengupta 1993), interdependence (J. C. Andersen & Narus, 1984; Dwyer et al., 1987; Mohr & Spekman, 1994) and relationship termination costs (Morgan & Hunt, 1994).

Overall, the concepts of commitment and trust are central to the success of inter-firm relationships. Commitment and trust were even proposed as mandatory for every model in the context of successful relationships (Fontenot & Wilson, 1997).

However, particularly when it comes to the concept of trust, the research is diverse in its approach and spread across many different disciplines (mainly psychology, sociology, and economy). In the next section the concept of trust is explored in more depth across a variety of academic fields.

2.2.3.1 The concept of trust

Trust has been studied from several different disciplinary perspectives (mainly psychology, sociology and economy) and this cross-discipline interest has led to a number of different definitions. Gargiulo & Ertug (2006, p.167) define trust as *"The willingness of a party (the trustor) to be vulnerable to the action of another party (the trustee) based on the expectation that the trustee intends and is able to perform in ways that will not harm the trustor in a particular situation, irrespective of the trustor's ability to control the trustee's behaviour"*.

Authors like Geyskens, Steenkamp, & Kumar (1998, p.225) emphasise the need for honesty: "*The extent to which a firm believes that its exchange partner is honest and/or benevolent"*. Banerjee, Bowie, & Pavone (2006, p.252) define it as "*The expectation that a partner will not engage in opportunistic behaviour, even in the face of opportunities and incentives for opportunism"*.

This broad interest and the accompanying diversity of definitions make it somewhat difficult to find a single cross-discipline definition for trust (Gargiulo & Ertug, 2006). However, it is generally accepted that trust refers to the willingness of an individual to take risks and therefore be vulnerable to a trustee (Mayer, Davis, & Schoorman, 2006; Rousseau, Sitkin, Burt, & Camerer, 1998).

In short it can be said that, depending on the discipline, scholars look at different units of analysis which leads to different definitions. Psychologists conduct research mostly on an individual level; sociologists look at social groups or society as a whole and economists explore entire organisations (Rousseau et al., 1998).

In a special issue about trust, the Academy of Management Review (Rousseau et al., 1998) focussed on the commonalities and provided the following cross-discipline definition of trust: *"Trust is a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behaviour of another" (Rousseau et al. 1998b, p. 294).*

The interest of economists in the concept of trust grew significantly in the late twentieth century. Increased competition, outsourcing, new communication technologies and restructures changed working environments and increased economic interest in the concept of trust during the late 1980s, with the publications of Gambetta (1988) and Zucker (1986) marking the beginning (Gargiulo & Ertug, 2006).

Companies face more uncertainty than ever before and need to be highly flexible to succeed under these conditions. As stated by Bachmann & Zaheer (2006, p. 3) *"we are living in a trust society where much of our well-being depends on the phenomena of trust and trustworthiness".* Some argue that without trust even the simplest forms of economic exchange would not work (Arrow, 1974) and that trust is a source of sustained competitive advantage (Barney & Hansen, 1995).

In the next section it will be discussed how trust, originally only applied in the context of individuals, has extended to cover whole groups including organisations.

2.2.3.1.1 Organisational trust

Some issues must be considered when applying the concept of (individual) trust in an organisational setting. As stated by Zaheer, McEvily, & Perrone (1998, p.141) *"A fundamental challenge in conceptualizing the role of trust in economic exchange is extending an inherently individual-level phenomenon to the organisational level of analysis".* In a similar context Janowicz & Noordhaven (2006) describe the issues when defining trust in an inter-organisational context. Specifically, the question of who is the

subject of inter-organisational trust needs to be addressed – is it the organisation itself or the individuals within the organisation?

Janowicz & Noorhaven (2006) initially describe four constructs when addressing this question. The first construct refers to inter-personal trust, which is when two individuals representing two different organisations trust each other (Zaheer, McEvily, & Perrone, 1998). In addition to such interpersonal trust, the authors distinguish between inter-organisational trust (trust between two organisations (J. C. Andersen & Narus, 1990), firm-level trust (trustor is individual, trustee is firm, (Noteboom, Berger, & Noordhaven, 1997) and where the trustor is an organisation and the trustee an individual (Doney & Cannon, 1997).

In the strict sense of the word 'trust', organisations cannot be the trustor because only individuals can trust (Doney & Cannon, 1997; Zaheer et al., 1998). The classification of trust into both behavioural and attitudinal trust, however, clarifies this issue (Janowicz & Noordhaven, 2006). On the one hand, attitudinal trust is based on reliance on others and thus is extendable to groups or organisations (Currall & Inkpen, 2002).On the other hand, behavioural trust refers to a partner's reliability to fulfil its obligations fairly without behaving opportunistically, which can only be attributed to individuals and not organisations (Janowicz & Noordhaven, 2006).

Taking this into consideration, it is more appropriate to divide organisational trust into interpersonal and inter-organisational trust. Zaheer, McEvily, & Perrone (1998) refer to interpersonal trust as trust between the boundary-spanning agents of two collaborating organisations. This is in contrast to inter-organisational trust which refers to the trust that individuals of an organisation place on a partner organisation as a whole.

Janowicz & Noordhaven (2006) go a step further and argue that the conceptualisation of inter-organisational trust is more meaningful when only the individual is the subject of trust. In this context the authors stress the importance of 'boundary spanners' (e.g. top managers) in comparison with non-boundary spanning staff. In order to evaluate the trust

of an organisation in another firm (the trustee) the opinions of such boundary spanners about the trustee are the most meaningful. The more the individual boundary spanners trust each other, the more the organisation trusts its partner (Janowicz & Noordhaven, 2006).

However, other studies (McEvily et al., 2006; Zaheer, McEvily, & Perrone, 1998) highlighted how powerful organisational trust can be. They emphasised that individuals can develop trust in individuals of another organisation based on the membership of these individuals in a particular organisation. That happens even though first-hand experience of that particular individual is limited or does not even exist at all.

In short, *"inter-organisational trust assumes that the trustor is always an individual, while the trustee can be either the partner organisation as a whole or its individual member" (Janowicz & Noorhaven, 2006, p. 277).*

2.2.3.1.2 Building trust

Considering the immense importance of trust from an economic point of view, it is not surprising that many scholars aim to identify enabling factors for trustworthiness. A number of factors have been proposed in this context but the three most common are ability, benevolence, and integrity (Mayer et al., 2006). Ability refers to the expertise a trustee possesses in a specific field and benevolence refers to the good intentions a trustee is believed to have beyond egocentric profit motives. Integrity refers to a set of principles a trustee is following (Mayer et al., 2006). It is argued by Mayer et al. (2006, p. 96) *"If a trustee is perceived as high on all three factors … [he/she] will be perceived as quite trustworthy*".

However, it is further argued by Mayer et al. (2006) that in order to understand the extent to which a person is willing to trust, his or her propensity to trust must also be taken into consideration. *"Propensity might be thought of as the general willingness to trust others" (Mayer et al., 2006, p. 88).* In this context Hofstede (1980) differentiates between personality types and cultural background as indicators for the propensity to trust.

A meta-analysis by Geyskens et al. (1998) in the context of trust in marketing channel relationships highlights the importance of honesty and benevolence. The authors refer to honesty (Geyskens et al., p.225) as a channel member's belief that the business partner *"is reliable, stands by its word, fulfils promised role obligations, and is sincere";* benevolence refers to *"a channel member's belief that its partner is genuinely interested in one's interest of welfare and is motivated to seek joint gains" (Geyskens et al., p.225).*

Lastly, trust is not static – it evolves over time. This means that if an individual's trust in another person leads to a positive outcome, the perception of trust will be enhanced for future interactions (Mayer et al., 2006).

2.2.3.1.3 The benefits of trust

Gargiulo & Ertug (2006) describe three main benefits of trust. Firstly, trust lowers information-processing costs because trust-based relationships are cheaper to maintain than those with a lack of trust (Dyer & Chu, 2003; Zaheer et al., 1998; Jones, 1995; Meyerson, Weick, & Kramer, 1996). However, it was found that a high level of inter-organisational trust can compensate for low interpersonal trust. This means that even if interpersonal trust is low, transaction costs do not necessarily have to be high. This finding emphasises though that interpersonal trust alone is not sufficient to reduce transaction costs. *"Interpersonal trust plays a distinct, thought subordinate, role in affecting the costs of negotiation when examined in conjunction with inter-organisational trust" (Zaheer, McEvily, & Perrone, 1998, p.156).*

The second beneficial point described by Gargiulo & Ertug (2006) is that trust increases satisfaction with the relationship because relationships are more likely to be perceived as successful when trust is established (Zaheer et al., 1998).

Lastly, trust reduces uncertainty. It was found that the higher the levels of trust, the lower the perceived probability that a loss might result from such collaboration (Noteboom et al., 1997; Zaheer et al., 1998). Mayer et al. (2006, p.99) state that a trustor compares *"the*

level of trust (with) to the level of perceived risk in a situation. If the level of trust surpasses the threshold of perceived risk, then the trustor will engage in a risk- taking relationship (RTR). If the level of perceived risk is greater than the level of trust, the trustor will not engage in the RTR."

Other benefits of trust range from improving the efficiency of market exchanges (Arrow, 1974; Smith & Ashford, 1995) to its positive impact on co-operation (Mayer et al. 2006; Ring & Van de Ven, 1992; Smith & Ashford, 1995; Gambetta, 1988). It is further argued that it reduces harmful conflicts (Meyerson et al., 1996) and enhances a firm's ability to adapt to change (Korsgaard, Schweiger, & Sapienza, 1995; McAllister, 1995).

2.2.3.1.4 The drawbacks of trust

A topic addressed less frequently in literature is the negative element of trust. However, it is argued that trust is only beneficial until a critical point; once this point is passed and trust becomes "excessive" the disadvantages outweigh the advantages (Gargiulo & Ertug, 2006). Trust is not linear. *"There may be an 'optimal' level of trust and … additional investments aimed at enhancing trust may hinder the probability that benefits will accrue to the actors involved" (Gargiulo & Ertug, 2006, p.183).*

According to Gargiulo & Ertug (2006) excessive trust can lead to 'blind faith'. As a consequence of such blind faith, the trustor reduces monitoring below a reasonable level. This lack of monitoring increases the probability of being 'betrayed' or 'let down' by the trustee.

Another negative point of excessive trust is that it turns commitment into complacency. This may impact on the ability of the trustor to evaluate the performance of a trustee. Before the trustor can react to negative development and initiate corrective measures, large losses are possible (Gargiulo & Ertug, 2006).

A last point is that excessive trust might create unnecessary obligations. Such unnecessary obligations may have only a limited impact on uncertainty reduction in comparison with the agreed obligations (Gargiulo & Ertug, 2006).

2.2.4 Summary of parent theories

Academic research in the context of RM can be broadly classified into a narrow approach and a broad approach. The narrow approach focuses on customer relationships only (e.g. Berry, 1995) whereas the broad approach considers all relationships a company has (e.g. Gronroos, 2000). Both the approaches get support and critique (e.g. Peterson, 1995).

With reference to the work of the Industrial Marketing and Purchasing Group (Hakansson & Snehota, 2000) and the resource-based view of the firm (Wernerfelt, 1984), the relationship marketing approach adopted in this research complements the broad view which defines relationship marketing as: *"[Anything which helps] to establish, maintain, and enhance relationships with customers and other partners, at a profit, so that the objectives of the parties involved are met" (Gronroos, 1990, p.138)*. In the context of such co-operations, the success factors suggested in literature to lead to successful relationships are the research problem area of this study.

From the vast amount of research papers looking at the success factors for such co-operations (e.g. Palmer, 1994, Reicheld, 1996, Rust, Zahorik, & Keiningham, 1996, Buchanan & Gillies, 1990) trust and commitment emerged as central for the success of inter-organisational relationships

However, most studies that examined inter-organisational relationships were conducted in a firm-firm context. As will be discussed in the next section, only a few studies looked at relationships between private firms and public research organisations (e.g. Dooley & Kirk, 2007, Mora-Valentin et al., 2004, Plewa et al., 2005, Plewa and Quester, 2007).

2.3 Contextual setting (research problem area)

The second part of the literature review sets the context of this research which are national innovations systems (NIS) and specifically public research organisation (PRO) – firm relationships within these systems. Such relationships are arguably crucial in NIS (Lundvall, 1992b). Specific issues and critical success factors for such co-operations are discussed in depth. Before the chapter concludes with a summary of the contextual setting, the New Zealand Innovation system is reviewed.

2.3.1 The concept of National Innovation Systems (NIS)

The concept of National Innovation Systems (NIS) first emerged during the mid-1980s in the context of debates over industrial policy in Europe (Godin, 2009). The driver behind this trend was learning that investments in knowledge (e.g. governmental-funded research, investments in the education system etc.) are crucial for economic growth and prosperity (OECD, 1997).

The NIS concept helps policy makers to initiate support measures for successful technology and information transfer among private industry, universities and government research institutes. Specifically it should help *"to measure the knowledge distribution power of a national innovation system, which is considered one determinant of growth and competitiveness" (OECD, 1997, p.11).*

The term 'National Innovation Systems' was coined during the late 1980s by Christopher Freeman (1987), in relation to his study of the Japanese innovation system. Freeman described the main elements of the Japanese innovation system as being the in-house R&D facilities of the companies and the education and training system of the country. Freeman (1987, p.1) defined an NIS as *"the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies"*.

Other definitions for the NIS are those from:

> Lundvall (1992, p.6) who defines an NIS as *"the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge … and are either located within or rooted inside the borders of a nation state"*.
>
> Nelson (1993, p.4) who speaks of an NIS as *"a set of institutions whose interactions determine the innovative performance of national firms"*.
>
> Patel & Pavitt (1994, p.10) who define it as *"the national institutions, their incentive structures and their competencies, that determine the rate and direction of technological learning (or the volume and composition of change generating activities) in a country"*.
>
> Metcalfe (1995, p.10) who provides the most detailed definition and defines it as *"the set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies and which provide the framework within which governments form and implement policies to influence the innovation process. As such it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artifacts which define new technologies"*.

As these definitions all highlight, the central feature of the NIS concept is the set of relationships across the different elements of the innovation system (OECD, 1997). These elements are primarily private firms, universities and public research institutes.

The concept of NIS first and foremost aims to understand how the elements are interlinked and how knowledge is transferred among them. Knowledge can be transferred among enterprises, universities and public research laboratories, through the diffusion of knowledge and technology to firms, and through the movement of personnel (OECD,

1997). Technically, knowledge can be transferred in the form of joint research, personnel exchange, licensing of IP etc (OECD, 1997).

The innovative performance of a country depends fundamentally on these linkages and how well they transfer knowledge and technology (Lundvall, 1992). Specifically, the flow of knowledge to the private industry is of most importance (Godin, 2009) because the ultimate goal of a country's innovative system is a commercially usable outcome. The flow of technology and information to private industry is considered key for the production of commercially usable innovations (Lundvall, 1992).

As the previous discussion underlines, the concept of NIS views successful innovation from its ability to be commercialised. This system-wide approach to the commercialisation of innovations is a direct response to the fact that innovation is becoming more knowledge-intensive than ever before and firms need knowledge from outside the company boundaries to be successful (Etzkowitz, Webster, & Healey, 1998). As highlighted by Lundvall (1992), knowledge is the most fundamental resource in the modern economy and learning is the most important process in such a system (Lundvall, 1992).

In his conceptualisation of the NIS, Lundvall (1992) makes a distinction between a narrow and a broad approach to NIS. The narrow approach focuses only on elements which are directly involved in searching and exploring innovations, whereas the broad approach includes all parts of an economy that affect learning, searching and exploring.

Even before the concept of NIS was designed and gained popularity during the late1980s, the work of the Organisation for Economic Co-operation and Development (OECD) contributed significantly to the development of a system-wide approach towards innovation (Godin, 2009). A variety of OECD publications highlighted the main sectors (government, university, industry, and non-profit) necessary for success in a country's innovation system (Godin, 2009).

The main difference between the OECD approach and the more recently developed concept of the NIS is the commercial focus of the NIS (Godin, 2009). In the NIS concept the private firm represents the core of the system and all activities should therefore be tailored to its needs and wants (Lundvall, 1992a). On the other hand the system approach developed by the OECD emphasises the importance of the government (Godin, 2009). Nonetheless, the NSI concept helped to crystalise the system approach that has existed in one way or the other for more than 30 years in many countries (Godin, 2009).

2.3.1.1 Successful NIS

In the early years of exploring the NIS concept, the Japanese approach was often the focus of attention (e.g. Freeman, 1987, Odagiri, 1993). Of interest was the speed at which Japan was able to catch up with technology-leading nations like the US or Western Europe (Freeman, 1987). It was argued that the reason for this speed lay in the unique features of the Japanese NIS.

The main success factors identified in the Japanese context were the impulses given by the Ministry of International Trade and Industry (MITI), knowledgeable companies, the high level of the education and training system, and an industrial structure that favoured long-term strategic investment over short-term monetary goals (Freeman, 1987).

However, innovation systems face different challenges depending on whether a technology gap needs to be closed versus fundamental science being needed to lead technology (Freeman, 1987). Even though Japan is now a technology leader in some industries, a review of the Japanese innovation system highlighted the general inability of the system to be at the forefront of worldwide technology (Odagiri & Goto, 1993).

Japanese innovation systems are traditionally driven by large companies and isolated in-house research projects (Motohashi, 2008). Such an NIS is only partially suited to competing in world markets which are characterised by open innovation and research collaborations (Motohashi, 2008). Under such conditions, the US innovation system with

its entrepreneurial spirit, the availability of venture capital, and close relationships between firms and universities, is better suited to develop and commercialise leading-edge technologies (Mowery, Oxley, & Silverman, 1996).

Germany is another country which has leading-edge technology and strength of continuity in its innovation system. The core of the German innovation system is its industry-oriented training and education system which was established at the end of the 19th century (Keck, 1993).

However, in recent years the focus of successful innovation systems has shifted to the fast growing economies of Taiwan and South Korea whose NIS are arguably superior in comparison with those of Western Europe or the US (Dodgson, Mathews, Kastelle, & Hu, 2006; Peters, 2006; Tu & Yang, 2008). These countries not only managed to catch up with leading technologies, but also managed to surge ahead in many ways (Peterson, 2006).

In comparison with such fast-moving and fast-growing economies as those of Taiwan and South Korea, the US and Western European innovation systems tend to be more short-term focussed (Peters, 2006). Taiwanese and South Korean companies in contrast are long-term focussed and committed to learning. The CEOs of Western companies too often see the short-term return on investment as the main driver (Peters, 2006, Mowery, 1993).

In summary the most important factors for a successful innovation system are continuity; highly competent firms which are able to source from an innovation system and commercialise new technologies; an education and training system that delivers human resources which are required by the industry; and appropriate fiscal, monetary, and trade policies (Nelson, 1993). Finally, a successful network of relationships is required which connects the whole system.

In the context of the last point the earlier-cited work on relationship marketing and networks provided helpful insights into what drives networks of relationships and what accounts for their success. The next section will continue along this path and specifically focus on the relationships between public research organisations and firms within national innovation systems.

2.3.2 Public research organisation (PRO)–firm relationships

The speed of technology change in recent years has significantly shortened the product life cycle and increased the need for new technologies (Bettis & Hitt, 1995; Ali, 1994). Many companies lack the in-house resources to respond to these new market conditions (Lambe & Spekman, 1997; Swan & Allred, 2003). One way to respond to technology change is to acquire knowledge from outside the company in the form of partnerships (Doz & Hamel, 1997; Lane & Lubatkin, 1997). Particularly when the knowledge base of an industry is complex, the focus of innovation is to be found in collaborations (Powell, Koput, & Smith-Doerr, 1996). In this context Lundvall (1998) highlights the importance of knowing the right people (know-who) with the required know-how.

Tatikonda & Stock (2003) write in this context of a technology supply chain which consists of a knowledge supplier and the knowledge recipient. One such source of knowledge for firms is public research organisations (PRO). Public research organisations are universities and publicly-funded research institutes. Such collaborations between universities and industries can have a variety of forms such as contract research, joint ventures, research consortia, and university-sponsored research parks, etc. (Dill, 1990).

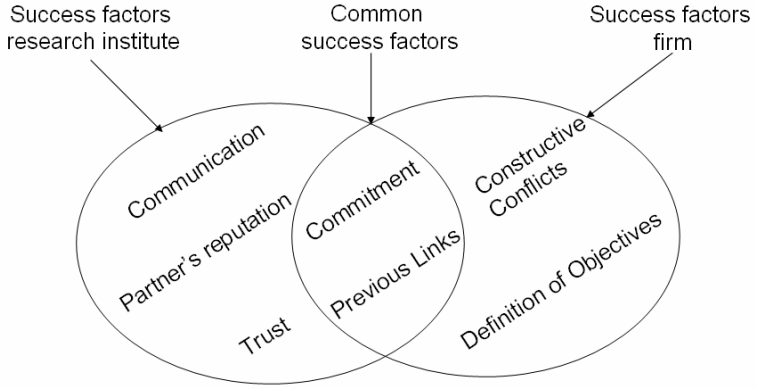
Traditionally, the emphasis of such collaborations has been on technology transfer. Innovation was seen as a linear process and followed the steps of basic research, applied research, development, design, manufacturing and distribution (Yin, 1979). However, basic research does not necessarily come before applied research anymore. It order to secure additional funding for university research, academic research is increasingly

driven by applied problems of the industrial sector in the form of research collaborations (Santoro, 2000). Such collaborations particularly apply to large companies (Cohen, Nelson, & Walsh, 2002; Fontana, Geuna, & Matt, 2006; Laursen & Salter, 2004; Mohnen & Hoareau, 2003) with intense R&D activities (Fontana et al., 2006). Companies perceive such relationships to be positive and believe in their benefits (Kleyn & Kitney, 2007).

However, such collaborations are not without challenges. Plewa et al. (2005) write of the challenges of organisational environmental differences (OED) which need to be overcome. These include, for example, the different values and norms that academia and the private sector have which are often in contrast to each other. Overcoming such OED is crucial for successful knowledge and technology transfer from academia to industry (Plewa & Quester, 2007). The measures to overcome such OED can therefore be considered as success factors.

Figure 2 below illustrates these success factors split between firms, research institutes and common research goals between the parties. As the figure highlights, only two factors (commitment and previous links) are perceived as equally important by both partners. Communication, partner's reputation and trust are perceived as important primary by the research institute, whereas constructive conflicts and definition of objectives are perceived as important primarily by the firm.

Figure 2: Example of success factors for research collaborations



Source: Developed by author drawing on Mora-Valentin et al. (2004)

In the following section the obstacles and possible solutions (success factors) for research co-operation are discussed in more detail

2.3.2.1 Specific issues in the context of POR-firm collaborations

Issues most commonly identified in the literature as causing problems for parties involved in research collaborations are in the context of different research objectives, different time orientations and reward systems, ownership of intellectual property (IP) rights, and uncertainty within the collaborating firm. These factors will be discussed in depth in the next sections.

2.3.2.1.1 Different research objectives

PRO and firms collaborate with each other, but for different reasons. Dooley & Kirk (2007) found that universities are mainly interested in additional funding, access to industry technology, gaining feedback for science output, or simply in responding to governmental pressure for such collaborations. On the other hand, the industry partners want to gain access to existing (publicly funded) knowledge and bring new technology to market faster. Other researchers found a similar pattern: that academia mainly seeks additional funding whereas industry aims for new technologies (Dill, 1990; Kleyn & Kitney, 2007; Lee, 2000). Some consider these different sets of research goals as incompatible (Santoro, 2000).

Disagreements over objectives are not unusual in relationships between partnering organisations, however, they are extreme in the context of research collaborations between firms and PROs, and specifically between firms and universities (Parvatiyar & Sheth, 2000).

Firms and universities bring with them a different set of objectives for which each of them is *"willing to commit time, energy, and intellectual resources" (Lee, 2000, p.129).* These differences can cause serious misunderstandings and be a major obstacle for any research project (Elmuti, Abebe, & Nicolosi, 2005; Kruecken, 2003; Siegel, Waldman,

Atwater, & Link, 2004; Plewa et al., 2005). In order for research collaborations to be satisfactory for both industry and university, the research objectives of both organisations need to be explicitly considered as a part of the project specification (Daniel, Hempel, & Srinivasan, 2002; Dill, 1990).

2.3.2.1.2 Different reward systems and time orientations

Based on the differences discussed above in research objectives, reward systems vary significantly between the organisations. While on the one hand, universities prize publications in academic journals, industrial partners are rewarded for the fast development of new technologies (Howells & Nedeva, 2003; Santoro & Chakrabarti, 2002).

These differences in reward systems reflect the different time orientation which underlies the actual problem. While academic research is aiming for long-term oriented objectives which consider academic rigour, the industrial partner aims for short-term goals and wants to bring new technologies speedily to market (Beise & Stahl, 1999; Gonnart, 1999; Liyanage & Mitchell, 1994; Mansfield & Lee, 1996; Meyer-Kramer & Schmoch, 1998). Harryson, Kliknaite, & Dudkowski (2008) refer to the exploration-orientation of the university versus the exploitation-orientation of industry. "*Scientific knowledge produced by companies is usually claimed to be short- and medium-term oriented, aiming at exploitation, whereas the strength of academic research is claimed to prevail in exploration, but seldom comes up with results ready for commercialisation. (Harryson, Kliknaite, & Dudkowski, 2008, p.113).*

2.3.2.1.3 Uncertainty within the collaborating firm

Uncertainty is a big issue in research collaborations. A high degree of uncertainty exists for firms who are engaged in such projects. Van't Haaf (1989) writes of 'black boxes' when referring to services which are difficult to evaluate for the customer. Such services are often performed away from the customer. Vulnerability is higher in such projects because customers have only limited knowledge with which to evaluate the service

performed. To overcome this uncertainty, trust is of fundamental importance (Plewa et al., 2005).

2.3.2.1.4 Difficulties with intellectual property (IP) right negotiations

IP rights are a common issue in research. Partners often cannot agree on how to share the IP (Graff, Heiman, & Zilberman, 2002; Rappert, Webster, & Charles, 1999; Kleyn & Kitney, 2007). *"Disagreements are common in this area; with industry claiming that IP from universities is often over-priced and ignores the risk industry is exposed to while commercialising it. Universities fear that industry may steal their discoveries and generate revenue streams that rightly belong to the university (Dooley & Kirk, 2007, p.322).*

Having reviewed the difficulties for research co-operations, the next section highlights the success factors suggested in the literature to address these issues.

2.3.2.2 Success factors for research collaborations

Philbin (2008a) introduced a concept which measures collaboration success on three levels (technology measure, project and business measure, social measure). The technology measure captures to what extent new knowledge was generated; the project and business measure captures to what extent agreed research goals or milestones were achieved; and the social measure captures to what extent social capital was established.

Philbin (2008a) covered most of the success factors discussed in the literature. The success factors to be discussed further below are trust and commitment, social bond between the boundary spanning managers, satisfaction with communication, mutual objectives and experience with research collaborations.

2.3.2.2.1 Trust and commitment

Apart from what is found in general RM literature (Morgan & Hunt, 1994), trust and commitment are observed to be of fundamental importance for research collaborations in their own rights (Plewa et al., 2005; Betts & Santoro, 2009; Philbin, 2008b).

When tacit knowledge is to be transferred, trust is particularly crucial because it reduces the high level of uncertainty which is inherent in such projects (Plewa & Quester, 2007). Trust is less important when explicit knowledge is to be transferred (Sherwood & Covin, 2008). The differences between tacit and explicit knowledge are that *"explicit knowledge is potentially codifiable in form and can, therefore, be checked for qualities like content, completeness, and clarity. Tacit knowledge, by contrast, tends to be more ambiguous in scope, embedded in practice or skill set, and difficult for the knowledge source to "surface" for conscious consideration and transference purposes" (Sherwood & Covin, 2008, p.173)*

Time is an essential contributor for trust to develop in research collaborations (Davenport, Grimes, & Davies, 1998). It is recommended to build the level of trust up slowly and start new research partnerships with smaller projects (Barnes et al., 2002). In addition it is recommended to secure continuity with key personnel who are working on the research projects (Barnes et al., 2002).

In the context of commitment it is argued that senior management commitment is crucial for the overall development of commitment in a co-operation: *"The higher the contribution of resources, the managerial support and the involvement of the rest of the staff, the higher the partner's degree of commitment" (Mora-Valentin et al., 2004, p.21).*

2.3.2.2.2 Social bond between boundary spanning managers

In order for trust to develop, the social bond between the boundary spanning managers is crucial. Boundary spanning managers have the task of linking the scientists with the firm or entrepreneur (Siegel et al., 2004). They often have positions as university technology managers (Siegel et al., 2004) and are in charge of objective setting, progress monitoring, and effective communication (Barnes et al., 2002). They are also responsible for bridging the mentioned environmental differences.

Such relationships are crucial because scientific knowledge is transferred mostly through interpersonal relations and social contacts between firms, universities and research institutes (Oliver & Liebeskind, 1998). Social contacts are important because knowledge transfer includes learning, which is a social process. Social ties need to be developed between the boundary spanners of such organisations in order to facilitate such organisational learning and knowledge transfer (Santoro & Bierly, 2006). Interpersonal relationships are of fundamental importance to enable complex learning and knowledge transfer (Brown & Duguid, 1991).

Co-operations which lack such social networks will struggle to build trust and transfer knowledge, especially when it is tacit (Kale, Singh, & Perlmutter, 2000). It is well accepted that the more tacit knowledge is, the more communication and social interaction is required to successfully transfer this kind of knowledge (Kale et al., 2000; Mowery et al., 1996). Others found that facilitators of knowledge transfer, like social connectedness, trust, technological relatedness, and technological capability are more important when tacit knowledge is transferred (Santoro & Bierly, 2006). On the other hand, the transfer of explicit knowledge is less challenging since it is written down in published papers or patents (Santoro & Bierly, 2006).

2.3.2.2.3 Satisfaction with communication

Communication is defined as *"the process of exchanging information, concepts and ideas between individuals that belong to different organisations" (Mora-Valentin et al., 2004, p.22).* One reason for the importance of communication is that personal relationships in the form of networking between scientists and practitioners are crucial (Siegel et al., 2004). Communication is necessary in order to develop and maintain social networks and promote the exchange of information and knowledge (Siegel et al., 2004). Social networks, in turn, facilitate trust, which is necessary to address the uncertainty which is arguably part of research projects (Siegel et al., 2004).

Regular communication should occur particularly between the technology experts of the organisations (Sherwood & Covin, 2008). A good relationship between the 'experts' is a major contributor to better connectedness between organisations (Cockburn & Henderson, 1998). Such connectedness is important to enable the flow of information and knowledge, as stated by Lim (2000, p.167): *"Technology experts forge 'connectedness' between the partner organisations, thus strengthening the knowledge interface and facilitating knowledge transfer"*. Although legal contracts are indeed an important part in the management of research collaborations (Kleyn & Kitney, 2007); regular communication is at least as important for such partnerships (Daniel et al., 2002).

A distinction between the requirements of more contractual arrangements in comparison with more 'social' co-operations can be drawn depending on the type of knowledge transferred. Rich communication between two organisations is more important when tacit knowledge is transferred, whereas contractual arrangements make more sense when explicit knowledge is to be transferred. As stated by Santoro & Bierly (2006, p.505): *"Tacit knowledge requires rich, sophisticated technical communication and more hands-on experience while technological overlap and external knowledge requires more theoretical competencies to be able to read academic journals, understand the implications of specific patents, etc."*

2.3.2.2.4 Mutual objectives

In order to secure collaboration success, it is important to clearly define objectives and consider the interests of both sides (Mora-Valentin, Montoro-Sanchez, & Guerras-Martin, 2004). As discussed earlier, academic scientists aim for publications and recognition within the scientific community, whereas firms aim for financial gain (Siegel et al., 2004). It can be said that in order for industry-PRO collaborations to be successful the partners need *"to possess synergistic goals and the complementary assets to facilitate achievement of these goals" (Dooley & Kirk, 2007, p.331).*

Problems can occur when academic researchers are not sensitive enough to the requirements of industrial partners or vice versa – for example, a scientist who is guiding

a project in a direction which is favourable for academically-valued outcomes (e.g. publications in journals; Barnes, Pashby, & Gibbons, 2002). On the other hand the industrial partner may press the university scientist into a tight time schedule because of his need for short-term benefits (Barnes et al., 2002). *"Effectively, therefore, success in university-industry collaborations is strongly dependent on achieving mutual benefit and not simply ensuring that the industrial partners achieve proprietary benefit, though this is equally important" (Barnes et al., 2002, p. 282).*

One might argue that the financial benefits should be enough motivation for academia to co-operate with industry, but in order for academia to be attractive to industrial partners they must maintain a good reputation and provide leading-edge research (Dooley & Kirk, 2007). A university which makes too many concessions in publications and focuses too much on commercial projects is jeopardising its future attractiveness for industry. Financial benefits cannot be the only objective for universities.

Bjerregaard (2009, p.172) reports that collaborating partners have *"to balance goals of achieving immediate, tangible R&D results and intangible outcomes pertaining to, amongst others, learning and relationship building"*. In other words, short and long-term goals should be in balance.

2.3.2.2.5 Experience with research co-operations

It is argued that previous contact between research participants has a strong impact on the success rate of such projects (Dill, 1990). In this context Sherwood & Covin (2008) highlight that partner familiarity is an important success factor for knowledge transfer between universities and firms. However, as highlighted by the authors, such experience does not necessarily have to have a positive impact on co-operations: *"just as partners can learn to trust, they can learn to distrust" (Sherwood & Covin, p.175).*

Having public research organisation (PRO) – firm relationships described in the general context of national innovation systems, the next section will go on to specifically look at PROs and firms within the New Zealand innovation system.

2.3.3 The New Zealand Innovation System

In a recent review of the New Zealand innovation system the OECD (2007) stressed that the New Zealand innovation system is insufficient to outweigh the additional challenges (small size and remoteness from big international markets) that the country faces. Even though the country does quite well, as stated by the OECD (2007, p.9): *"[the] conditions of innovation need to be excellent"* in order to overcome New Zealand's additional challenges. Table 1 summarises the major strength and opportunities of the New Zealand innovation system as stated by the OECD (2007).

Table 1: Strengths and opportunities of the New Zealand Innovation System

Strengths	Opportunities
Resourceful and entrepreneurial population	Greater exploitation of value-added innovation in the primary and associated sector
Unique physical environment for work, living, sports and tourism	Continued exploitation of the opportunities for innovation raising productivity and growth in emerging industries
Well-functioning products and labour markets	Use of New Zealand's strengths in science and technology in resource-based industries and related value-added services, e.g. application of ICT in a range of sectors
Strong presence in primary sector such as agriculture, forestry and fishing and some strength in related industries and services	Use of New Zealand's strengths in science and technology in resource-based industries and related value-added services, e.g. application of ICT in a range of sectors
A sound education system and a reasonably high level of innovation	More efficient exploitation of New Zealand's environmental advantages
Relatively strong university and public sector research institutions	Improvement of international connectivity and access to knowledge of international markets, e.g. by improved use of ICT leveraging, the New Zealand diaspora, and immigrants' knowledge of their home countries
Awareness of the importance of science and technology in meeting socio-economic goals, including ecological objectives	
Strength in agricultural biotechnology and health research	
Pockets of excellence in fast-growing industries such as software and creative industries, as well as in the underlying sciences	
An open society which engenders trust, and a frank and open policy environment	
A society that recognises cultural diversity as a source of innovation	

Source: OECD (2007, p.26)

The major strength of the New Zealand innovation system is its strong presence in the primary sector and related industries. Based on a relatively strong university and public-research science system, New Zealand has strength in agricultural biotechnology and health research. One of the main future opportunities for the country lies in a better exploitation of this knowledge.

Two of the major weaknesses of the New Zealand innovation system are its low level of business R&D spending and issues around how public-sector research is organised. The latter point is of particular concern because it may damage the long-term capabilities of New Zealand science. Table 2 summarises the main weaknesses of, and threats to, the New Zealand innovation system as stated by the OECD (2007).

Table 2: Weaknesses and threats of the New Zealand Innovation System

Weaknesses	Threats
Lagging GDP per capital and relatively low levels and growth of productivity by OECD standards	Relatively weak productivity performance holds back living standards
Small national market with a preponderance of small enterprises	Marginalisation of New Zealand as a location for internationally mobile investment and innovation
Relative isolation from world markets and the processes of globalisation	Deterioration in the long-term capabilities of public research institutions, caused partially by failure to pay professors and scientists internationally competitive salaries
Shortcomings in the physical and virtual infrastructure (broadband, energy, transport)	Accelerated outflow of highly qualified staff and entrepreneurs
Lack of investment in business R&D associated with a lack of external funding for business R&D and innovation	
Fragmented system of government support for R&D and innovation combined with a lack of coherence across the full range of innovation -related policies	
Inappropriate incentives for public sector research institutions in respect of building long-term capabilities, financing research infrastructure and transferring research results to business	
Shortcomings in the process of technology diffusion	
Barriers to growth of firms, including a preference of many entrepreneurs for “lifestyle” businesses	

Source: OECD (2007, p.26)

In addition to the OECD (2007), a variety of scholars have reviewed the national innovative system in New Zealand and emphasised different elements of it. A report by

Smale (2009) investigates the innovation performance of New Zealanders from a cultural perspective. Smale (2009) concludes that in New Zealand dimensions such as individualism, short-term orientation and the pursuit of discovery and adventure, makes 'Kiwis' better at the initiation stage than at the implementation stage. Harvey (2003) argued similarly that cultural, structural and historical issues are hampering innovation in this country. Marsh (2003) reviewed the New Zealand innovation system in the specific context of biotechnology. The author concludes that New Zealand has some islands of excellence in this context but the overall NIS performs poorly. In recent years it has often been recommended (e.g. Smith, 2006) that New Zealand copies the highly successful innovation system of Finland.

This review of the New Zealand innovation system will conclude by examining the New Zealand business sector and the Crown Research Institutes in more depth.

2.3.3.1 The New Zealand business sector

New Zealand firms are generally small and mostly focussed on domestic trade; large companies which are engaged in international trade are relatively scarce (OECD, 2007). In 2009, of the approximately 476,000 enterprises in New Zealand, 97% had fewer than 20 employees while only 0.4% had more than 100 employees (Statistics New Zealand, 2009). Most firms are involved in business within the service sector or are engaged directly with the primary goods sector (Statistics New Zealand, 2009).

Within the different innovation activities (product, process, management, and marketing) New Zealand companies are internationally competitive only in marketing innovations (Statistics New Zealand, 2009). When it comes to product and process innovations, the above-described industry structure particularly hampers innovations and New Zealand lags behind other OECD countries (Statistics New Zealand, 2010). The R&D expenditure as a percentage of the GDP is in New Zealand among the lowest in the OECD. In 2008 1.21% of GDP in New Zealand was invested in R&D, which is well below the OECD average of 2.28% (OECD, 2010a).

However, this limited investment in R&D cannot be entirely explained by the industry structure. Other reasons for such a low investment in R&D are a lack of external funding, insufficient motivation and capabilities which include limitations at the top management level (Statistics New Zealand, 2010). In addition it is often argued that New Zealand companies lack a culture in which innovative thinking is supported (e.g. Harvey, 2003).

Interestingly, the number of New Zealand firms that co-operate for innovation is relatively high in comparison with other countries. Around 30% of New Zealand industries co-operate for innovation, which is well above countries such as Ireland (25%), Canada (21%) or Germany (12.5%) (OECD, 2010b). However, more than half of these co-operations are somehow related to marketing and distribution objectives (Statistics New Zealand, 2010), which once more highlights the dilemma of New Zealand innovation which lacks R&D co-operations (Mapp, 2010). Specifically, R&D co-operations between firms and universities or CRIs are limited (Statistics New Zealand, 2010).

2.3.3.2 The Crown Research Institutes (CRIs)

As the largest providers of science research in New Zealand, the Crown Research Institutes are important elements of the New Zealand innovation system. Alongside the universities, these research institutes are responsible for the scientific infrastructure in this country. The eight CRIs together employ 4,400 people and in 2008/2009 accumulated revenue of $675 million; a quarter of New Zealand's total research expenditure (MoRST, 2010). Around 39% of this research is in the areas of agriculture, forestry and fishing (OECD, 2007). A summary of the eight CRIs and their missions is provided in Table 3.

A well-known problem experienced by many CRIs is an inability to build effective commercial relationships with private firms and other research organisations (MoRST, 2010). The New Zealand business community finds it difficult to work with CRIs and tends to question the ability of CRI staff to work efficiently with the private sector

(OECD, 2007). These difficulties are explained by a lack of market orientation on the part of the CRIs and an accompanying lack of awareness of the aims of their research (OECD, 2007).

Table 3: The Crown Research Institutes

CRI	Mission
AgResearch Ltd.	Supports the sustainability and profitability of New Zealand pastoral sectors. It undertakes biotechnology R&D
HortResearch*	Undertakes fruit science research using New Zealand's resources and production systems to produce innovative fruit and food products
Crop & Food Research*	Focuses on sustainable land and water use, high-performance plants, food, high-value marine products, biomaterials and biomolecules
Industrial Research Ltd. (IRL)	Undertakes R&D for industry. It creates value by commercialising technologies by working with key business partners to take innovations to the market
Scion	Develops sustainable biomaterials. It develops new biomaterials from renewable plant resources and undertakes R&D for the forestry sector through Ensis, a joint venture between Scion and Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO)
Institute of Geological and Nuclear Science Ltd. (GNS)	Undertakes research on Earth systems and isotope science research, energy and mineral resources, and on geological hazards and risk, and includes a centre for isotope and non-invasive scanning technologies
Landcare Research	Specialises in sustainable management of land resources optimising primary production, enhancing biodiversity and conserving and restoring New Zealand's natural assets.
National Institute of Water & Atmospheric Research Ltd. (NIWA)	Research includes marine, freshwater and atmospheric science; sustainable management and development of natural resources and ensuring optimal value is obtained from marine species.
Institute for Environmental Science & Research (ESR)	Provides specialist science solutions relating to public health, environmental health and forensic science.

* HortResearch and Crop & Food merged in 2008 to Plant & Food OECD (2007, p.26)

Even in sectors where New Zealand science is considered leading-edge, the limited number of co-operations between the CRIs and the other elements of New Zealand's NIS is hampering commercial success. Marsh (2003) highlights this problem in the context of biotechnology. Although New Zealand has some pockets of excellence within this sector, the overall innovation system performs poorly because of the general lack of connectedness (Marsh, 2003). The partial isolation of the New Zealand private sector

from the science sector is a major issue since the private sector should be the core of every NIS (Lundvall, 1992; OECD, 1997).

The New Zealand Government is well aware of the weak link between the private sector and the science system and aims to address it (Mapp, 2010). A recent report (MoRST, 2010) about improving value for New Zealand through the investment in CRIs has recommended measures to the Government which should encourage long-term partnerships among CRIs and New Zealand firms. The Government has now taken the first steps to implement these measures in the near future (Mapp, 2010).

2.3.4 Summary of contextual setting (research problem area)

The concept of NIS highlights the importance of knowledge distribution within an innovation system by means of inter-organisational relationships (OECD, 1997). At the core of every innovation system should be the private firm, which needs to be well connected to its environment (OECD, 1997). One such linkage which received reasonable attention in the literature is that between firms and public research organisations. Organisational environmental differences (OED) add complexity to such co-operation which goes beyond the issues with which firm-firm relationships have to deal (Plewa, 2005).

To overcome these OEDs it is argued that trust and commitment (Plewa et al., 2005; Betts & Santoro, 2009; Philbin, 2008b), social bonds between the boundary spanning managers (Santoro & Bierly, 2006; Brown & Duguid, 1991), satisfactory communication (Cockburn & Hendersen 1998; Lim, 2000; Sherwood & Covin, 2008), mutual objectives (Barnes et al., 2002, Dooley & Kirk, 2007, Harryson, Kliknaite, & Dudkowski, 2008) and experience with such relationships (e.g. Bjerregaard, 2009; Mora-Valentin et al., 2004; Sherwood & Covin, 2008) are crucial.

The New Zealand innovation system traditionally suffers from a weak link between public research organisations and private firms (OECD, 2007). This might be explained

on the one hand by the small size of the New Zealand business sector and the fact that small firms spend less money in R&D (OECD, 2007). On the other hand, the New Zealand Crown Research Institutes are often criticised for not being sufficiently market-focussed (OECD, 2007).

However, as will be discussed next, no research exists which specifically looks at the relationships between firms and research institutes in New Zealand. Furthermore, related research which looks at co-operations between firms and universities often lacks depth by not looking at research co-operation in its totality.

2.4 Research problem, justification of research, and contribution

The research problem addressed in this study is:

> *What are the critical success factors for research co-operations between firms and CRIs in New Zealand?*

As observed at the beginning of this chapter, RM is an *"old new field"* of marketing (Berry, 1995) which needs further conceptual development (Brodie, Coviello et al., 2003). In the context of the conceptual development of RM, Plewa, Quester et al. (2005) criticise the undue concentration of RM on relationships between private organisations. As was highlighted by several authors, a company can have relationships with a variety of other organisations which do not necessarily have to be private firms (Webster, 1992; Morgan and Hunt, 1994; Gronroos, 2000).

Plewa, Quester et al. (2005) addressed the issue by proposing a conceptual model which describes the success factors in relationships between organisations with fundamentally different organisational environments (OED). This concept was later empirically tested by the same lead author (Plewa and Quester, 2007), and similar concepts were tested by others (e.g. Daniel, Hempel et al., 2002; Mora-Valentin, Montoro-Sanchez et al., 2004; Santoro and Bierly, 2006).

However, a limitation of these studies is that empirical data in the context of research co-operations were mostly limited to a university-firm context and/or were in an American or European context which is typically large-scale. Only a limited number of studies looked at co-operations between firms and research institutes (e.g. Mora-Valentin, et al., 2004). To the knowledge of the author, no empirical data about research co-operations exists from a New Zealand point of view.

A second limitation is that the majority of empirical papers base their conclusions on single data sources where typically a single decision maker is interviewed or surveyed. Conclusions are not made in the overall context of co-operations, but are rather based on the experiences and opinions of isolated individuals.

This study contributes to the development of RM approaches by providing empirical data from research institute-firm co-operations in New Zealand. Methodological limitations are addressed by utilising a case study methodology with the unit of analysis being the research co-operation rather than single individuals. Specifically, a theoretical model derived from the above-reviewed literature is qualitatively tested, using a case study research approach. The next section describes the theoretical model with its associated propositions.

2.5 Conceptual framework and propositions

The conceptual framework and its propositions draw heavily from sections 2.2.3 and 2.3.2 which discuss success factors for co-operations in general, and specifically relevant challenges and success factors for research co-operations.

As summarised in Table 4, areas proposed as being obstacles for the success of research co-operations are perceived differences in the context of research objectives (P1), time orientations (P2), reward systems (P3), ownership of IP rights (P4), and a certain degree of uncertainty on the side of industrial partners (P5).

Table 4: Proposed issues for research co-operations (P1-P5)

Factors which have negative impact on research co-operations	Reference
P1: Different research objectives	Dill (1990), Kleyn & Kitney (2007), Lee (2000)
P2: Different time orientations	Beise & Stahl (1999), Gonnart (1999), Liyanage & Mitchell (1994), Mansfield & Lee (1996), Meyer-Kramer & Schmoch (1998)
P3: Different reward systems	Howells & Nedeva (2003), Santoro & Chakrabarti (2002)
P4: Intellectual Property	Graff, Heiman, & Zilberman, 2002; Kleyn & Kitney, 2007; Rappert, Webster, & Charles, 1999
P5: Uncertainty at firm	Van't Haaf (1989), Plewa, Quester et al. (2005)

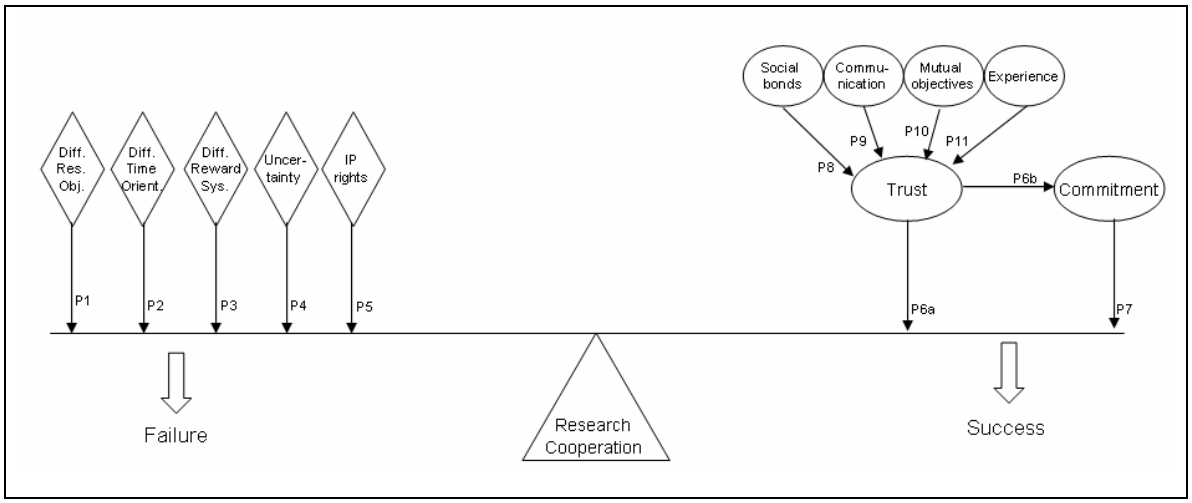
In order to overcome these obstacles and secure a successful outcome from such projects involved managers and researchers will seek to secure commitment and trust. Trust has a direct positive impact on the success of a co-operation (P6a) and an indirect one by improving the level of commitment (P6b, P7). The development of trust in turn is dependent on the bond between boundary spanning managers (P8), satisfaction with communication (P9), mutual objectives (P10) and experience (P11). Table 5 summarises the proposed success factors for research co-operations alongside the academic references.

Table 5: Proposed success factors for research co-operation (P6a – P11)

Factors which have a positive impact on the perceived success of research co-operations	Reference
P6a: Trust	Barnes, Pashby, & Gibbons (2002), Betts & Santoro (2009), Mora-Valentin, et al. (2004), Philbin (2008), Plewa et al. (2005), Betts & Santoro (2009), Mora-Valentin et al. (2004), Plewa, Quester et al. (2005)
P7: Commitment	Barnes, Pashby, & Gibbons (2002), Mora- Valentin, et al. (2004)
Factors which have a positive impact on the development of commitment	
P6b: Trust	Betts & Santoro (2009), Mora-Valentin et al., (2004), Philbin (2008), Plewa, Quester et al. (2005), Morgan & Hunt (1994)
Factors which have a positive impact on the development of trust	
P8: Social bond between boundary spanning managers	Brown & Duguid (1991), Santoro & Bierly (2006)
P9: Effective communication	Cockburn & Henderson (1998), Lim (2000), Sherwood & Covin (2008), Siegel et al. (2004)
P10: Mutual objectives	Barnes et al. (2002), Dooley & Kirk (2007), Harryson, Kliknaite, & Dudkowski (2008), Howells & Nedeva (2003), Mora-Valentin et al. (2004), Santoro & Chakrabarti (2002)
P11 : Experience	Bjerregaard (2009), Mora-Valentin et al. (2004)

Figure 3 illustrates the above discussed failure and success factors. Propositions 1-5 refer to the extraordinary challenges research collaborations are facing which are increasing the likelihood that such co-operations will fail (the scale tips to the left). Propositions 6a-11 reflect measures to address these challenges, and increase the success chances of such co-operations (the scale tips to the right). The more the success factors (P6a-P11) are established in a research co-operation, the higher is the likelihood that the negative elements (P1-P5) are outweighed, and that the co-operation is a success.

Figure 3: Conceptual model of this thesis



The overall structure of this model is based on a conclusion by Barnes, Pashby, and Gibbons who argue *"that the success of a collaborative project is governed by a complex interaction of factors, and the cumulative result of negative and positive impacts from those factors" (2002, p. 274).* What accounts for the success or failure of a co-operation depends on individual circumstances and does not necessarily always generate success if managed well, nor always cause failure if mis-managed (Barnes, et al., 2002). However, as further argued by Barnes, et al., (2002) where particular factors were found to have had a positive or negative impact on several projects, such factors should be given particular emphasis for best practice.

Following the above argumentation, the factors which are most commonly suggested in the literature as having a positive or negative impact on research co-operations were included in the model. Trust and commitment being universal success factors beyond the

specific context of research co-operations are the central elements of this model. The scale considers the individual circumstances of research co-operations as mentioned by Barnes, et al. (2002), the sum of the proposed success factors are likely to cause success, but single elements might be missing in successful co-operation or might be found in less successful co-operation.

2.6 Chapter conclusion

This chapter has discussed the literature underpinning this study. The parent theories and literature relating to the specific research problem of this study were reviewed and analysed. Further, the research problem was outlined and the contribution of this study described. At the end of the chapter a conceptual model with 12 propositions was introduced.

Chapter 3 describes the methodology utilised for this study to address the research problem as outlined in this chapter.

3 Methodology

3.1 Introduction

Chapter 2 reviewed the literature underpinning this study and discussed limitations in current relationship marketing theory. A conceptual model was presented which is to be tested in this study. Specifically, this study intends to address some of the current limitations in the literature by contributing empirical data in a New Zealand context. In addition, a case study methodology is utilised, which should enable deeper insights.

This chapter begins by justifying the use of a case study methodology for this research. It goes on to describe the need for prior theory and describes the criteria for the case selection. Next the process of data collection is described in depth, followed by information about data analysis and measures taken to ensure validity and reliability of findings. At the end of the chapter ethical considerations are outlined.

3.2 Justification for the use of a case study research methodology

As stated by Yin (2009, p.18) case study research copes with *"technically distinctive situations in which there will be more variables of interest than data points, and as one result relies on multiple sources of evidence, with data needing to converge in a triangulation fashion, and as another result benefits from the prior development of theoretical propositions to guide data collection and analysis"*.

These multiple data points (Yin, 2009) are in our context informants in firms and research organisations. Existing studies often collect data from single data sources like interviews or surveys, which limits the depth of information gained. In order to obtain a deeper understanding into the phenomena (research co-operations) it is necessary to get physically and psychologically closer to the phenomena (Perry, 1998). This was achieved in this study by means of a case study methodology.

To achieve such a physical and psychological closeness, direct observation and interviewing are recommended by Yin (2009) as the method for case study research. As will be discussed later, these two methods were utilised for data collection in this thesis.

Specifically, the study applies a case study methodology to test theory. Although case studies have been primarily used as an exploratory research tool, they are also suitable for theory testing (Johnston, Leach et al., 1999). Although a quantitative research approach might normally seem to be more suitable to test theory, the new context of this research (research co-operations in New Zealand) required a flexibility in the data collection process which could not be achieved with a quantitative research approach. In addition, as noted above, this study aimed to achieve richer and more insightful findings.

3.3 The need for prior theory

To test theory with a case study, a systematic research approach is required (Johnston, Leach, & Liu, 1999). A theoretical background needs to be developed on which a systematic research design can be built (Johnston, Leach et al., 1999). At the end of such a systematic research, analytical generalisation can be claimed.

Analytical generalisation requires the comparison of a previously developed concept with the results of a case study (Yin, 2009). If one or more case studies support the same theory, replication can be claimed (Yin, 2009) and the proposed construct stands on stronger empirical grounding (Eisenhardt, 1989).

Prior theory is also important for the development of propositions which help to guide the data collection in the right direction (Yin, 2009). It is recommended to develop an initial framework and set of constructs for case study research; otherwise, it is easy to become overwhelmed by the data (Eisenhardt, 1989). Such a theoretical framework, with the purpose to guide the study in the right direction, was proposed in Chapter 2. This study aimed at analytical generalisation of existing relationship marketing concepts to support the development of relationship marketing theory.

3.4 Case selection

Case selection for a case study research depends on the objectives of the research (Yin, 2009). These can be the replication of previous studies, the extension of theories, or to contrast polar types (Yin, 2009). Eisenhardt (1998, p. 537) states that *"Random selection [of cases] is neither necessary, nor preferable"*.

In this study the polar situations of successful and unsuccessful research co-operations between CRIs and firms were explored. In such a context it is important to carefully choose each case "*so that it either (a) predicts similar results (a literal replication) or (b) predicts contrasting results for anticipatable reasons (a theoretical replication)" (Yin, 2009).*

For the specific setting of this research an equal number of successful and unsuccessful research co-operations were included. Such extreme and polar situations make the phenomenon under investigation *"transparently observable" (Yin, 2009).* Yin (2009) suggests carefully selecting four to six cases (which represent this contrasting result) to enable theoretical replication.

The cases for this study were selected in close consultation with one of the account managers of a Crown Research Institute (CRI/A). This account manager has more than 30 years' experience in building and maintaining relationships between CRIs and New Zealand industry. Yin (2009) refers to such individuals as 'informants' and considers them as crucial for a successful case study because they provide invaluable *"insights … and also can initiate access to corroboratory or contrary sources of evidence"* (Yin, 2009, p.43).

Regular meetings were held with the account manager and a variety of research projects were discussed. The projects considered most suitable for this research were chosen. Screening criteria were: qualification for one of the extremes (clear failure or success of the co-operation), and the availability of key personnel for interviewing.

3.5 Data collection

In this section the different components of the data collection process are described. This includes the interviewer, the pilot study and its purpose, the main study and how data was analysed.

3.5.1 The interviewer

All the interviews were conducted by the primary researcher of this study. The interviewer was on several occasions employed at the CRI involved in this study, including the last four months of the research. The interviewer knew all individuals at the CRI prior to the research. However, no prior contact existed with any of the interviewees within the private firms.

3.5.2 The pilot study

Prior to the actual data collection, a pilot study was conducted which helped to consider and identify New Zealand-specific issues in the final questionnaire which were not evident from the literature. As stated by Yin (2009, p.33), *"The pilot case … is assisting … to develop relevant lines of questions – possibly even providing some conceptual clarification for the research design as well"*.

However, as the study proceeded, confidentiality issues reduced the initial number of cases available for study to three. As adjustments to the interview questionnaire were only marginal, it was decided to include the pilot study in the main analysis to secure the desired number of four cases (two successful and two less successful).

3.5.3 The main study

Data collection for the main study was by means of in-depth interviews. Apart from the formal interviews, a number of informal discussions were held with employees of the

CRI. Other information sources used to build up the case were newspaper articles, company website homepages, and other documentation which was freely available.

For the formal interviews, the interviewees were initially contacted by the informant and if they agreed to participate in the research their contact details were passed to the primary researcher. The focussed interviews (Yin, 2009) lasted between 1-2½ hours and took place at a place and time convenient for the interviewees. This location was, for all interviews, the workplace of the interviewees, who were spread throughout New Zealand. The interviewees held different positions, including science leaders, account managers and general managers.

The interviews were open-ended and generally conversational in nature. The case study protocol, and specifically the interview guide, ensured that the interview remained focussed around the main research themes and propositions. In total, two different interview guides were used, depending upon whether the interviewees were from the CRI or from the private firm (refer to Appendix A for these interview guides).

Table 6: Overview of cases

Data Source	Case A	Case B	Case C	Case D
Formal Interview 1	Senior Manager Firm/A	Senior Manager Firm/B	Senior Manager Firm/C	Senior Manager Firm/D
Formal Interview 2	Senior Manager A CRI/A	Senior Manager B CRI/A	Senior Manager B CRI/A	Senior Manager C CRI/A
Formal Interview 3	Senior Manager B CRI/A			Senior Manager B CRI/A
Other	Informal discussions and secondary documentation	Informal discussions and secondary documentation	Informal discussions and secondary documentation	Informal discussions and secondary documentation
Co-operation type	Technology transfers and contract services	Research partnership	Commercialisation partnership	Technology transfers and contract services
	Perceived as successful	Perceived as successful	Perceived as less successful	Perceived as less successful

Table 6 gives an overview of the cases, including data sources, the types of co-operations and whether the co-operations were perceived as successful or less successful (refer to Appendix B for a one-page description of each of the four cases). Pseudonyms for

individuals, the CRI and the firms are used throughout this thesis to maintain confidentiality. The employees of the CRI who were interviewed for this study are referred to as employees of CRI/A; the employees of the firms participating in this research are referred to as employees of Firm/A, Firm/B and so on.

3.6 Data analysis

The formal interviews were voice-recorded, transcribed and analysed using data reduction and data display techniques suggested by Miles & Huberman (1994). In the first part of the process, the data was screened and analysed alongside the stated research propositions and compiled into a case study database.

Case study databases (Yin, 2009) were prepared for all four cases. As stated by Yin (2009, p.12), *"every case study project should strive to develop a formal, presentable database, so that in principle, other investigators can review the evidence directly"*. The case study database further included some secondary data and notes about the informal conversations.

In a second step, data was analysed beyond the stated propositions. Interview transcripts were read and re-read and subsequently the data was organised and reduced (Miles & Huberman, 1994). This was done by writing summaries, coding, teasing out themes, and making clusters. In the final step, coded main themes were displayed in a matrix. The matrix enabled contrast and comparison of main themes across the four cases.

3.7 Reliability and validity in data analysis

Reliability and validity are among the major criticisms of qualitative research (Eisenhardt, 1989). As will be described next, several steps as suggested in the literature were utilised in this research to ensure validity and reliability of findings.

3.7.1 Validity

Validity *"testifies to how well the results obtained from the use of the measure fit the theories around which the test was designed" (Cavana, Delahaye, & Sekaran, 2001), p.454).*

To secure correct measurement of the proposed concept, multiple sources of evidence were used and the key informant reviewed a draft of the case study report and provided further feedback. These two measures were proposed by Yin (2009) in order to avoid possible misunderstandings. In addition, confirmation of the results by key informants increases the degree of validity (Hirschman, 1986).

Multiple sources of evidence were secured by building the cases on a variety of opinions (from formal interviews with two or three informants per case, plus additional informal conversations). These multiple views of the cases increased the likelihood that a 'true' picture of the phenomena was captured rather than just reflecting the subjective opinion of single individuals. Neuman (2000, p.124) refers to this as the *"triangulation of measures"* which means that more than just one measure is taken of the same phenomena.

In addition to the above, prior theory was considered during the process of research design, which further fosters validity of findings (Healy, 2000).

3.7.2 Reliability

Reliability refers to *"the internal consistency and stability over time of the measuring instrument" (Cavana et al., 2001, p. 461).* To secure reliability of findings, a case study protocol and case study database was prepared for each of the four cases. Based on the literature review and pilot study, a detailed interview guide was used in order to interview all the participants in a similar manner. These interview guides are provided in Appendix A for future reference.

Furthermore, the relatively detailed case descriptions in Appendix B should provide as much background information as possible to understand the context of the research.

3.8 Ethical considerations

Ethical issues need to be considered to avoid unfavourable consequences for the research and the research participants (Patton, 2002). This study used in-depth interview techniques in a highly sensitive field. In particular, the interviewees and firms of the less successful research co-operations needed to be protected against any negative consequences resulting from their participation.

To achieve this protection, ethical guidelines from Victoria University of Wellington (VUW, 2007) were followed, and approval from the Human Research Ethics Committee of Victoria University of Wellington was obtained (refer to Appendix C for a copy of the HREC application for this study)

In accordance with the HREC guidelines, the following steps were taken to inform the interviewees of their rights and protect them from unfavourable consequences.

- All participants were sent a participant information sheet a few days before the interviews outlining their rights (refer to Appendix D for a copy).

- On the day of the interview the rights and obligations as outlined in the participant information sheet were verbally explained to the interviewee, giving them the opportunity to raise questions.

- All participants signed a consent form (refer to Appendix E for a copy) on the day of the interview, confirming understanding of their rights and obligations in this research participation.

- The study was confidential. Neither the individuals nor their firms are identified or recognisable in the written analysis.

3.9 Chapter conclusion

This chapter has justified the use of a case study methodology in the specific context of research co-operations in New Zealand. It further outlines the specific methods used for case selection and data collection, and explains the measures taken to ensure validity and reliability of findings. The final part of the chapter outlines the steps taken to protect the research participants from any negative consequences of participation.

4 Findings & Discussion

4.1 Introduction

In Chapter 3 the methodology utilised in this study to address the research problem identified in Chapter 2 was described. Specifically, a conceptual model with 12 propositions was introduced, which has been tested by means of a case study methodology in a New Zealand context. This chapter presents the findings of this study and discusses them.

The chapter begins by assessing the perceived success or failure of each of the four cases in this study and continues with an analysis of the proposed challenges for research co-operations. Next is the in-depth analysis of trust and commitment and further the proposed moderating variables of trust are evaluated. A conclusion sums up the discussion and findings chapter.

4.2 Perception of success or failure in the four cases

Before propositions P1-P11 are examined, the perceived success or failure of the co-operations is described and assessed. Extreme and polar cases (successful versus unsuccessful co-operations) were required to make the phenomena under investigation (critical success factors for research co-operations) 'transparently observable' (Yin, 2009).

As Table 7 highlights, four such 'extreme' cases were included in the investigation. Two of the four co-operations were perceived as successful (Cases I & II) and two as less successful (Cases III & IV). Mutual agreement existed across both parties as to whether a co-operation was a success or not. Perceived success was always linked to the commercial outcome of the projects. These two polar groups are compared and contrasted next in order to evaluate propositions P1-P11.

Table 7: Citations about perceived success of the research co-operations

	Case I	Case II	Case III	Case IV
CRI/A	"Yes it's been reasonably successful … We've been working together for 20 years and we delivered a number of opportunities to them" (Senior Manager CRI/A)	"Yes [it is successful] but it's still in progress. We've got a stage where we found about … 15 products that look like they have a future in the market place" (Senior Manager B CRI/A)	"No-one has any great expectations for this to be an entirely successful relationship" (Senior Manager B CRI/A)	"We want it to be more successful and so does Firm/D and there are frustrations on both sides" (Senior Manager C CRI/A)
Firm	"We did well in the early stages … that has created the strategic opportunities for us which we have taken up … and we want to grow that" (Senior Manager Firm/A	"I think the fact that we've got those 15 ingredients … is something special" (Senior Manager Firm/B)	"I think the pace [of the project] has slowed down and there are some issues now about timetables which … caused some tensions in the relationship" (Senior Manager Firm/C)	"We are less comfortable … with the way our commercial interactions with CRI/A are going" (Senior Manager Firm/D
Perception of co-operation	Successful	Successful	Less successful	Less successful

4.3 Evaluation of the challenges for research co-operations (P1-P5)

The proposed challenges for research co-operations, as introduced in Chapter 2, were that both partners perceived different research objectives (P1), different time orientations (P2), and different reward systems (P3) as a problem. In addition, a certain degree of uncertainty within the collaborating firm (P4) and conflict in the negotiation of IP ownership (P5) can be an encumbrance to such co-operations.

These proposed challenges are to a large extent derived from research examining the co-operation between universities and firms, and hence may not be entirely transferable to research co-operations between firms and research institutes. CRIs are government-owned and operated and are charged with helping New Zealand industry grow by providing them with new technologies, or helping them to develop new technologies (OECD, 2007). As highlighted by one senior manager: *"Our success is that industry*

invests [in our technology] … that would be the ultimate goal, did you actually get someone to invest money in your technology?" (Senior Manager A CRI/A).

Despite the reward systems for CRI/A appearing to be beneficial for external co-operations, the objectives of CRI/A were perceived by all of the commercial partners, in one way or another, as conflicting with their own objectives. As Table 8 highlights, the specific reasons for this varied across the cases; from disagreements about whether CRI/A should compete internationally with New Zealand firms (Case I), publications in scientific journal vs. secrecy (Case II), speed to market of new technology (Case III), and conflicting co-operations with third parties (Case IV).

Table 8: Citations of conflicting objectives by commercial partners

	Case I	Case II	Case III	Case IV
Quote	"But what we don't want is that CRI/A is competing with us in the marketplace …If we were in competition then how do you resolve the fact that their role is to help New Zealand industry grow and yet they are hindering that grow by competing with us, that doesn't make any sense" (Senior Manager Firm/A)	"Yeah there is always the dilemma about whether you publish something and then it becomes part of public knowledge, or whether to control it by other means, by not having the public knowledge out there" (Senior Manager Firm/B)	"CRI/A probably wishes to retain a research and development role in the project rather than a long term commercial future for the project … the difficulty is that … CRI/A has some short term objectives" (Senior Manager Firm/C)	"We are also aware that CRI/A commercially has undertaken some relationships with other organisations that could well undermine [our] rights in the property that Firm/D felt it was collaborating with CRI/A to obtain" (Senior Manager Firm/D)
Conflicting objectives	Competition	Publication versus secrecy	Speed to market	Co-operations with third parties (IP issues)

This is consistent with findings in a university-firm context which highlight that research co-operations can suffer if the partners have different research objectives (Dill, 1990; Kleyn & Kitney, 2007; Lee, 2000). The underlying reason for these conflicting objectives is that CRI/A typically seeks industrial partners in order to access additional funding for existing research projects, or to commercialise existing IP. The industrial partner, on the other hand, looks for custom-designed new technologies from CRI/A which will ideally provide them with a competitive edge in their international markets. As highlighted by

one senior manager of CRI/A, this is not always possible: *"I perfectly understand from their point of view that they want to have a monopoly position and grow their business … that's a perfectly understandable business role but that does conflict with what we were tasked to do by the Foundation who are ultimately paying us the money for [that programme]" (Senior Manager C CRI/A).*

These findings highlight the dilemma of the CRIs, who need to provide the New Zealand industry sector with new technologies but at the same time be able to build up new expertise and be financially sound. One senior manager referred in this context to mixed messages the CRIs received from the Government, which puts tensions into the arrangement: *"There are some real conflicts within the CRI structure … the CRIs are taxpayer entities, there to support New Zealand industry, but for a number of years you have often found a sort of market model applied in an area which is not necessarily appropriate" (Senior Manager Firm/A).* All this leads to a relatively high degree of uncertainty among the commercial partners. A moderate to high degree of uncertainty exists if the co-operation is intended to lead towards a commercial success (see Table 9).

Table 9: Citations of uncertainty among the industrial partners

	Case I	Case II	Case III	Case IV
	"They have got to be fair to industries, so one CRI shouldn't come along and say we are going to do all this work for free" (Senior Manager Firm/A)	"The things that were really important were confidentiality and the output, who owns the IP?" (Senior Manager Firm/B)	"[There is uncertainty because] CRI/A's objectives may change and I have no control … our objectives now will not change to the end of the project but the problem is if the partner's objective changes then the whole project objectives can change" (Senior Manager Firm/C)	"We are concerned today, as of now, about the status of the commercial relationship that we have with them and I would say that some of the concerns that we have do represent a risk" (Senior Manager Firm/D)
Major concern	Competing with CRI/A	Confidentiality	Delays in commercialisation	Value for money (new IP)

As the above discussion highlights, the conflicting objectives within the CRI system (assist industry vs. making money) are causing issues which are similar to the one caused by conflicting reward systems found in university-firm co-operations (P3). Across all the cases, the research objectives of CRI/A were perceived by the firms as conflicting with

their own objectives (P1) which caused a degree of uncertainty (P4). Different time orientations (Case III, P2) or issues in the context of IP rights (Cases II & IV, P5) were also perceived as a problem.

Having the perception of challenges for research cooperations assessed, next the proposed critical success factors are discussed. The proposed critical success factors for research co-operations as introduced in Chapter 2 were that trust has positive impact, which is both direct (P6a) and indirect (P6b/via commitment P7) on the perceived success of a co-operation. In addition, it was proposed that such trust is influenced by the quality of the social bond between the boundary spanning managers (P8), satisfaction with communication (P9), the existence of mutual objectives (P10), and experience with research co-operations (P11).

However, as the analysis proceeded it became evident that the proposed success factors needed to be considered in the light of additional theory which was not formally incorporated into the initial conceptual model. These additional themes are discussed in separate sections alongside the propositions to which they relate. Specifically, these additional themes are the multidimensionality of trust, group diversity, team tenure, and type of experience. The 12 propositions, plus these additional themes which emerged during the data collection phase, are discussed in turn below.

4.4 The impact of trust (P6a, 6b) and commitment (P7) on success

The propositions P6a, P6b, and P7 are only partially supported by this study. As Table 10 highlights, the industrial partners exhibited, regardless of the perceived success or failure of the co-operation, a moderate to high degree of implicit trust in CRI/A. Specifically, the technical capabilities of CRI/A (organisational trust) were universally respected by the firms which led to a high degree of commitment towards the co-operation across all the cases.

Table 10: Citations of trust in expertise of CRI/A and commitment of firms

	Case I	Case II	Case III	Case IV
Organisational trust (technical level)	"The only reason that we've got there is because of the expertise and resources … they've got a world reputation" (Senior Manager Firm/A)	"I think they've always had a really good [science] team that was lead by Peter (Senior Manager Firm/B)	"I think their technical expertise is very good … there is a good institutional knowledge" (Senior Manager Firm/C)	"We hold CRI/A's technical capabilities in quite high regard" (Senior Manager Firm/D)
Commitment towards relationship with CRI/A	"The collaboration is very important [to us] and we want to strengthen that collaboration" (Senior Manager Firm/A)	"The party that we've most opened up and utilised has been CRI/A in the past … and we don't see them as competitors because they are not in the commercial space if you like" (Senior Manager Firm/B)	"Well [in the long term] I'd like to be invested … in a commercial project, commercial return from this [technology]" (Senior Manager Firm/C)	"[Despite some issues] we still want to have this relationship … we are interested to hear about how thing might be done differently [in future]" (Senior Manager Firm/D)

Considering the high level of uncertainty firms have in the context of such co-operations, it makes sense that New Zealand firms would not engage in research co-operations if no trust towards CRI/A existed at the outset. Similarly, Mayer et al. (2006) argue that a trustor compares the level of trust with the perceived risk of a situation and only if the level of trust outweighs the perceived risk will the trustor engage in the risky activity.

However, trust and commitment on the part of CRI/A towards the relationship correlated highly with perceived success or failure. The cases which were perceived as less successful (Cases III & IV) were characterised by lower degrees of trust and commitment on the part of CRI/A than was found in the successful cases (Cases I & II). As Table 11 highlights, the main motivation to continue the relationships in Cases III & IV were the high relationship termination costs (government funding is at stake), whereas in Cases I & II a 'true commitment' towards the relationships existed.

Table 11: Citations of trust in firms and commitment of CRI/A

	Case I	Case II	Case III	Case IV
Organisational trust (technical level)	"Firm/A is one that gets it and gets it correctly and in big time and is prepared to invest in that sort of strategy … they are a very good partners to work with because they understand what innovation is" (Senior Manager A CRI/A)	"They have a very good philosophy, a very good cultural fit" (Senior Manager B CRI/A)	"I think what has been shown up is that they actually don't … have that technical expertise" (Senior Manager C CRI/A)	"I believe it is a little bit of a weakness in their business that they don't have someone who is a specialist [in that field]… that makes them very reliant" (Senior Manager C CRI/A
Commitment	"I mean at the senior level … there is a little bit of tension … but underlying that there is a fundamental belief that [we] … have to collaborate strongly on this" Senior Manager A CRI/A)	"Well at the moment CRI/A is looking to invest in Firm/B and thats just the ultimate measure of commitment" Senior Manager B CRI/A)	"I haven't approached … [terminating the co-operation]. I think the risk is if you did that you could lose your funding and yeah, that's a real risk" (Senior Manager B CRI/A)	"Firm/D is one of the partners and … I don't want to find out to be honest [what happens if Firm/D withdraws from the project]" (Senior Manager C CRI/A)
Type of relationship	Technology transfer, co-funding of research	"True" research co-operation	Joint commercialisation of new technology (joint venture)	Technology transfer, co-funding of research

However, the level of commitment CRI/A devotes to the co-operations can not entirely be explained with the level of trust between the parties. Next to trust, the kind of co-operation significantly influences the commitment of CRI/A. Specifically, co-operations which were arranged to access governmental funding (Cases III & IV) were often lacking 'true commitment' from CRI/A. As Table 11 above underlines, commitment in this context is limited to the contract and the securing of governmental funding. This interpretation was confirmed in an informal conversation with one of the senior managers at CRI/A, who expressed disappointment in the marked reduction in commitment towards relationships with industry once contracts were signed.

This was different in Case II, a research partnership which, by its very nature, required more commitment on the part of CRI/A. As the following quote by one senior manager from CRI/A highlights, CRI/A was truly committed to creating value: "*The purpose of*

this was … to create some IP which gave Firm/B a competitive advantage internationally and in New Zealand, we respected and honoured that" (Senior Manager B CRI/A).

In sum, the level of trust and commitment (P6a, P7) gives a good indication about the success or otherwise of a research co-operation, but only from the CRI/A perspective. The trust and commitment of the firms seems not to have had discernible impact on the perceived success or failure of a project.

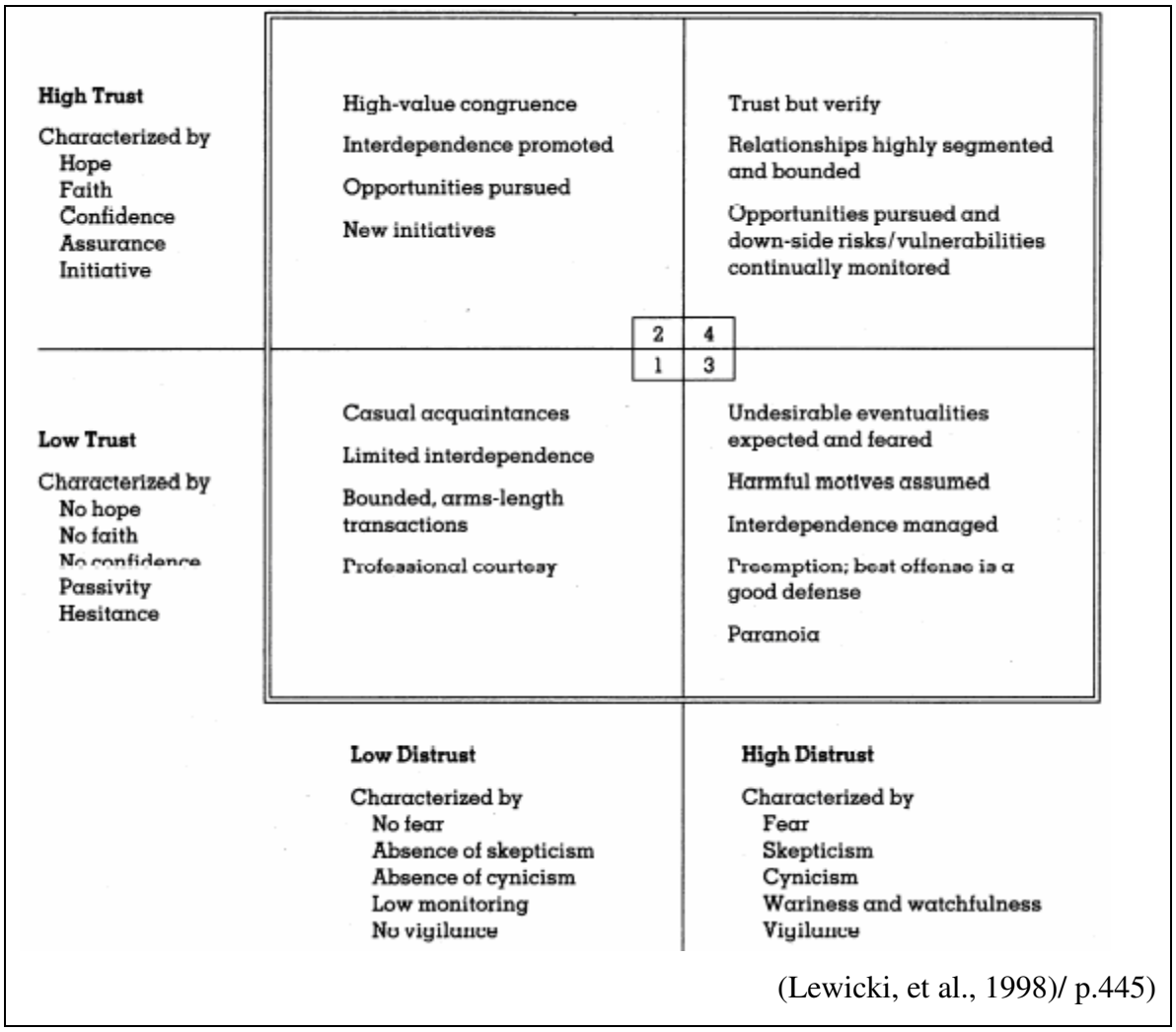
Additionally, findings of this study also indicate, perhaps somewhat counter-intuitively, that distrust can exist in successful research co-operations independently of the above-described level of trust. As will be discussed in more depth in the next section, this suggests that a multidimensional view provides a richer and more accurate understanding of the trust construct.

4.4.1 Additional theme: Multidimensionality of trust

In the four research co-operations, trust and distrust differed significantly between the technical and the commercial interactions. Generally the level of trust was much better on the technical level than on the commercial level (across the cases). Even if the overall co-operation was perceived as successful (Case I) distrust still existed in relation to the commercial aspects of the co-operation.

To illustrate the development of trust and distrust within the cases, and to enable better comparison of the current level of trust and distrust within the four cases, a model proposed by Lewicki, et al. (1998) was identified and utilised. In this model, trust and distrust exist as two separate dimensions (see Figure 4) Trust is illustrated on the vertical dimension and distrust on the horizontal dimension. With time and through dialogue, interaction, joint decision-making, common experience etc., trust and distrust change and the relationship might migrate around these two dimensions (Lewicki, et al., 1998).

Figure 4: Integrating trust and distrust: alternative social realities



(Lewicki, et al., 1998)/ p.445)

Within this two-dimensional framework Lewicki, et al. (1998) identify four prototypical relationships which are the low trust and low distrust cell (Cell 1), the high trust but low distrust cell (Cell 2), the low trust but high distrust cell (Cell 3), and the high trust and high distrust cell (Cell 4).

Within this study, the dimensions of trust and distrust were found in the commercial (distrust) and science (trust) aspects of the co-operations. However, research co-operations between New Zealand firms and research institutes are unlikely to be in Cells 1 and 3. As discussed earlier and confirmed in the initial analysis, firms only enter such co-operations when there is a pre-existing base level of trust in the technical expertise of

CRI/A. Such trust is, in effect, a pre-condition for entering a relationship, and is required to outweigh the high perceived risk of such co-operation. Crown-funded and operated entities give a sort of reassurance to private firms through the credibility of CRIs. McEvily, Weber, Bicchieri, & Violet (2006) speak in this context of organisational trust which describes the trust of individuals in members of another organisation without first-hand experience. As Table 12 highlights, most of the industrial partners enter the co-operation with a base level of trust in CRI/A.

Table 12: Citations about organisational trust in CRI/A*

Case I	Case II	Case IV
"They're not a private company who can do whatever they like and try and get involved in shaggy deals if they want to. They haven't got a choice [other than acting in the best interest for our firm]" (Senior Manager Firm/A)	"I guess it comes down to that, that if CRI/A were independently owned, by a third party that wasn't government, I guess it always be a potential, if you collectively came up with something, they suddenly change their whole strategy to take advantage of it" (Senior Manager Firm/B)	"I know that CRI/A has a mandate to help develop New Zealand industry and I sincerely believe that their interest in collaboration with us is because they see that there is a way of assisting New Zealand industry" (Senior Manager Firm/D)

* Case 3 is excluded because the starting history of the relationship was not typical (refer to Appendix B)

As the above highlights, a relatively high trust dimension exists across all the cases. However, the distrust dimension differs significantly across the cases, which might explain why some of the co-operations are perceived as more successful than others.

These distrust dimensions which developed within a certain degree of organisational trust – Cells 2 and 4 in Lewicki's model (Lewicki, et al., 1998) – are discussed in turn next and serve as the frame of reference for the assessment and illustration of the development of trust and distrust in co-operations, and its impact on the perception of success.

4.4.1.1 High trust / low distrust in work groups

In Cell 2 *"the relationship is likely to be characterised by pooled interdependence, where interested parties are assured that partners are pursuing common objectives*" (Lewicki, et al., 1998, p.446). In such relationships the parties aim to intensify the relationships and

look for ways to increase the mutually beneficial interdependencies (Lewicki, et al., 1998). Cell 2 can be seen as the starting point for firm-CRI co-operations. A high degree of trust existed on the technical level, and areas of distrust had not yet developed. In most of the co-operations, however, distrust developed over time, especially on the commercial level.

Only Case II is characterised by a high level of trust and a low level of distrust. Both sides looked for ways to intensify the co-operation in the near future. However, as the following quote illustrates, the co-operation was organised in a very stringent manner which did not allow room for the development of distrust elsewhere: *"There were certain milestones that had to be hit, it wasn't just a pure science thing because we overlaid [it with] the commercial [objectives] …it wasn't just research for the research purpose you know, pure research, because we overlaid it with that business management thing [and] I do think that kept them on track" (Senior Manager Firm/B).*

This suggests that initially a high degree of distrust existed on the side of Firm/B relating to whether the co-operation would lead to a commercial success. However, this distrust was addressed early in the co-operation and did not negatively impact on the development of trust later on. Case II is a good example of the positive dynamic which can develop from distrust. The importance of distrust will be further discussed in the next section, which is in the context of the high trust/high distrust cell of Lewicki, et al. (1998).

4.4.1.2 High trust/high distrust in work groups

In Cell 4 a high degree of trust exists in certain areas but distrust exists in others. Cell 4 is the most prevalent form in practice *"as business relationships mature and interdependencies are expanded and elaborated between executives in teams, partnerships, and alliances" (Lewicki, et al., 1998, p.447).* In fact it is argued that social structures are most stable when there is a balance between trust and distrust. *"Increases in trust or distrust – apart from an increase in the other – may do more harm than good"*

(Luhmann, 1979), p.89). Interestingly in this context, a Holmes & Rempel (1989) study found that individuals evaluate a partner's behaviour and motives more positively after recalling negative experiences than positive experiences. A 'marriage' between trust and distrust is of fundamental importance for the creation of 'hot groups' (Leavitt & Blumen, 1995) and 'good fights' (Eisenhardt, Kahwajy, & Bourgeous, 1997). A certain degree of distrust brings difficulties to the surface quickly and allows for more timely resolution of difficulties and conflict.

As Table 13 highlights, with the exception of Case II, all co-operations were characterised by trust on the technical level (as already discussed above) and a certain degree of distrust on the commercial level.

Table 13: Citations about trust and distrust in the co-operations

	Case I	Case II	Case III	Case IV
Trust on technical level	"The only reason that we've got there is because of the expertise and resources … they've got a world reputation" (Senior Manager Firm/A)	"I think they've always had a really good [science] team that was lead by Jim" (Senior Manager Firm/B)	"I think their technical expertise is very good … there is a good institutional knowledge" (Senior Manager Firm/C)	"We hold CRI/A's technical capabilities in quite high regard" (Senior Manager Firm/D)
Distrust on commercial level	"If we are finding that they say: 'We want to compete, we need to grow our own business, our primary goal is to grow our own business' … then we will be questioning that" (Senior Manager Firm/A)	*No obvious distrust on commercial level found but as stated in previous section the project was organised in a very stringent manner which does reflect distrust*	"I don't think they behave very commercially, they behave like a CRI rather than a commercial organisation" (Senior Manager Firm/C)	"We are also aware that CRI/A commercially has undertaken some relationships with other organisations that could well undermine [our] rights" (Senior Manager Firm/D)

In order to make such co-operations with mixed levels of trust and distrust successful, Lewicki, et al. (1998) suggest limiting the interdependences to those linkages that reinforce trust, and separate those areas which are increasing the level of distrust. Our findings support this argumentation. In the successful co-operation the project was organised in such a way that scientists were dealing with scientists and commercial people were dealing with commercial people. This meant that issues from the commercial

part of the co-operation did not negatively impact on the good relationship between the scientists. In Cases III & IV such a separation did not exist; there was much overlapping across the disciplines, and as soon as disagreements came up on the commercial level this impacted on the technical level as well. Citations in Table 14 substantiate this argumentation.

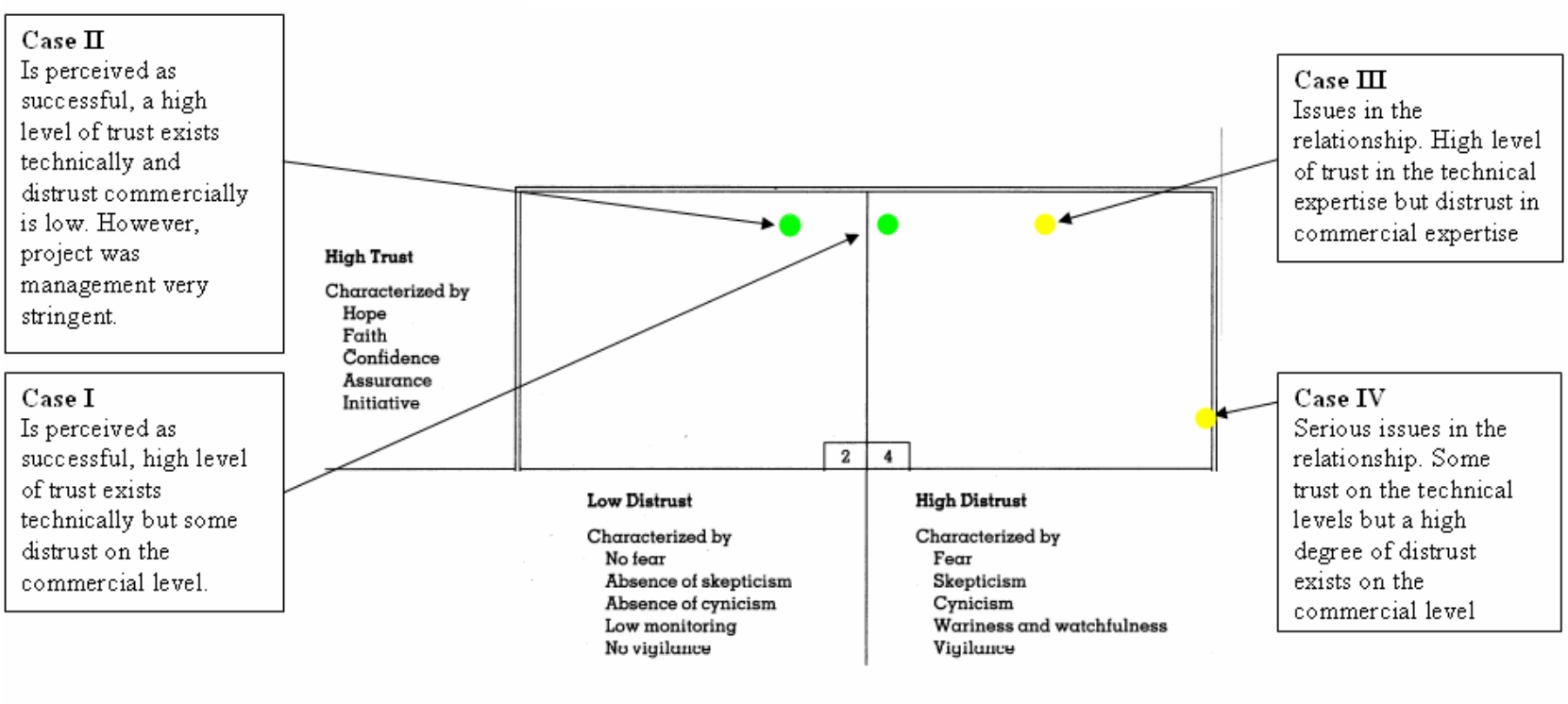
Table 14: Citations of separation between commercial and technical work streams

	Case I	Case II	Case III	Case IV
Quote	"Mainly five to six people, mostly technical people and we would have communication with them, lots of communication" (Senior Manager A CRI/A)	"I personally would have probably a better relationship with Jim just because of the fact him and I do similar roles" (Senior Manager B Firm/A)	"We run two committees; one is management committee … and second is the technical committee. I sit on both of those committees for Firm/D" (Senior Manager Firm/C)	"It is very, it is both frustrating and is very strange to try to do an interaction with an organisation where you are trying to create a commercial contract and you are dealing with somebody from the science group" (Senior Manager Firm/D)
Organisation of work streams and success	Work streams are separated – co-operation is perceived as successful	Work streams are separated – co-operation is perceived as successful	Work streams are interwoven – co-operation is perceived as less successful	Work streams are interwoven – co-operation is perceived as less successful

As described by Lewicki, et al. (1998), the level of distrust in one part of the co-operation contaminated, at least partly, other parts of the co-operation. As a consequence, even if trust in the technical expertise of CRI/A existed, the co-operation was perceived as less successful overall.

Figure 5 summarises the multidimensionality of trust and distrust in the four co-operations. If distrust on the commercial level is too high, then trust on the technical level is significantly diminished, and a co-operation is perceived as less successful or even a failure. However, as long as work areas involving trust and distrust are kept separated from each other and balanced, a certain degree of distrust does not necessarily lead to a negative perception of the co-operation.

Figure 5: Trust and distrust in the four cases



4.5 Evaluation of the moderating variables of trust

Having assessed the level of trust and commitment, and how they impact upon the perceived success of research co-operations, the proposed moderating variables for trust (P8-P11) are now considered.

Additional themes which emerged in the context of the moderating variables were group diversity, which was found to have an impact on the development of social bonds between the boundary spanning manager and on experience; and team tenure and type of experience, which were both found to moderate experience. These additional themes are discussed in the context of the propositions to which they are related, but in separate sections.

4.5.1 Social bond between boundary spanning managers (P8)

The quality of social relationships between the boundary spanning managers was, as proposed (P8), crucial for the development of trust and overall perception of a co-operation. As commented by one senior manager: *"The relationship may not be successful but the project is fairly successful …in the end business is people, and we had ongoing and continuing difficulties in the people relationships" (Senior Manager B CRI/A).* As Table 15 highlights, the interpersonal relationships between the boundary spanning managers appeared to be a significant indicator of the perceived success of such co-operations.

Table 15: Citations of quality of personal relationships

Case I	Case II	Case III	Case IV
"Jason and John have been 100% supportive … no issues with them whatsoever" (Senior Manager Firm/A)	"I think it was about the people relationships which are still very strong … everyone was really open and transparent, honest and respectful" (Senior Manager Firm/B)	"On the commercial side they had been almost annual changes, there is no continuity … I have no trust (Senior Manager Firm/C)	"I think that the people I interact with … I don't think they are particularly plotting for bad things to happen … I just think they … have acted on the commercial side … unprofessional, immature and ineffective" (Senior Manager Firm/D)
Is perceived successful	Is perceived successful	Is perceived less successful	Is perceived less successful

The case study methodology utilised in the research revealed additional insights into the development of social bonds between the boundary spanning managers which have not yet been linked to RM. As discussed next, an additional theme of this research which explained the formation of social bonds within work groups is known as diversity research (van Knippenberg & Schippers, 2007).

4.5.1.1 Additional theme: diversity research

Diversity research looks at the different backgrounds of individuals in a group and evaluates how these differences impact on the development of personal relationships and the overall performance of a group (Jehn, Northcraft, & Neale, 1999).

Two theories exist in diversity research (similarity theory and equity theory), which address the question of whether or not diversity in a team is beneficial. Similarity theory argues that homogenous groups perform better than heterogeneous groups because individuals with similar backgrounds are attracted to one another and co-operate better (Bowers, Pharmer, & Salas, 2000). On the other hand, equity theory argues that heterogeneous groups perform better because they have access to a larger knowledge base (Bowers, et al., 2000).

Both theories are valid because the type of diversity determines whether or not it might be of benefit to the relationships (Jehn, et al., 1999). Such different types of diversity are, for example, information diversity (different professional backgrounds of group members) or value diversity (different beliefs and values etc. (Jehn et al., 1999).

In the following text it will be discussed why information diversity and/or value diversity appeared to have a positive impact on the relationships in Cases I & II but a rather more negative impact in Cases III & IV.

4.5.1.1.1 Information diversity

Information diversity (differences in the professional backgrounds of the group members) is desired and is, in fact, the main reason for most of the co-operations. The firms co-operate with CRI/A in order to benefit from the expertise of the research scientists, which they themselves do not have. The inter-organisational work groups are a composition of research scientist, industrial scientist, and commercial staff.

Information diversity is a good indicator of the knowledge base of a group which in turn is positive for a group's performance (Webbera & Donahue, 2001). As stated by Milliken & Martins (1996, p.404): *"A group that is diverse could be expected to have members who may have had significantly different experiences, and therefore, significantly different perspectives on key issues and problems"*. In addition, it is argued that such groups are more creative in their decision making (Bantel & Jackson, 1989) and are more committed to the project (Jehn, et al., 1999).

However, diversity within the work groups adds complexity to group interactions and is often the cause for misunderstandings and conflicts. This is most evident in Cases III & IV (see Table 16) where the different backgrounds of the leaders prevents a mutual understanding of what needs to be done. On the other hand, cases where information diversity is lower (I & II) and group leaders are on par, personal relationships are better because a mutual understanding exists of what needs to be done.

Table 16: Citations about information diversity in the groups

Case I	Case II	Case III	Case IV
"Firm/A has that technical infrastructure, so they have invested in technical people in their business…they are in a position to pick up that research and implement it" (Senior Manager A CRI/A)	"So the reason that it worked is because they had a formulation team which are scientist … and they complemented our discovery team quite well" (Senior Manager B CRI/A)	"I think what has been shown up is that they actually don't have [sufficient technical expertise] but that is the real issue" (Senior Manager B CRI/A)	"I believe it is a little bit of a weakness in their business that they don't have someone who is a specialist in [this field] … that makes them very reliant" (Senior Manager C CRI/A)
Moderate information diversity but common language spoken	Moderate information diversity but common language spoken	High information diversity, no common language spoken	High information diversity, no common language spoken

As this highlights, although information diversity existed in all the cases, it might have a negative impact on personal relationships and consequently on a group's performance (as in Cases III & IV). It is argued that in order for work groups to benefit from information diversity the various group members still need to be able to understand each other and integrate the contributions of the dissimilar others (van Knippenberg & Schippers, 2007). They need to 'speak the same language' in order to understand the other opinions and views (van Knippenberg & Schippers, 2007). If such an understanding is lacking then tensions occur. This means that information diversity is only of benefit until it reaches a certain point, beyond which the group members cannot fully understand each other and the diversity has a negative impact on the relationships and performance (van Knippenberg, De Dreu, & Homan, 2004).

As Table 16 above highlights, the different (science) backgrounds of the technical group member of Cases I & II enabled them to efficiently co-operate with CRI/A on the technical part of the project. In Cases III & IV such a common language was missing because educational backgrounds were too different and technical capability at the firm level was limited. If the 'gap' in the backgrounds of the boundary spanning managers is too big, then misunderstandings and conflicts are likely to hinder the co-operation.

4.5.1.1.2 Value diversity

Whereas information diversity refers to the hard skills (professional backgrounds), value diversity refers to the soft skills (attitude, beliefs etc.). It is recommended that value diversity in work groups be avoided because it negatively influences personal relationships which will suffer from misunderstandings, miscommunication, and dislikes (Steiner, 1972).

Such a negative impact of value diversity became most salient in Case III. Boundary spanning managers have fundamentally different beliefs about how the co-operation should be organised (see Table 17). As a consequence of this polar view, serious tensions

existed in the relationship. That high value diversity will most likely lead to a performance decrease was confirmed by others (e.g. Jehn, et al., 1999).

Table 17: Citations about value diversity in Case III

Case III (Firm/C view)	Case III (CRI/A view)
"[Contracts] are vital from my point of view because they have taken a great deal of time to negotiate and they provide the basis on which we co-operate. Unfortunately sometimes we have to rely on the agreements to ensure that we are co-operating as we originally agreed" (Senior Manager Firm/C)	"The collaboration agreement in itself is 14 pages of various detailed processes … very little room for flexibility" (Senior Manager B CRI/A)

Shared values are important to increase the willingness of the group leaders to engage in the demanding process that might lead to innovative performance (Jehn, et al., 1999). Groups which are characterised by a lower level of value diversity function better (Evans & Dion, 1991; Shah & Jehn, 1993; Wright, 1984) because they *"do communicate more and provide more positive encouragement …, they also are committed and more cooperative, which leads to higher performance levels" (Jehn & Shah, 1997, p. 786).*

Such a value diversity is low in Case I, where boundary spanning managers have a friendship-like relationship. As a consequence, even if the relationship goes through a difficult time, the positivity of the interpersonal relationships among these managers leads to a positive perception of the co-operation.[1]

Communication and group performance is better in groups with a low-value diversity because low-value diversity promotes the development of friendship-like relationships between the boundary spanning managers. Groups with friendship-like relationships criticise each other differently from groups that have less harmonious relationships (Gottman & Parkhurst, 1980). As stated by Jehn & Shah (1997, p.780), *"Friends offer more explanations to their partners, make more criticisms, and are more likely to get confirmatory information relative to non-friends"*.

[1] Conclusion mainly based on informal conversations

The functioning of interpersonal relationships is crucial for complex learning and knowledge transfer (Brown & Duguid, 1991). Co-operations that suffer from interpersonal differences among the boundary spanning managers will have a problem transferring technology. Particularly when the knowledge is tacit rather than explicit, the quality of these relationships is crucial for a successful co-operation (Sherwood & Covin, 2008). This study confirms this argumentation. It was found that the quality of the social bond between the boundary spanning managers was, as proposed (P8), beneficial for the overall development of trust, and more generally, for the perceived success of a co-operation. In this context information and value diversity emerged as strong moderators of these bonds.

As discussed, however, diversity is a 'double-edged' sword (Milliken & Martins, 1996). While information diversity is generally beneficial for group performance, value diversity is a constant threat for interpersonal relationships between the boundary spanning leaders. Information diversity must not go on at the expense of interpersonal relationships (Triandis, Kurowski, & Gelfand, 1994) because the co-operation will suffer from this in the long term.

4.5.2 Satisfaction with communication (P9)

As proposed (P9), satisfaction with communication was found to be a good predictor of trust. The industrial partners of the successful co-operations (Case I & II) were satisfied with information exchange and communication, whereas interviewees in the cases with a high level of distrust (the less successful Cases III & IV) were dissatisfied with information exchange and communication (see Table 18).

However, communication quality was not related to communication frequency. The frequency of communication was high in all cases. In fact, the least successful co-operation with the highest level of distrust (Case III) had a higher frequency of communication than some of the successful cases. In Case IV the frequency of communication was significantly increased as distrust in the co-operation grew. As stated

by one senior manager of CRI/A, *"I think it has been decided that fortnightly, you know even video conferencing or something like that, that is what we need to head to now"*.

Table 18: Citations about satisfaction with communication

Case I	Case II	Case III	Case IV
"You know it's sometimes the guys come up here and we've discussion or we go down to CRI/A and have a discussion … [communication] is not an issue. " (Senior Manager Firm/A)	"They all were in contact quite regularly. They also had contact with the other people in our R&D division …there was interaction on a whole lot of different levels across both organisations" (Senior Manager Firm/B)	"[Communication is] very good from our side [but] very poor from CRI/A's side. I communicate with them all the time and provide them with a lot of information and I get little or nothing back" (Senior Manager Firm/C)	"We don't feel we get particularly good feedback from our CRI/A colleagues about where things are at. And you know what it's like whenever you don't get communication, it can be a source of concern" (Senior Manager Firm/D)

This is consistent with a study by Ancona & Caldwell (1992) who found a negative relationship between communication frequency and self-rated performance. A high level of communication may be an indicator of conflict, which hampers team performance (Ancona & Caldwell, 1992; K. G. Smith et al., 1994). Such an increased frequency of communication may also reflect an implicit desire to try and restore a relationship by one of the partners. On the other hand, lower communication frequency might reflect satisfaction with the quality of the communication and the relationship in general.

As this highlights, the quality of communication is more important than its frequency. The term 'reflexivity' is commonly used in this context to describe the quality of group discussions (Schippers, Den Hartog, Koopman, & Wienk, 2003). In order to enable such reflexive communication, a certain degree of expertise is required on the part of the industrial partner. As Table 19 highlights, such expertise existed in Cases I & II but was perceived as limited by interviewees of CRI/A in Cases III & IV. In a similar context it was concluded by Bougrain & Haudeville (2001) that small and medium-sized enterprises need to develop in-house capacities first, before engaging in external co-operations. Such in-house capacity is especially important in the context of complex jobs (West, 1996).

Table 19: Citations about perceived technical expertise of firms

Case I	Case II	Case III	Case IV
"Firm/A has that technical infrastructure, so they have invested in technical people in their business. They may not be doing research but they are in a position to pick up that research and implement it" (Senior Manager A CRI/A)	"So the reason that it worked is because they had a formulation team which are scientists" (Senior Manager B CRI/A)	"I think what has been shown up is that they actually don't [have sufficient technical expertise] but that is the real issue, they don't have that technical expertise" (Senior Manager B CRI/A)	"I believe it is a little bit of a weakness in their business that they don't have someone who is a specialist in this [research field] … that makes them very reliant, they don't have any, or they've got very little internal R&D capability" (Senior Manager C CRI/A)

However, to what extent internal expertise is required depends to a large extent on the kind of interaction between the organisations. Pure technology transfer requires less expertise because it is less complex and easier to transfer (Santoro & Bierly, 2006). On the other hand, when tacit knowledge is to be transferred, rich and sophisticated communication is required on the technical side (Santoro & Bierly, 2006).

Overall, it can be said that the quality of communication is, as proposed (P9), a strong predictor of trust in a research relationship. In addition, it was found that purely the frequency of communication is not. A high frequency of communication might well reflect distrust and be a result of the desire of one partner to repair an unsuccessful co-operation. A low frequency of communication might reflect satisfaction with the co-operation and the willingness of the firm to trust CRI/A to continue with the good work.

In order for communication to be reflexive (task- and process-related) the industrial partner must have a good understanding of the science carried out by CRI/A. This is especially important when the transferred knowledge is tacit (not codified). Simpler co-operations (transfer of explicit knowledge, e.g. technology transfer) can be successful with only moderate internal research capacities.

4.5.3 Mutual objectives (P10)

Mutual objectives (P10) could not be found in any of the co-operations. As mentioned earlier, even in the most successful co-operation (Case II) different research objectives were observed. In Case II specifically, secrecy (desired by the commercial partner) vs. journal publications (desired by the research scientist) was perceived as an issue. As stated by the Senior Manager Firm/B: *"They couldn't just publish anything without our prior approval, so that we could have a think about it and make a decision as to whether we are happy with it or not".*

Mutual objectives would have been beneficial for the research co-operations because they have a positive impact on a group's performance by decreasing in-group/out-group biases and promoting solidarity (Schippers, et al., 2003). Gaertner & Dovidio (2000) explain this positive impact with the fact that such interdependence helps the group to focus on common goals and distracts the group from sub-group categorisation.

However, depending on the type of co-operation, a certain degree of task interdependence existed which substitutes for the lack of common objectives. Task interdependence describes the depth of interactions required by a group to reach a common goal (Wageman, 1995). This was found in prior research to have a positive impact on communication, trust and commitment and the perceived success of a co-operation (Schippers, et al., 2003). The findings of this research are consistent with such earlier work.

CRI/A co-operates with New Zealand industry by means of research partnerships, technology transfer or contract services. Depending on which of these co-operation types the relationship is based on, task interdependence was either high or low. As highlighted by the main informant: *"All our successful projects are where there is interaction … if you just give me a job to do and I just go and do it, you don't feel you get value but if you give me a job to do and we interact doing that job, that's where value is created" (Senior Manager B CRI/A).*

A high level of task interdependence existed in Case II, which is a research partnership that requires a high degree of interaction among the partners (task interdependence). On the other hand, co-operations I, III and IV are a type of contract research or partnerships based on technology transfer. Task interdependence is limited under such conditions because the technical work is carried out autonomously by CRI/A. Table 20 underlines these different levels of task interdependence.

Table 20: Citations for task interdependence in the co-operations

	Case I	Case II	Case III	Case IV
Quote	"We put some money into a project which enabled them … to get a bigger amount of money from FRST … but there hasn't been quite enough involvement from ourselves … It's a bit like, 'we've got your money and the government money and now we are doing our own thing' " (Senior Manager Firm/A)	"We had a project plan and then for each of the nine sub-projects we sort of said, 'that's what CRI/A is doing, this is what our discovery is doing'. They all had chunks in it and they were sequencing, like that had to be done first and than that could be done after that" (Senior Manager Firm/B)	"I don't, to be honest, know what they are doing but I do know that in the past they have done work of their own which to some extent they are entitled to do" (Senior Manager Firm/C)	"[Most of the issues are in the context of the new] programme and possibly it's a feel that Firm/D has no control over what happens in this [programme] … also as I mentioned before … it's got to be for the benefit of New Zealand as a whole not one company" (Senior Manager C CRI/A)
Task interdependence	Low	High	Low	Low

Overall it can be said that mutual objectives (P10) could not be found in any of the four co-operations, however, the positive impact of task interdependence in Case II underlines how beneficial task and outcome interdependence is for the success of research co-operations. However, such interdependences did not directly impact on trust and commitment, but rather increased reflexive communication (task- and outcome-related communication) which in turn positively influenced the development of trust and commitment.

4.5.4 Experience positively impacts on the development of trust (P11)

Experience working with each other (in the following referred to as 'group longevity') was not always found to positively influence the development of trust as proposed (P11). In fact, group longevity did, in some cases, significantly increase distrust (Cases III & IV). This is alongside the argument of Sherwood & Covin (2008, p.175) who state that *"just as partners can learn to trust, they can learn to distrust"*.

One explanation for the increase of distrust might be that certain processes are seen as evident over time and negatively impact on a group's desire for communication (Schippers, et al., 2003). As a consequence, reflexive communication (task- and process-related communication) decreases over time, which causes misunderstandings and might decrease trust (Schippers, et al., 2003). Although such a negative effect of longevity was not found in all cases, tensions and bad experiences occurred in all the cases over time. In the cases which were perceived as successful (I & II), the level of distrust on the commercial level did not grow at all, or not as much.

Additional themes which emerged, and might explain why group longevity impacted differently on the development of trust, were team tenure, type of experience, and group diversity. These themes will now be discussed in turn, with group diversity only touched on briefly as it has already been discussed above.

4.5.4.1 Additional theme: team tenure

Team tenure describes the length of time individuals have been with the team (Schippers, et al., 2003). It is well-accepted that for groups to work efficiently and effectively they need to get to know each other, which requires some time (Goodman & Leyden, 1991).

As Table 21 highlights, the staffing in Cases I & II was relatively consistent over the years. This consistency in personnel enabled key decision makers to develop close interpersonal relationships which, in turn, positively impacted on the perceived success of the relationship. On the other side, Cases III & IV were characterised by relatively

frequent personnel changes, particularly of the commercial level. This hampered the development of close personal relationships, which increased distrust in the relationship.

Table 21: Citations about consistency in personnel across the cases

Case I	Case II	Case III	Case IV
"Having Peter on the top with his consistent strategy has meant that we built that [good relationship] but if you change personnel than you have to re-establish the relationship, you have to establish the value propositions for both partners new" (Senior Manager A CRI/A)	"I just think, I did put a lot of this down to John to be honest. I just think he is really personable, he is hard when he needs to be hard but he makes things work and nothing is a problem, let's just work through it" (Senior Manager Firm/B)	"I have some concerns that they rotate staff too frequently. In the last five years I think they have had five or six commercial managers involved in this project and that's too many" (Senior Manager Firm/C)	"I think that's been another issue for them as well that the industry engagement contact has changed quite a number of times over recent years. They are not feeling like they got any continuity of people that they are dealing with" (Senior Manager C CRI/A)

4.5.4.2 Additional theme: type of experience

'Type of experience' distinguishes between task-related experience and group-related experience (Littlepage, Robison, & Reddington, 1997).

Task-related experience improves a single group member's ability and, as a consequence of that, a group's total performance (Littlepage, et al., 1997). Co-operation which is aimed at technology transfer (I & IV) benefited from task-related experience because the scientists involved increased their individual expertise, from which the overall co-operation benefited (first-class technology was licensed to the commercial partner). However, in such a context a group's performance remains only on a high level as long as the individual's expertise is transferable to a new performance situation (Littlepage, et al., 1997). This means that the co-operation must remain in such a context that developed technology is to be transferred from CRI/A to the firm.

As Table 22 highlight in the context of Cases I & IV, as soon as the co-operations moved on and new tasks become part of the interactions (e.g. more commercial interactions) the

previously-gained task experience of the scientists is insufficient because the group had no experience in interacting with each other in the new context.

Table 22: Citations about increasing tension with new challenges*

Case I	Case IV
"Now we are trying to form a more formal strategic alliance, to actually tie down exactly how we're going to work together … and then you've got people who say 'oh shit, what about me?' … and this is where things have got a bit muddy" (Senior Manager Firm/A)	"We have been pretty comfortable with the outcome that we have had from the point of view of developing technologies … [However, the new] programme is 2 ½ years old, maybe three now … and we don't see good evidence of progress towards the objectives" (Senior Manager Firm/D)

*Cases II & III are one-project co-operations only

On the other hand, group-related experience improves a group's experience on relevant tasks as a group (together, not individually). This in turn facilitates the recognition of other group members' expertise and improves a group's performance as a whole (Littlepage, et al., 1997). Take, for example, the co-operation of Case II which was characterised by a high degree of task interdependence and group experience. Team members of both sides gained a good understanding of each other's expertise and skill sets. Future challenges can be addressed accordingly. A similar result was found by Larsen & Christensen (1993).

4.5.4.3 Additional theme: group diversity

Depending on a group's diversity (similarity versus difference of backgrounds) group longevity has a positive or negative impact on a group's performance. On the one hand, the cases whose group members have the most diverse backgrounds (education-wise and/or attitude-wise, Cases III & IV) were characterised by serious interpersonal issues that got worse over time. In both cases, group conflicts escalated and were not seen to be manageable with current group members (see Table 23).

Table 23: Citations about interpersonal tensions in the less successful cases

Case III	Case IV
"Most probably they should have someone else managing and working on the contract, you know, business is people" (Senior Manager B CRI/A)	"It seemed a bit that the whole problem was stemming from me [so] I removed myself from the picture" (Senior Manager C CRI/A)

On the other hand, in the less diverse teams (Cases I & II), interpersonal tensions were not evident and group members perceived problems differently. As Table 24 highlights, problems are linked to environmental circumstances rather than individual blame. Because the relationships are long-lasting, problem-solving skills, involving integration and discussion of ideas, have developed and got better over time.

Table 24: Citations about environmental issues in the successful cases

Case I	Case II
"They've got this big problem … the Government gives them a mixed message and it's not surprising [that] you get mixed messages back from the management" (Senior Manager Firm/A)	"New managements are always trying to make their mark differently. But the management change was beyond our control and their control. It's just life, the world changes" (Senior Manager B CRI/A)

A similar result was found by Schippers, et al. (2003), who argued that longevity had a positive effect on homogenous groups because reflexive communication (task-related) increases over time, whereas highly diverse teams become less reflexive over time and thus longevity has a negative impact on such groups. In the latter case, conflicts are seen as relational and it is believed that most conflicts are caused by personal differences which cannot be resolved.

4.5.4.4 Summary moderating effect of experience (P11)

Long-term working relationships (P11) can have a positive impact on the development of trust, but not necessarily in all instances. All co-operations were relatively mature but these working experiences impacted differently on the development of trust across the cases. The three themes that emerged, which might explain this different development, were team tenure, group diversity and type of experience.

In the context of team tenure, it was concluded that group longevity positively moderated a co-operation if key individuals remained the same over a long time period and were given the chance to build interpersonal relationships. The development of such relationships was found to be moderated by the backgrounds of the individuals (group diversity). In addition, the overall goal of the co-operation must not fundamentally change, in order to benefit from group longevity. Finally, if experience is gained in a field which is not related to future tasks (e.g. technology transfer vs. co-funding of research) the experienced gained might be insufficient in the new context.

4.6 Chapter conclusion

This chapter discussed the findings of this study. Specifically, the 12 propositions as stated in Chapter 2 were evaluated in light of the data gathered from this case study. Additional themes in the context of the proposed critical success emerged from the study and were discussed alongside the formal propositions. Chapter 5 highlights the implications of this study for theory and practice.

5 Conclusion

5.1 Introduction

The stated research problem for this study was to identify the critical success factors for research co-operations in New Zealand. Justification for this study was provided by highlighting the lack of empirical research papers that look at research co-operations between companies operating in different organisational environments (Plewa, et al., 2005).

Research does exist in a similar context, which is the university-firm context (e.g. Daniel, et al., 2002; Mora-Valentin, et al., 2004; Plewa & Quester, 2007; Plewa, et al., 2005; Santoro & Bierly, 2006) but to the knowledge of the author none of this work has been carried out in a New Zealand context. Additionally, only a very small number of these studies derived conclusions from looking at research co-operations as a totality. Conclusions were mostly drawn from opinions of decision makers from only one side of a given co-operation. To address this limitation a conceptual model with 12 propositions was developed and tested in this study by means of a case study methodology and the findings were discussed. The approach utilised multiple informants, which allowed for a rich conceptualisation.

This chapter begins by drawing conclusions about the research propositions, and a revised conceptual model is presented. Implications for relationship marketing theory are discussed alongside implications for policy makers and practice. Limitations of the study and opportunities for future research are at the end of this thesis.

5.2 Conclusion about research propositions and research problem

Table 25 summarises the assessment of the 12 research propositions that were presented for this study. That some of them were only partially supported (P6a, 6b, P10, P11) can be explained with the New Zealand context and the chosen research approach which

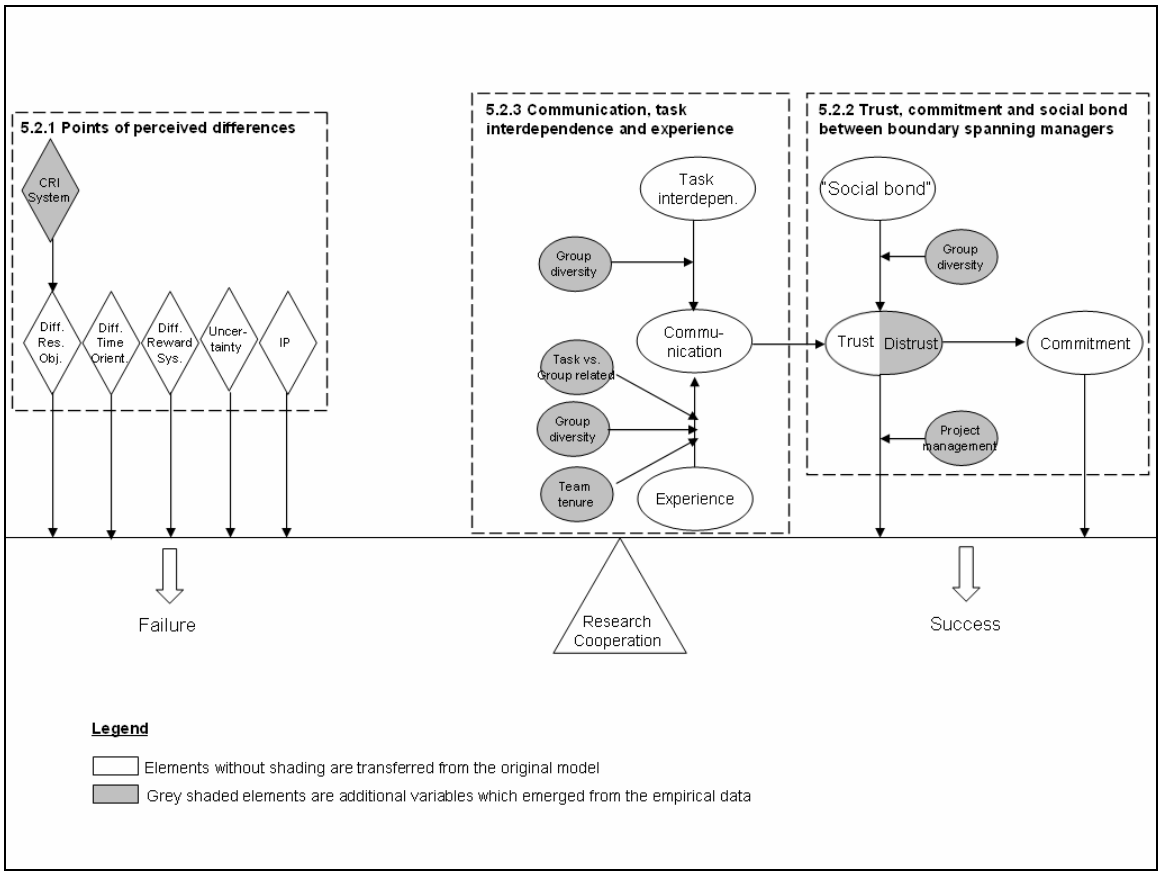
allowed for a richer conceptualisation. New concepts could be included in the model, most notable of which is the one of group diversity and the multidimensionality of trust.

Table 25: Summary of evaluation of propositions

	Supported / not supported	Comments
Point of perceived differences		
P1: Research objectives	Fully supported	
P2: Time orientations	Fully supported	
P3: Reward systems	Fully supported	
P4: IP rights	Fully supported	
P5: Uncertainty	Fully supported	
Success Factors		
P6a: Trust	Partly supported	Trust is multidimensional
P6b: Trust increases commitment	Partly supported	Trust is multidimensional
P7: Commitment	Fully supported	
P8: Social bond increases trust	Fully supported	Moderated by group diversity
P9:Satisfaction with communication increases trust	Fully supported	
P10: Mutual objectives increase trust	Partly supported	Task interdependence improves communication
P11: Experience increases trust	Partly supported	Experience might positively impact on communication but this can be negative as well

Figure 6 summarises this study in the form of a revised model, and the set of critical success factors for research co-operation in New Zealand. The additional moderating variables which emerged in this study are shaded grey. The most noticeable contribution of this study is in the context of the multidimensionality of trust which is highlighted with a grey/white element in the model. The conclusions of this research which led to the revised model are presented as outlined in Figure 6 and further discussed in the next sections.

Figure 6: Revised model for critical success factors for research co-operations



5.2.1 Points of perceived differences

In comparison with existing literature and conclusions about specific issues in the context of university-firm co-operation, the findings of this study generally confirm earlier work and provide some additional insights. The New Zealand firms participating in this study perceive similar issues cooperating with CRI/A as firms have cooperating with universities. Most notably are perceived different objectives of such co-operations.

This similarity to a university-firm context was somewhat surprising, as one might assume that CRI's purpose of supporting New Zealand industry (OECD, 2007) should provide a strong mutual objective around the purpose of such co-operations. However, as already discussed in several publications (e.g. Mapp, 2010; OECD, 2007) and also raised by interviewees in this study, the New Zealand CRI system has flaws which can perpetuate conflicting objectives. Specifically, a CRI has to help New Zealand firms

develop new technologies in the short to medium term, while at the same time build strategic expertise and remain financially secure.

As concluded by Lee (2000) the problems of such conflicting objectives are that the academic research partner based in the CRI is investing time and energy in parts of the project which are seen as inappropriate by the firm. Issues arising out of these conflicting objectives were observed in most cases. Alongside the argumentation of Santoro (2000) these were sometimes even perceived as unsolvable, and hampered greater co-operation. These problems add to the already high degree of uncertainty that firms face when entering a research co-operation with a CRI.

5.2.2 Trust, commitment, and social bond between boundary spanning managers

Since the publication of Morgan and Hunt (1994) trust is arguably the most important success factor for any kind of inter-firm co-operation. This is especially true for research co-operations because of the high degree of uncertainty around the future pay-back of such investment (e.g. Plewa & Quester, 2007). Furthermore, trust increases the perceived satisfaction with relationships, regardless of whether they are actually successful or not (Noteboom, Berger, & Noordhaven, 1997; Zaheer, McEvily, & Perrone, 1998). Findings of this study confirm those of prior research and underline the importance of trust and commitment in successful research co-operations.

Trust and commitment in this study were to a certain degree evident in all co-operations. The four firms participating in this research had a base level of trust in the technical capabilities of CRI/A, and belief in the long-term benefits of the co-operation which in turn made them committed. The positive impact of perceived benefits on commitment confirms a similar finding in the early work of Morgan and Hunt (1994).

However, it was further found that a certain degree of distrust, if managed properly, can also be important for the long-term success of a co-operation as trust. Distrust doesn't

necessarily have to be at the expense of trust and co-operation success, and a certain element of distrust adds a sharpness and even vitality to the nature of the co-operation.

Although inter-organisational and inter-personal trust were strong indicators for the success of a co-operation, the concept of trust as applied in firm-firm or firm-university co-operations is not fully applicable to research co-operations in New Zealand. Alongside the argumentation of Lewicki, et al. (1998) trust was found to be multidimensional. Even if trust existed on the technical level, distrust surfaced in most of the cases in other areas, most notably in the commercial interactions. In this context the quality of project management (PM) is crucial to balance out trust and distrust and lead to a successful co-operation.

Findings of this study indicate, perhaps counter-intuitively, that co-operations without any distrust might suffer in the long term. Harmful conflicts can surface in co-operations where "too much trust" existed in the past. It is temping to engage in purely trust-based relationships which are cheaper to maintain than those with no trust (Zaheer, et al., 1998) but firms in this study who more closely monitored their relationship with CRI/A proved to be more satisfied with the overall outcome of these co-operations.

One explanation for this might be that firms that have too much trust in CRI/A are unprepared for disappointments and problems which are unavoidable in research projects. Gargiulo (2006) speaks in this context of "excessive trust" which increases the risk to the trustee of being "betrayed". It is further argued by Gargiulo (2006) that there is an optimal level of trust which must not be exceeded. A certain degree of distrust found in the successful co-operation underlines this argumentation, and highlights the importance of at least some degree of distrust for the long-term success of a co-operation. However, distrust does not mean lack of confidence in the expertise of the CRI, but means rather that the firm acknowledges that the CRI's objectives may conflict with their own and therefore becomes more actively engaged in the co-operation to secure achievement of those objectives. If distrust becomes excessive the co-operation might suffer some harm,

or even irreversible damage. It is important to find the right balance between trust and distrust.

Although a certain degree of distrust is beneficial, it must not exist between the boundary spanning managers of the organisations. The social bond between the boundary spanning managers is crucial for success beyond the overall level of trust and commitment. Sherwood & Covin (2008) argue in a similar study that such individuals have the ability to influence internal structures, processes and climates. If the social bond between the boundary spanning managers is strong, these individuals will make an additional effort to secure trust and commitment across both the organisations and make the co-operation a success. The background of individuals (group diversity) supports or discourages the development of such social bonds.

5.2.3 Communication, task interdependence, and experience

Next to the social bond between the boundary spanning managers, communication emerged as key for the development of trust and commitment. Satisfactory communication is crucial for research co-operations because it reduces the high degree of uncertainty in such projects and strengthens the level of interpersonal and inter-organisational trust (Siegel et al., 2004). In this study, co-operations where communication was perceived as unsatisfactory were always characterised by a lack of trust and were perceived as less successful.

However, frequency of communication is not synonymous with satisfaction with communication. A high frequency of communication is often the result of conflicts and a disturbed balance between trust and distrust (Ancona & Caldwell, 1992). The quality of communication is more important than its frequency. In this study co-operations with a certain degree of task interdependence were better able to secure satisfaction with communication. Task independence increases the depth of communication rather than the frequency (Wageman, 1995). To enable such task interdependence, the educational background of individuals at firms and CRIs must not be too diverse. If the diversity of

backgrounds is too wide, the partners will not speak the same language at meetings and misunderstandings are unavoidable, especially when issues arise.

A second factor which was confirmed to influence satisfaction with communication was experience. However, experience working with each other does not necessarily have to be positive as experience can be negative as well. In this context it was found that high staff fluctuations (team tenure) can 'reset' interpersonal relationships or even increase distrust in the co-operation. Additional moderating variables of experience which emerged in this study are the type of experience (task vs. group) and group diversity.

5.3 Implications for relationship marketing theory

Plewa, Quester et al. (2005) highlighted the need to look at relationships between companies which operate in fundamentally different organisational environments. Although a number of publications exist in this context (e.g. Daniel, et al., 2002; Mora-Valentin, et al., 2004; Plewa & Quester, 2007; Plewa, et al., 2005; Santoro & Bierly, 2006), research which looks at co-operations between research institutes and firms is limited. This study contributed to the development of relationship marketing theory by presenting empirical data from research co-operations between research institutes and firms in New Zealand. The environmental circumstances in New Zealand (small companies, remoteness from international markets) provide a unique context for the examination of research relationships.

However, this research did not only contribute empirical insights. By applying a case study methodology, additional concepts were incorporated into the research based on RM concepts. Most noticeably the concepts of group diversity and the multidimensionality of trust emerged, providing valuable additional insights. Diversity research is mostly applied in intra-firm work groups (Jehn, et al., 1999). However, co-operations between New Zealand industry and CRIs are very close. Firms often perceive the CRIs as a kind of R&D department of New Zealand with which intra-organisational work groups are formed. Therefore, diversity research is in such a context as applicable as it is in intra-

firm relationships. It was also highlight that trust is multidimensional (Lewicki, et al., 1998). Trust and distrust can co-exist in the same relationship without distrust having a negative impact on the co-operation outcome.

5.4 Implications for policy makers and practice

The New Zealand innovation system is reviewed quite regularly, most recently by the Crown Research Institute Taskforce report (MoRST, 2010). It is often argued that the New Zealand innovation system has flaws and needs improving (e.g. OECD, 2007; MoRST, 2010). This study contributes to this discussion, and implications arising from this research for private sector managers and public sectors analysts are discussed below.

5.4.1 Implications for private sector managers

A variety of implications arise from this research for firms and CRIs in New Zealand who are currently involved in research co-operations or aiming to become engaged in research co-operations in the near future.

First of all, a certain degree of distrust on the side of the firm can have a positive impact on the co-operation because distrusting firms are more involved in the co-operation. However, trust and distrust must be managed by means of good project management. Specifically, care should be taken that areas of distrust (usually in the commercial part of the interactions) are separated from areas where trust is required (usually in technical interactions). If managed properly, distrust, perhaps counter-intuitively, actually helps build trust on a personal level, both commercially and scientifically.

Next to securing a good balance between trust and distrust, managers need to take care that all involved parties are satisfied with the level of communication. In this study, dissatisfaction with communication was synonymous with dissatisfaction with the overall outcome of a co-operation. Satisfaction with communication is best achieved by incorporating a certain degree of task interdependence into the co-operation. When such task interdependence does not exist or is only limited, the work of the CRI turns into a

'black box' which the commercial partner cannot assess. Increasing distrust in such a context is unavoidable and often results in the desire of the firm to 'over-communicate' in order to address the high degree of uncertainty. As this study further highlighted, such 'over-communication' is not necessarily positive for a co-operation because the quality of communication is more important than its frequency.

5.4.2 Implications for public sector policy analysts and managers

The fundamental assumption of the concept of National Innovation Systems is that the private firm is at the heart of the system and everything else should be designed around the requirements of the private firms (Lundvall, 1992a). However, the recent discussions and intended improvements of the New Zealand innovation system do not reflect that. The Minister of Research, Science and Technology in New Zealand, Wayne Mapp (2010) speaks of "changes aimed at ensuring New Zealand gets the best from its Crown Research Institutes" and not about "changes aimed at ensuring New Zealand firms get the best from our Crown Research Institutes". As this study highlighted, this lack of 'firm-focus' can lead to serious tensions in firm-CRI co-operations.

One possible way to address this issue and increase stakeholder awareness of firms being at the heart of the system would be the establishment of a ninth CRI, whose sole purpose would be to link CRIs' science outcomes to private firms. Separating the commercialisation component of the business from the direct influence of the research institutes is not unusual and can be found, for instance, in Germany (Keck, 1993). Such a measure might reduce current issues within the commercial part of the co-operations and strengthen the positions of firms in the New Zealand innovation system.

5.5 Limitations

This research addressed a common limitation in the literature by conducting case study research, with the actual research co-operation being the unit of analysis rather than individuals. However, the sensitive nature of research co-operations and the accompanying desire for confidentiality limited the number of cases that could be

assessed. Although four cases are sufficient for the chosen methodology (Yin, 2009) two or three more cases would have provided more robust findings. In addition, the number of formal interviews conducted per case (2-3) limits the objectivity of the findings as they might be biased by the personal opinions of interviewees. Findings based on four to six interviews would have been more robust.

These limitations notwithstanding, the chosen research approach is still a significant improvement in comparison with existing research which often collects data from only one of the collaboration partners. The collection of data from both co-operation partners within the context of the same research co-operation enabled new insights into the matter.

5.6 Further research directions

This study contributes to discussion of the New Zealand Innovation System by having proposed critical success factors for research co-operations between firms and CRIs. However, more research is needed to further increase understanding of the relationship between firms and research institutes. A thorough understanding of this linkage is crucial in order to improve the New Zealand innovation system.

One possible approach for future research would be to conduct a single in-depth case study of such a research co-operation. Because of the size of the research project in this study, more than ten individuals were contributing to the overall project. In-depth interviews with all of these individuals could potentially provide interesting insights into the dynamics of such co-operations. Specifically, more insights into the co-existence of trust and distrust in different part of the co-operation might be gained.

Following on from that, the findings of this research could be disseminated to a wider population by means of a quantitative research approach. The cases for this research were carefully chosen to enable evaluation of the proposed model. However, to what extent themes identified are of concern for the majority of firms cooperating with CRIs needs to be researched.

Last but not least, future research might also replicate the research in a different setting. New Zealand industry is characterised by small and medium-sized enterprises that often place little emphasis on research. Findings might differ in countries with a more pro-active industry approach for research and development. Of interest would be to review such co-operations in Finland, for instance, whose innovation system is often seen as a model for New Zealand.

Overall, future research should further examine how private firms in New Zealand are linked to the innovation system and how this compares with other countries with successful innovation systems. By having a better understanding of this linkage in New Zealand more meaningful improvements can be made to the innovation system.

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Appendices

Appendix A

Interview guides firms

Questions about background

- Briefly describe your position at (Firm).
- How well do you know the CRIs?
  (Culture, vision, people there etc.?)
- How well do you know CRI/A?
  (Culture, vision, people there etc.?)

Questions about research objectives

- Please describe the project with CRI/A. What were the objectives of both the partners in this project?
- How successful was the research co-operation with CRI/A (for CRI/A respectively for Firm?)
- CRI/A and their scientists need publications to maintain science leadership. Does this matter for Firm?
- How do you feel about the fact that the project can be successful for CRI/A (achieved publication) but not for the industrial partner?
- What are the consequences of this project for future co-operations with CRI/A?

Questions about uncertainty

- Was it risky for Firm to collaborate with CRI/A on that project?
- Does Firm has the knowledge (expertise) to evaluate the service CRI/A provided? (Science that can lead to innovation)
- Does CRI/A have enough knowledge in the area of science required by Firm?

Questions about commitment

- How was the task sharing between Firm and CRI/A? Who did what?

- What resources did CRI/A & Firm contribute to the research projects?
- Did you disagree with anything in this context?
  (Any issues regarding task sharing?)

Questions about communication

- How many people were included in the research co-operation and how did they exchange information? (On the different levels)
- Who was Project Manager and how do you judge his leadership skills?
- Which relationship do you consider the most important to make this project a success? (What were the reasons that this project failed?)
- How often and by what means did you communicate with your contact?
- How did communication go on the other levels?
- Can you think of ways to improve communication?

Questions about trust

- How would you describe the level of trust in this co-operation?
  (On the different levels: science, management etc.)
- How important were specific individuals in making this co-operation work (science level vs. management level?
- What about organisational trust?
  (How is CRI/A perceived as an organisation?)
- What do you think about CRI/A in general?
- How important was the contract in the co-operation with CRI/A? Just a formality or more than that?
- Have you experienced any conflicts during the co-operation with CRI/A?
- How were these conflicts managed?
- What could CRI/A has done better in the collaboration with Firm?
- What can CRI/A generally do better when collaborating with New Zealand Firms?
- What could Firm have done better?

- What do you think were the main reasons for the (un)successful co-operation between CRI/A and Firm?

Interview guide CRI/A

Questions about background

- Briefly describe your position at CRI/A
- Do you usually work on commercial projects or is this project an exception?
- How well do you know the New Zealand industry sector?
  (Company culture, vision, people there etc.?)
- How well do you know Firm?
  (Company culture, vision, people there etc.?)

Questions about research objectives

- Please describe the project with Firm. What were the objectives of both the partners in this project?
- How successful was the research co-operation, for CRI/A respectively for Firm.
- Did you have any personal goals from this co-operation?
- Do you think it's problematic that a project can be successful for CRI/A, but not for the industrial partner?
- What are the consequences of the failure/success of this project for future co-operations with Firm?
- Are you (personally) interested in future research projects with Firm? Please comment.

Questions about uncertainty

- Was it risky for Firm to collaborate with CRI/A?
- Does Firm has the knowledge (expertise) to evaluate the service CRI/A provided? (Science that can lead to innovation)
- Does CRI/A have enough knowledge in the area required by Firm?

Questions about commitment

- How was the task sharing between Firm and CRI/A? Who did what?
- What resources did CRI/A & Firm contribute to the research projects?
- Did you disagree with anything in this context?
  (Any issues regarding task sharing?)

Questions about communication

- How many people were included in the research co-operation and how did they exchange information? (On the different levels)
- Who was Project Manager and how do you judge his leadership skills?
- Which relationship do you consider the most important to make this project a success?
- How often and by what means did you communicate with your contact?
- Can you think of ways to improve communication?
  (Any particular issues?)
- How did communication go on the other levels?

Questions about trust

- How would you describe the level of trust in this co-operation?
  (On the different levels: science, management etc.)
- How important were individuals in making this co-operation work? (Science level vs. management level)
- What about organisational trust?
  (How is CRI/A perceived as an organisation by Firm?)
- What do you think about Firm?
- How important was a contract in the co-operation with Firm? Just a formality or more than that?
- How were conflicts managed?
- What could CRI/A had done better in the collaboration with Firm?
- What can CRI/A generally do better when collaborating with New Zealand firms?
- What could Firm have done better?

Appendix B

Description Case I

Firm/A is owned by a private equity firm and belongs to the New Zealand top 500 list of companies. It operates in a niche market and sells intermediaries in a business-to-business context. The company has a strong international focus; more than 95% of its products are being sold outside of New Zealand.

For the next decade the company anticipates a dynamic growth with exceeding a turnover of NZ$100 million a year. Firm/A is a highly research-driven and innovative organisation and emphasises research and development as key for future growth and success.

To achieve their expectations, a small in-house R&D team of around ten scientists and technicians was established over the years. To complement this in-house resource and be able to compete internationally, the company engages in external co-operations which are mainly with CRIs. CRIs are appreciated as the R&D department of New Zealand.

Amongst all the co-operations the company is engaged in, the one with CRI/A is considered special because it has enabled the company to develop new expertise and significant expansion of the business in the past.

Originally, the co-operation with CRI/A was fostered because of the outstanding expertise of the CRI in the required research field. The co-operation with CRI/A promised significant future expansion possibilities because of the new expertise it would bring into the company.

The co-operation between Firm/A and CRI/A is a strategic one and the relationship has existed for more than 20 years. Originally, the co-operation began with a licensing agreement between the organisations and the relationship has grown in intensity since

then. The co-operation is perceived as successful by both parties mainly because it offered Firm/A a significant expansion of its business.

Description Case II

Firm/B is a small, privately-owned New Zealand consumer goods company with around 80 staff in the country. Most of the company's production facilities and staff are located in New Zealand; however, the company employs some staff outside its home country, mainly in Australia and the UK. In addition to domestic success, the company is committed to exports and markets its products internationally, with a focus on the European and Asian continents.

During the first decade of the new millennium, the company recorded a significant increase in turnover, which is based on products with a clear customer value proposition. The unique selling proposition of its products is built around the unique flora of New Zealand. An additional pillar of the company's philosophy is to carry out its business in an ecologically friendly and sustainable fashion.

The success of the company was initially based on the R&D achievements of its founder. However, the company subsequently established a small R&D team with four full-time staff members. The knowledge produced in-house was then protected by means of secrecy. As a consequence, for many years it was not in the interest of the company to engage in external research co-operations.

However, the in-house expertise was not enough to secure future growth through new product development. Because of the small size of the company and limited financial opportunities, the development of this expertise internally was not an option. To overcome this limitation and remain internationally competitive, Firm/B was looking for an external partner that could provide the scientific expertise required.

In looking for such a partner, it was very important to Firm/B that they co-operate with an organisation they can trust. As mentioned above, know-how is mainly protected by means of secrecy, and collaborating with a Crown Research Institute provided a kind of reassurance that this secrecy was warranted.

The actual research project was well-organised, both in commercial and scientific terms. The co-operation continued for around four years and at the end of the project both partners agreed that the research objectives had been achieved. These research objectives were to discover ingredients with a competitive edge (price and benefit) which could fuel the future product pipelines of Firm/B.

Description Case III

Firm/C is a small New Zealand-based consultancy that provides business development services to a national and international customer base. Its customers are found within the private as well as the public sector.

The company possesses a high level of business expertise, as well as some technical expertise in their field. In addition to its in-house capabilities, Firm/C engages in external co-operations to complement its in-house capabilities and provide a better offering to the market. The most important of these co-operations is with CRI/A.

Originally, the co-operation developed out of a joint bid for governmental funding. However, Firm/C did not approach CRI/A by choice; rather the co-operation was requested by the funding agency, which had competing applications from CRI/A and Firm/C. Both organisations were applying for the same funding – CRI/A on its own and Firm/C in co-operation with a third CRI.

The co-operation is a long-term project which has lasted for over six years. As mentioned above, the project is subsidised by the Government and funding has been granted for at least another four years.

The project is divided into two separate work streams: a technical work stream and a business development and commercialisation work stream. Although when reporting to Firm/C on technical progress, CRI/A is solely responsible for the technical work stream. Both partners are jointly considering the business development and commercialisation aspect of this co-operation.

Originally the project was perceived as successful, but dissatisfaction grew throughout its course and the project is viewed less positively now.

Description Case IV

Firm/D is a small manufacturing company that employs around 30 staff. The company operates in a business-to-business context and is internationally successful. In recent years the company achieved a significant growth of around 25% per annum and has ambitious objectives for the future.

The growth strategy of the company is based on innovation and new product developments. Because of its small size, external co-operations are seen as essential for future success and growth. Firm/D maintains four external research co-operations, of which the one with CRI/A is considered the most important.

The relationship between the two organisations is reasonably longstanding, around 15 years in total. Lacking in-house R&D facilities, Firm/D significantly benefits from technology licensed from CRI/A, which is perceived as a kind of R&D department for Firm/D. Over the years the co-operation has grown in intensity and moved from a fee-for-service agreement to the co-funding of research carried out at CIR/A.

Although originally the relationship was harmonious, with the increasing complexity of the co-operation tensions have increased. Currently Firm/D is less satisfied with the co-operation and the future of the co-operation is in doubt.

Appendix C

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

HUMAN ETHICS COMMITTEE

Application for Approval of Research Projects

Please email Pipitea (Faculty of Commerce and Administration and Faculty of Law) applications to your supervisor who will then email it to a Pipitea HEC member for a preliminary review.

Note: The Pipitea Human Ethics Committee attempts to have all applications approved within three weeks but a longer period may be necessary if applications require revision.

1 NATURE OF PROPOSED RESEARCH:

(a) Student Research

(b) Degree MCA Course Code: MARK591

(c) Project Title: Critical success factors for research collaborations between firms and research institutes in New Zealand

2 INVESTIGATORS:

(a) Principal Investigator

Name: Stefan Celeski

E-mail address: stefan.celeski@vuw.ac.nz

School/Dept/Group: School of Marketing and International Business

(b) Other Researchers: Nil

(c) Supervisor: Peter Thirkell

3 DURATION OF RESEARCH

(a) Proposed starting date for data collection: June / July

(b) Proposed date of completion of project as a whole: February 28th, 2011

4 PROPOSED SOURCE/S OF FUNDING AND OTHER ETHICAL CONSIDERATIONS

(a) Sources of funding for the project: **N**

(b) Is any professional code of ethics to be followed **N**
If yes, name

(c) Is ethical approval required from any other body **N**
If yes, name and indicate when/if approval will be given

5 DETAILS OF PROJECT

Briefly Outline:

(a) The objectives of the project

Globalisation, fast technology change and shorter product life-cycles have increased the pressure for companies to introduce more radical product innovations to market (Etzkowitz, Webster, & Healey, 1998). This market need for radical innovations can't be addressed by a single company's in-house R&D facility, rather partnering and research collaborations are necessary. As stated by Burnisde and Witkin (2008, p.27): "The 'go-it-alone' approach to innovation and development is no longer valid. Today the complexity of problems and the need for multidisciplinary approaches requires interaction, the flow of ideas and knowledge exchange".

One interface of such knowledge transfer is between firms and research organisations. However, fundamental differences in value creation among these two partners often made such collaborations difficult and led to a vast number of research papers which aimed to explore the critical success factors of such collaborations (e.g. Santoro, Bierly, 2006; Betts and Santoro, 2009; Plewa and Quester, 2005; Plewa and Quester, 2007, Philbin, 2008).

The vast majority of these papers are in the context of partnerships between firms and universities. This can be explained with the traditionally strong firm-university linkages in North America (Mowery & Rosenberg, 1993). However, in many European countries such as Germany (Keck, 1993) or France (Chesnais, 1993) or outside Europe in New Zealand (OECD, 2007), governmental research institutes play a significant role in the National Innovation Systems.

This research project is addressing this gap in the literature by looking at collaborations between governmental research institutes and firms. Specifically, it looks at critical success factors for research collaborations between firms and one of New Zealand's Crown Research Institutes.

(b) Method of data collection

Date collection will mainly be based on in-depth interviews with team members of research projects between New Zealand firms and Crown Research Institutes. Interviews will be conducted with around 10-15 individuals and last between 60 - 90 minutes (refer to the Interview Guide in Appendix A). The interviews will be administered by the researcher listed above. They will be voice-recorded for analysis at a later date. Each participant will be briefed about the study, and their rights as research participants. This will be done both verbally and in writing (refer to the participant information sheet – Appendix B). Participants will be assured of their confidentiality throughout the study, and their names will be changed to protect their identity. Only the researcher and supervisor will have access to the data. This information is contained on the participation information sheet. Participants will also be able to withdraw from the study at any time, no questions asked, without any disadvantage to them. Recording will only begin once everyone has read the information sheet, been given the opportunity to ask questions and have them answered, and signed the consent forms. Interviews will be conducted at the working place of the participants.

(c) The benefits and scientific value of the project

The study will contribute to Relationship Marketing (RM) by testing existing theory in the context of research collaborations in New Zealand (firm-research institute). Current findings in this context are mainly based on firm-firm or firm -university collaborations. From an applied point of view, this study will underline critical success factors for research collaborations and enable best practice.

(d) Characteristics of the participants

10-15 participants will be interviewed. Participants will be 18 years of age and over, male and female, and work for the Crown Research Institute supporting this study or the partnering firm.

(e) Method of recruitment

A CRI business development manager is providing assistance in contacting the required employees.

(f) Payments that are to be made/expenses to be reimbursed to participants

None

(g) Other assistance (e.g. meals, transport) that is to be given to participants

None

(h) Any special hazards and/or inconvenience (including deception) that participants will encounter

There are no foreseeable risks to the participants. In the event that the line of questioning does develop in such a way that a participant feels hesitant or uncomfortable, he or she will be reminded of their rights to decline to answer any particular question(s), and that he or she can choose to withdraw from the project before 1st September 2010 without any disadvantage to him- or herself of any kind.

(i) State whether consent is for (delete where not applicable):

(i)	The collection of data	**Y**
(ii)	Attribution of opinions or information	**N**
(iii)	Release of data to others	**N**
(iv)	Use for a conference report or a publication	**Y**
(v)	Use for some particular purpose (specify)	**N**

Attach a copy of any questionnaire or interview schedule to the application (see Appendix A)

(j) How is informed consent to be obtained (see sections 4.1, 4.5(d) and 4.8(g) of the Human Ethics Policy)

(i) The research is strictly <u>anonymous</u>, an information sheet is supplied and informed consent is implied by voluntary participation in filling out a questionnaire for example (include a copy of the information sheet) **N**

(ii) The research is <u>not anonymous</u> but is confidential and informed consent will be obtained through a signed consent form (include a copy of the consent form and information sheet) **Y**

This research is not anonymous but participants are assured of their anonymity as their names will be changed, and any information traceable to them will not be included in any publications and/or reports, and confidentiality will be

maintained throughout the study. Informed consent will be obtained in writing (refer to Appendix C) after the participant has been briefed in person, and provided with a participant information sheet (refer to Appendix B). The participant will also be given the opportunity to ask questions and have them answered. His or her rights will be fully explained to them during this process. Once again, names will also be changed and any information that is traceable to the participant will not be contained in any write up and subsequent reports or publications.

(iii) The research is neither anonymous nor confidential and informed consent will be obtained through a signed consent form (include a copy of the consent form and information sheet) **N**

(iv) Informed consent will be obtained by some other method (please specify and provide details) **N**

With the exception of anonymous research as in (i), if it is proposed that written consent will not be obtained, please explain why **N**

(k)If the research will not be conducted on a strictly anonymous basis, state how issues of confidentiality of participants are to be ensured if this is intended. (See section 41(e) of the Human Ethics Policy). (e.g. who will listen to tapes, see questionnaires or have access to data). Please ensure that you distinguish clearly between anonymity and confidentiality. Indicate which of these are applicable.

(i) Access to the research data will be restricted to the investigator **N**

(ii) Access to the research data will be restricted to the investigator and their supervisor (student research) **Y**

Participants are assured of confidentiality both verbally and in writing (refer to the Appendix B & C). They will be informed that only the investigator and the supervisor will have access to any data that is traceable to them.

(iii) All opinions and data will be reported in aggregated form in such a way that individual persons or organisations are not identifiable **N**

Results of this project may be published but any data included will in no way be linked to any specific participant or their organisations. Synonyms for participating individuals and participating will be used in any written document.

(iv) Other (please specify) **N**

(l) Procedure for the storage of, access to and disposal of data, both during and at the conclusion of the research. (see section 4.12 of the Human Ethics Policy). Indicate which are applicable:

(i) All written material (questionnaires, interview notes, etc) will be kept in a locked file and access is restricted to the investigator and supervisor.
Y

(ii) All electronic information will be kept in a password-protected file and access will be restricted to the investigator and supervisor.
Y

(iii) All questionnaires, interview notes and similar materials will be destroyed:

(a) at the conclusion of the research **N**

or (b) **Two** years after the conclusion of the research **Y**

(iv) Any audio or video recordings will be returned to participants and/or electronically wiped **N**

The researcher and supervisor are the only people who will have access to the data. The data, including electronic recordings, will be stored in a locked cabinet at the School of Marketing and International Business. Participants are assured of anonymity and confidentiality both verbally and in writing. Results of this project may be published but any data included will in no way be linked to any specific individual. At the end of the project any personal information collected will be destroyed immediately, and any raw data on which the results of the project depend will be retained in secure storage for two years, after which time it will be destroyed.

(m) Feedback procedures (See section 7 of Appendix 1 of the Human Ethics Policy). You should indicate whether feedback will be provided to participants and in what form. If feedback will not be given, indicate the reasons why.

If the participants would like feedback on the final results, they can provide their contact details on the consent form, and a written summary of the aggregate findings will be provided to the participants at the end of the project. This information is also contained on the Participant Information Sheet. However, the summary will not contain any information that is traceable to individuals. Participants will be informed of this both verbally and in writing, at the start of the interview.

(n) Reporting and publication of results. Please indicate which of the following are appropriate. The proposed form of publications should be indicated on the information sheet and/or consent form.

(i) Publication in academic or professional journals **Y**
(ii) Dissemination at academic or professional conferences **Y**
(iii) Deposit of the research paper or thesis in the University Library (student research) **Y**
(iv) Other (please specify) **N**

Signature of investigators as listed on page 1 **(including supervisors) and Head of School.**

NB: <u>All investigators and the Head of School must sign before an application receives confirmed approval</u>

…… Date…….

…… Date…….

…… Date…….

Supervisors:

…… Date…….

…… Date…….

Head of School:

……. Date ……

Appendix D

VICTORIA UNIVERSITY OF WELLINGTON

Te Whare Wānanga o te Ūpoko o te Ika a Māui

School of Marketing and International Business

PARTICIPANT INFORMATION SHEET

Critical success factors for research collaborations between firms and research institutes in New Zealand

Masters Student: Stefan Celeski
Supervisor: Dr. Peter Thirkell

WHAT IS THIS INFORMATION SHEET FOR?

This study has been approved by Victoria University's Human Ethics Committee. This information sheet is to respect and acknowledge your rights, and to provide you with information about the research.

WHY IS THIS RESEARCH BEING DONE?

This research is being conducted as part of a Marketing Masters degree at Victoria University of Wellington. It will be compiled into a thesis which will be presented to the University.

WHAT IS THE PURPOSE OF THIS STUDY?

This study is concerned with establishing the critical success factors for research collaborations between New Zealand firms and research institutes. By identifying these factors the research project aims to improve the understanding of successful practice within these relationships.

WHY WERE YOU CONCTACTED TO PARTICIPATE IN THIS RESEARCH?

The individuals to be interviewed for this study were chosen in consultation with one of the business development managers at the CRI participating in this research.

WHAT WILL YOUR ROLE AND RESPONSIBILITIES BE IF YOU TAKE PART IN THE STUDY?

Participation from you would involve being interviewed by me once, at a time that would be convenient to you. The audio taped interview would take approximately 60 to 90 minutes but will only begin with your consent, and it can be terminated at any time.

WHAT WILL HAPPEN TO THE INFORMATION YOU GIVE?

This research is completely confidential. Your name will not be used in the study and any information will be reported in an aggregated form, not traceable to you. The voice recordings will be reviewed by the researcher and the supervisor for the sole purpose of this research, and will be securely stored in a locked cabinet at Victoria University.

The raw data will be kept for two years upon the completion of the research project before being destroyed. The Master thesis will be deposited in the library of Victoria University of Wellington and parts of it may be published in academic journals, and/or conference papers but your name will have been changed and a pseudonym will be used. No identifiable information which is traceable to you will be included. If you would like a written summary of the study at the end of the project, please provide your contact details on the consent form. However, you can be reassured that the written summary would not contain any information that is traceable to you or any of the other participants.

CAN YOU WITHDRAW FROM THE RESEARCH?

You can withdraw from the study at any time before the 1st of October. Any information traceable to you would be destroyed or returned to you, and confidentiality would be maintained at all times.

IF I HAVE ANY QUESTIONS OR PROBLEMS, WHO CAN I CONTACT?

STUDENT:
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Marketing Masters Student
Victoria University
School of Marketing & International Business
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stefan.celeski@vuw.ac.nz

SUPERVISOR:
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Professor
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Appendix E

VICTORIA UNIVERSITY OF WELLINGTON

Te Whare Wānanga o te Ūpoko o te Ika a Māui

School of Marketing and International Business

CONSENT TO PARTICIPATE IN RESEARCH

Critical success factors for research collaborations between firms and research institutes in New Zealand

Please tick the relevant boxes before signing

☐ "I have been provided with adequate information relating to the nature and objectives of this research project,"

☐ "I have understood this information and have been given the opportunity to seek further clarification or explanations,"

☐ "I understand that I can withdraw form the study at any time before the 1st of October,"

☐ "I understand that I will be participating in a taped interview",

☐ "I understand that the results may be published in academic journals, and/or conference papers but my name will have been changed and a pseudonym will be used. No identifiable information which is traceable to me will be included,"

☐ "I understand that the supervisor has access to the raw data",

☐ "I understand that when this research is completed the raw data will be kept for 2 years upon the completion of the dissertation before being destroyed,"

☐ "I would like a written summary of the study at the end of the project." My contact details are:

_____

(Please write your email address or postal address)

Participant's Name **Participant's signature**

_____ _____

(Please print clearly)

Date: