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Initiation and early stage relationship development of University- Industry innovation collaborations: a relationship marketing approach

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**Initiation and early stage relationship development of University-
Industry innovation collaborations: a relationship marketing approach**

A thesis submitted in partial fulfilment of the requirements for the award of the degree

DOCTOR OF PHILOSOPHY

from

UNIVERSITY OF WOLLONGONG

by

ADRIAN CHARLES TOOTELL, B.ENG (HONS)

SCHOOL OF MANAGEMENT, OPERATIONS AND MARKETING

2016

THESIS CERTIFICATION

I, Adrian Charles Tootell, hereby declare that this thesis, submitted in partial fulfilment of the requirements for the award of Doctor of Philosophy, in the School of Management, Operations and Marketing, University of Wollongong is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

Adrian Tootell

02 June 2016

ABSTRACT

With growing pressure from many governments for more productive relationships between universities and industry, their relationships and motivations have become a significant research area. Perkmann et al. (2013) have synthesised the literature in the area and developed a normative analytical framework for successful academic engagement between universities and industry. A gap in the literature identified by Perkmann et al. (2013) was the pathway for academic engagement was not well defined. It follows that a focus on understanding the most effective ways for university-industry innovation relationships to be initiated and developed through the early stages is essential for closing this research gap.

Deliberately taking a pro-active stance, this thesis examines the proposition that universities can take the lead and drive research relationships with industry, in effect becoming the nexus point of collaboration networks for innovation projects. To do so the drivers and roadblocks to relationship initiation and early stage continuation are examined by using data collected from 36 respondents, with experience as university academics, industry collaborators and experienced intermediaries mainly from Australia. The participants were associated with academic engagement activities organised by the Australian Research Council Centre of Excellence for Electromaterials Science which encompasses diverse technologies with a wide range of complexity. The use of semi-structured in-depth interviews allowed for the lived experience of key actors to be explored and captured as they evaluated entry into new innovation projects. NVivo® was used to analyse their insights.

By exploring the potential of universities to act as the nexus point of such relationships this thesis shows that the most appropriate approach is a relationship marketing one which draws heavily from both social exchange theory and social penetration theory. These theories are heavily based on trust and its development between key actors in relationships. The findings in this thesis highlight how important trust actually is in such a high risk, uncertain and complex environment where new technologies are being developed with the intent to apply them commercially. The key concept that underpins all of the others is the importance of interpersonal trust development. University-industry relationships that move beyond the initiation and exploration stage (pre-linkage) are clearly based on a foundation of interpersonal trust

where the goal is to gather enough social data through face-to-face communication to determine whether or not the relationship is worth pursuing.

Therefore, the key finding of this thesis is that there is a lack of appreciation within the literature and most universities of the business development type skills necessary to effectively initiate and develop effective relationships. The discovery of the presence of Principled Nexus Behaviour (PNB) a major contribution. Interpersonal trust development needs to be supported and managed carefully by the university if it is to take a lead role in these innovation relationships.

This thesis contributes to the literature from a managerial perspective by supporting the research of Plewa et al. (2013) and Galán-Muros et al. (2016) that academic engagement with industry is driven by relationship marketing type activities which are all underpinned by interpersonal trust development, while this seems obvious to those with commercialisation experience, it is often neglected and unappreciated from the university side. This basic failing is a contributor as to why this thesis argues that they cannot perform a nexus role without a significant change in structure, approach and attitude.

Specifically addressing the need for a practical yet theoretically sound model to capture the highlighted importance of trust in the initial and early stages of a relationship, Ruekert's (1987) model which is based on marketing interactions with functions within organisations is surprisingly adaptable to the university-industry context. Contributing theoretically, a reconceptualised model was developed to capture the innovation nexus (university driven) and the underlying importance of trust and how it leads to principled behaviour which is evident in all successful university-industry relationships.

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The path to completing this thesis has been both a challenge and an adventure. So many life experiences have become entangled with the study on this journey that unravelling them in a page seems impossible. I wish to thank my wonderful wife Holly, she has been a rock of support throughout this journey through encouragement when hurdles were faced and by distracting our wonderful children who numbered one at the start and now sum four. Thankyou Sarah, Emma, Bella and Daniel for being patient while I completed this study. You have all been little angels. To our friends and family who have supported us, I am grateful for the love and friendship shown to our family; Especially my parents Bob and Lyn; in-laws Stuart and Kris (dec.); the Grants, Sutinens, Elmers, Carrs, and Grices.

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1 INTRODUCTION

There's a misconception that universities are the answer for everything, which is so far away from the truth (Intermediary Participant 25).

The purpose of this study is to examine the relationships between universities and their industry partners from a relationship perspective. In an age of 3D printing, the internet, open collaboration and the expectation government has for universities to maximise the commercial outcome of their innovations, this study examines how universities can take a proactive approach to initiating and maintaining these relationships with individual firms while having a trust-based relationship network. In contrast to the numerous studies that have examined long-term, highly-formalised relationships between large companies and universities with structures such as Cooperative Research Centres (CRCs), the focus of this thesis is on how universities engage with small and medium sized enterprises and develop relationships which will form valuable networks, with the university and its employees acting as the nexus.

This research draws heavily on the trust perspective from the relationship marketing approach to business-to-business relationships. In particular, a communication approach to developing trust is central to explaining how such relationships are initiated and maintained in the early stage of their existence.

1.1 Relationship marketing approach to innovation

An organisation response to a changing environment centres around its ability to adopt technological advances that are the outcome of innovation. The key

stakeholders in this process are universities and industry. Universities are the incubator for new ideas, employing over 90% of Nobel Prize winners. Industry is the driving force for commercialisation with control of over 90% of patents (Agrawal et al., 2002; Nobelprize.org, 2017).

The relevance of university-industry relationships in the innovation cycle is in the spot light with industry distracted by the impact of financial disruption and a focus on risk minimisation. Governments are seeking a rebalancing of the relationship with universities, which is expected to provide higher levels of leadership. Universities have been shown to proactively participate with industry through a framework known as academic engagement. Academic engagement comes in many different forms and has been shown to be affected by many factors. It contributes to society through scientific, educational and commercial output (Perkmann et al., 2013).

In this research, the focus on academic engagement is from the perspective of how individual academics interact with intermediaries and industry when initiating relationships to deliver on projects with commercial outcomes. The individual and organisational and factors that impact commercial outcomes have been heavily investigated empirically while the social exchanges have received little attention.

Innovation between universities and industry from a relationship marketing perspective had not been explored prior to a qualitative study was undertaken by Plewa et al. (2005). This qualitative study led to the development of a conceptual framework where relationship management was used to describe value drivers that universities and industry could use to overcome differences in the organisational environment. Although relationship management was found to have a positive effect, this study was limited by the small sample size and scope. An example of the role of relationship

development in innovation was illustrated by the improved levels of innovation experienced in the commercialisation of new biotechnologies (Daniel et al., 2011).

Since Henry Ford, a corporate manufacturing organisation has been best positioned to control the development of new products, however, recently the leading product developer role has become competitive between specialist manufacturing and collaborative organisations as well as individuals (Baldwin et al., 2011). Key enablers for competition between organisation types result from significant cost reductions in product design and communication. Examples of this include the development of rapid prototyping, advanced manufacturing and easier mass communication tools such as email and social media.

Despite the knowledge that exists in the academic engagement literature, organisations have difficulty translating new knowledge from universities into viable commercial products. An example of this phenomenon exists in organisations in Australia where the universities are highly ranked in the world for research output but are lowly ranked for translating that knowledge into commercialised products (Bucolo et al., 2014). The poor performance of commercialisation translating science into new products can be attributed to a lack of effectiveness in the current transactions and relationships that exist between universities and industry. This means that new relationships need to be formed between individuals working in universities and industry for an improvement to occur. These new relationships may be between people who have never met before, those who have had bad experiences in the past or a revisiting of existing relationships.

Global challenges that rely on science transformation into technology used by business include energy security, advanced manufacturing and biotechnology. As these challenges are identified as potential future industries for Australia, research into

creating new relationships should include people working on innovation products in these areas (Commonwealth of Australia, 2012). The key drivers and roadblocks that individuals come across when working on innovation projects can provide insights into improving the effectiveness and possible the efficiency of forming new innovation teams to deliver new commercialised products.

These insights also have the potential to enlighten policy makers on the appropriate leadership roles that should exist to drive innovation. The nexus for product development has resided with corporate manufacturers who have controlled the market, manufacturing and design elements by taking responsibility for the financing required to mass produce the products. Recently, however industry is wanting universities to be proactive in engagement and more aligned with their interests.

A nexus can be defined as either an endeavour undertaken by an organisational, individual or mixture of both. Shane (2003) relates entrepreneurship to the individual opportunity, while stakeholder agency relates the nexus to the organisation and/or party who has the power to control and lead the process (Hill et al., 1992). In this research, the focus is on the organisation that is in control of leading the process. It is expected that individual nexus characteristics will be uncovered through the insights provided by informants on drivers and roadblocks to relationship development.

The changes in the balance of the relationship expected by governments and industry as well as the possible change in nexus from reductions in design and communication costs creates a need to form an understanding if and/or how new communication technology, such as social media, is used by those involved in the creation of new working relationships between universities and industry.

1.2 Research propositions

The purpose of this research is to understand the drivers and roadblocks to the initial and early stage development of innovation relationships to address the research gap relating to how best to initiate and develop university-industry relationships. The purpose also includes assessing if the university can be placed as the nexus point of the collaboration network with innovative manufacturers by exploring the research gap of academics relationship marketing when involved in academic engagement.

The challenge is how to engage from both perspectives: how does an organisation, which has no existing relationship with a university, start a relationship, and how does a university reach out to the broader community.

The following three propositions are the primary and secondary research objectives that are formed from the gaps in the literature, identified in Chapter 2, and the methodology in Chapter 3.

P1) Determine drivers and roadblocks to relationship development between university and industry by interviewing key stakeholders.

P2) Universities can become a nexus point for university-industry partnerships through using a proactive relationship marketing approach during initial relationship phases.

P3) Social media is used during the initial stages of relationship development.

1.3 Thesis Structure

Chapter 2: Provides a review of the literature and discusses the complex aspects of university-industry relationships to produce a thematic summary of research gaps.

Chapter 3: Theoretical models are reviewed and developed by the author to provide an initial relationship marketing lens to interpret the experiences of actors involved in university-industry relationships.

Chapter 4: Provides an explanation of the research design and methodology used to analyse the experiences of actors interviewed.

Chapters 5 and 6: The roadblocks and drivers that were the results of the thematic analysis of interview content through a relationship marketing lens, focused on the initial and early stage relationship development.

Chapter 7: A discussion explaining the results from a relationship marketing perspective and highlighting the theoretical and managerial implications of the findings.

Chapter 8: The conclusion of the findings from the research acknowledging the limitations inherent with the approach taken to study the topic and suggestions for further work on the topic based on the findings.

2 LITERATURE REVIEW

The commercialisation of products relies on the integration of core activities which include the design of products and an understanding of the market need. In addition to in-house design, industry often utilises university-industry relationships to transfer knowledge for competitive advantage and the optimisation of products for their market (Hagedoorn et al., 2000). This literature review examines the university perspective of commercialising products, and in particular the early stages of initiating projects known as academic engagement. It also reviews the industry driven perspective of co-operative new product development with universities. The literature review systematises six broad existing bodies of literature which inform the topic. The overview includes:

- 1) the nature and complexity of university-industry relationships,
- 2) the motivation for university-industry relationships,
- 3) successful university-industry relationships,
- 4) university-industry actor experience,
- 5) relationship evolution and
- 6) stakeholders.

The general focus of this review is to capture the nature of working relationships between academics and industry participants, regardless of the context. To best represent the areas of review, the relationship between the research streams are shown in Figure 2.1, indicating that there are areas where they naturally overlap and need to be disentangled prior to discerning the relevant factors and pursuing some of the implications.

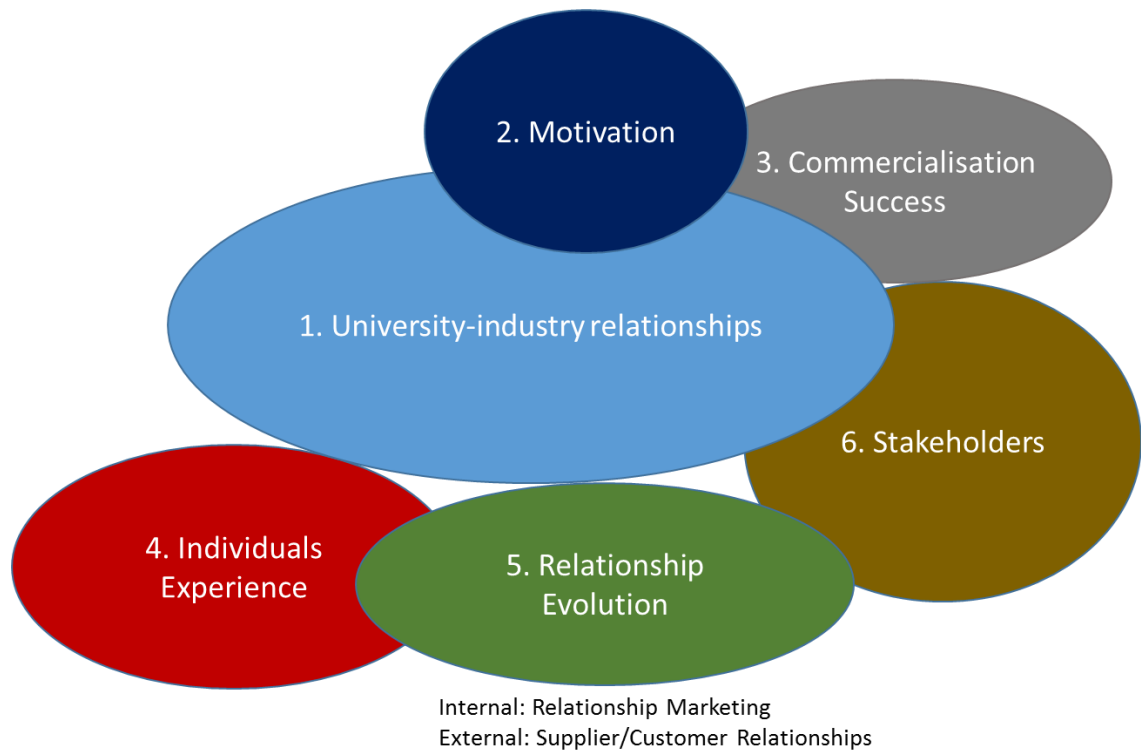


Figure 2.1 Inter-relationship of literature streams that inform the topic.

2.1 The nature and complexity of university-industry relationships

The expectations behind what, why and how these relationships exist has been a focal point for researchers in this field. Recently, a comprehensive literature review was undertaken by Perkmann et al. (2013) to analyse these studies within the context of academic engagement in the US and Europe. The outcome of their research argues that universities need to move out of traditional knowledge generation and teaching mode, into fostering links with knowledge users, and playing a facilitation role in technology transfer. It proposes that universities should not only focus on traditional commercialisation activities but also a new model of academic engagement (Perkmann et al., 2013).

Industry relationships

The most important types of university-industry relationships for this thesis relate to the creation of new relationships for innovation activities.. These new relationships are touched on by the entrepreneurship-university relationship literature. Shane (2003) develops a general theory of entrepreneurship which builds upon the concept of an individual-opportunity nexus by examining literature and empirical evidence. Of particular relevance to this research is the role of human agency in advancing entrepreneurship and the characterisation of psychological and non-psychological factors. These factors provide enlightenment on the type of people who are likely to participate and follow through on possible opportunities. An interesting point he highlights is the role of universities as a provider of trained graduates and post-graduate positions. The organisation is a contributor to the support of an individual's further education, which is a success characteristic of entrepreneurship. This is an important concept that supports individuals involved in university-industry relationships as a key for enhancing entrepreneurship for innovation.

The study of entrepreneurship and university interactions continued rapidly in the following years in both Europe and the US. Where Rothaermel et al. (2007) in a comprehensive review of 173 articles from a range of academic journals on university entrepreneurship was conducted. The review acknowledges the significant resources devoted to developing and understanding entrepreneurship and found four emerging major research streams including: entrepreneurially focussed university, the productivity of technology transfer offices, new firm spin-off creation and the context of the competitive business environment. Although an increased focus on entrepreneurship creates a university that is more receptive to the needs of industry, it

is not necessarily acting as the nexus which is the stakeholder that is the driving force behind commercialising the research.

The limited research of the role of industry actors in entrepreneurship is surprising in that actors from both sides of the university-industry partnership need to form good working relationships for innovations to become successful. More recently this critical aspect of successful working relationships has been given more weight in the academic engagement research of Perkmann et al. (2013).

The Perkmann review of academic engagement with industry

As can be seen, a systematic review of this topic was overdue. Perkmann et al. (2013) conducted the first systematic literature review of academic engagement. The aim was to determine if academic engagement and commercialisation were driven by the same factors. The research identified areas that require further research, and differences in the methodological approaches required to study academic engagement compared to those used for commercialisation. The analytical framework for academic engagement proposed by Perkmann et al (2013) provides insight into the inputs and outputs that academic engagement can produce, such as commercialisation of innovation.

In the Perkmann et al. (2013) model, the literature was grouped into individual, organisational and institutional factors. As can be seen, the relationship between the factors, have different levels of confidence based on the amount of research as illustrated by dotted and solid lines (Perkmann et al. (2013) made this assessment).

The individual factors influence academic engagement in different ways and have been summarised in Table 2.1. Examining this table, the findings from the research include: male academics are more likely to engage with industry; and that the effect of age is not clear. A training effect is proposed to explain the unknown age factor, and suggests that it could be dependent on the environment towards academic engagement that existed at that time, and therefore the training opportunities that took place. Previous collaboration experience of academics with industry positively affects their attitude towards industry projects. The organisational factors, driven by group-level norms, strongly moderate individual characteristics. If peers value awards and patents then academics are more likely to engage with industry.

One way to gain a deeper understanding of this topic is to compare the effects that individual, organisational and institutional antecedents have had on academic engagement and commercialisation. Perkmann et al. (2013) conducted a comparison that indicated where a positive, negative or ambiguous relationships, between factors exist (Table 2.1). It is interesting that most of the factors (72%) are ambiguous when related to impact on academic engagement, compared to only 40% on commercialisation. Also, only 22% of factors have the same impact on academic engagement as commercialisation. This data supports the need to have a clear, focussed suitable approach when investigating either academic engagement or commercialisation.

Table 2.1 Comparison between the factors that impact academic engagement and commercialisation, taken from Perkmann et al. (2013).

Variable	Engagement	Commercialisation
Individual determinants		
Male	+	+
Age	o	o
Seniority	+	o
Previous commercialisation experience	o	+
Grants awarded (government)	+	o
Contracts awarded (industry)	+	o
Scientific productivity	+	+
Organisational determinants		
Quality university / department	-	+
Organisational support	o	+
Incentive system	o	o
Organisational commercialisation experience	o	+
Peer effects	o	+
Institutional determinants		
Applied discipline	+	+
Life-science/biotech	o	+
Country-specific regulations/policy	o	+
Impact		
Scientific productivity	o	+
Commercial productivity	o	n/a
Shift towards applied research	o	o
Increased secrecy	o	+
Collaborative behaviour	+	+
Teaching	o	o

Note: The '+' and '-' signifies a positive and negative relationship. The 'o' signifies an ambiguous relationship. The variables highlighted in yellow signify known differences between academic engagement and commercialisation.

Perkmann et al. (2013) argues that the concept of academic engagement should be considered further, and notes that these relationships are found to be practiced more by academics than commercialisation. On an individual level, a correlation was found in most studies between engagement and government grants, as well as scientific studies. In comparison to commercialisation activities, it is more difficult to

distinguish correlations. Scientific output was found to be positively impacted by commercialisation while grants and contracts are less influenced, if at all.

Perkmann et al. (2013) provide key recommendations for future research most relevant for this thesis is the proposal that academic engagement requires distinct approaches to study it, especially considering that academic engagement utilises collaboration. Such collaboration needs to be studied within the context of how individuals initiate, build and maintain collaboration relationships between organisations.

Further important contributions by Perkmann et al. (2013) are the identification of gaps related to the lack of information for direct quantitative measures for successful university-industry working relationships which is examined further in Section 2.3. The resulting agenda for future research is as follows:

- 1) More research is needed on the organisational level and how it influences the characteristics of individuals. The study found that traditional technology transfer infrastructures do not play a significant role in fostering academic engagement. It is not clear what impact other organisational level factors such as centralised support mechanisms, department or research team characteristics have, if any,
- 2) The consequences and impacts of academic engagement on other academic deliverables such as research and educational outputs,

- 3) Research into the similarities and differences between academic engagement and commercialisation to further understand the mechanisms that drive each process,
- 4) Institutional aspects should be further explored to further understand the impact of factors such as organisations at different stages of economic development.

Perkmann et al. (2013) also focussed significantly on the key issues related to policy implications for universities and are captured below:

- 1) The analysis suggests a limited understanding of the impact of academic engagement activities. It is not clear if it is beneficial or detrimental to other activities that contribute to research and educational outputs. This information is important for policy makers to provide guidance that supports the delivery of all required outcomes.
- 2) Centralised technology offices are not associated with fostering academic engagement. It follows that different collaboration relationships and mechanisms may require different types of support and incentives. Since choices by individuals appear to be the main determinant for engagement with industry, it makes sense that policy makers should focus on providing some support around these relationships.
- 3) Firms need to also understand and be equipped to effectively participate in collaboration. The firms also need to be skilled in initiating and maintaining

collaborations to maximise the outcomes from these relationships. They need to understand that projects need to have an academic as well as a commercial benefit. Both parties need to understand the challenges facing other organisations and how to maximise the benefit for each.

- 4) The university is only one provider of technology to industry with the rise of polytechnics, national R&D laboratories and colleges. It is important to differentiate researchers who can provide value and engage with external organisations with those who have a traditional mind-set and provide individualised structures and rewards pertaining to their situation.

Summary: The research by Perkmann et al. (2013) is a foundation for this investigation of university-industry relationships and provides methodological considerations as well as gaps in the literature (Appendix A) where further research should focus. Key areas for further research that overlap with this study include the initiation and maintenance of relationships between university and industry actors and forming a mutual understanding of how projects can benefit both parties.

Commercialisation is explained as a part of the broader concept of academic engagement and is identified as unique to other academic engagement activities in its intention to protect knowledge for financial reward, often through founding an organisation or royalties (Perkmann et al., 2013).

Through research, academic engagement has evolved and characterised as inter-organisational collaboration, mostly as interactions between individuals, with goals that are broader than those usual for academic research. In this context, the

drivers for engagement can be separated into individual, organisational and institutional factors (Perkmann et al., 2013).

The antecedents for academic engagement have some similarity with the drivers. Individual characteristics, organisational and institutional context all contribute to create a potential for academic engagement to occur. Individual characteristics such as seniority, previous experience and scientific productivity have all been shown to have a positive impact. Likewise, an applied discipline is an institutional factor that has been shown to be beneficial.

Individual drivers have been well researched and relate to motivation and ability. They are key for university-industry relationships and are described in further detail in Section 2.2. Similarly, organisational factors such as leadership, department quality and support have been less researched while in contrast, the influence of institutional factors such as scientific discipline, have received more focus.

2.2 Motivation for university-industry relationships

A significant review of the literature exploring motivation for university-industry relationships was recently undertaken by Ankrah et al. (2013). There are strong connections between the literature regarding the motivations for university-industry relationships and the establishment of university-industry relationships themselves (Section 2.1). The relationships invested by university and industry actors through academic engagement provide a significant source of income and prestige to universities.

For university-industry knowledge transfer to take place, both parties as a minimum, need to be engaged. In a similar way to Section 2.1, I have reviewed and adapted the literature review table by Ankrah et al. (2013) in (Appendix B). The

analysis of 60 papers examined from the adapted table show that 29 focus on academics, 11 on industry actors, 17 consider both academic and industry actors while one focuses on one surveys industry, academia and intermediaries, one just intermediaries and one does not include any of the three types of actor. An asterisk has been recorded in the motives column in Appendix B when an outcome of the analysis was that motives were proven to exist for the actor groups examined in particular studies.

The research context for the Ankrah et al. (2013) research is large-scale projects that the government in the UK are sponsoring in the Faraday Partnership Initiative. The key stakeholders in these partnerships were from three parties: Department of Trade and Industry (DTI), Engineering and Physical Sciences Research Council (EPSRC) and a company contracted by DTI to facilitate the partnerships who provided skilled and experienced technology translators. It used 37 semi-structured in-depth interviews with actors from the stakeholders from five Faraday Partnerships providing multiple sources of evidence. The informants involved 9 university actors, 13 industry actors, 11 intermediary actors and three key stakeholder actors. The classification of motivation drivers to form collaborative relationships between university and industry actors utilised inter-organisational relationship motivators characterised by Oliver (1990) which are: necessity, asymmetry, reciprocity, stability and legitimacy.

Ankrah et al. (2013) found that both university and industry actors have a similar motivation on the macro-scale. Alignment between the actors was in wanting stability in their lives. However, differences were experienced between actors on the micro-scale where university actors had different things related to stability than industry actors. These differences are not an issue if they are understood by each party

and can lead to more trust in the relationship where behaviour becomes more predictable (Mitchell, 1982). A critical point from the study was that academics lack the interest in forming collaborative relationships with industry. The important role that an intermediary might play was noted where they are shown to be successful in understanding the motives for both sets of actors and fulfil those needs.

SYNTHESIS GAP 1: Limitations from the study are that only one type of partnership has been studied in the UK which may not have the detail required to inform policy makers. Further research may include a quantitative study to provide statistical evidence to provide greater detail, investigating other forms of UIRs in different cultures and countries that may be at a different stage of economic development.

The Ankrah et al. (2013) analysis includes the research of Beath et al. (2003) and D'Este et al. (2007). To help understand the optimal incentives for income generation in universities, Beath et al. (2003) investigated ways that funding for fundamental research could be preserved with alternate rewards for academic time spend on income producing activities. They found income generating academics to be motivated by four key factors including: research productivity in both fundamental and applied research; intrinsic desirability of fundamental research and the time required to keep up to speed in fundamental and applied research. These factors provide an insight into some of the influencers of motivation for academic individuals who are successful in the application of technology.

Other motivation influencers were found in a large scale survey of UK academics by D'Este et al. (2007) who investigated what influenced engagement through different industry channels. Through industry channels, such as: building of

new facilities; consultancy/contract research; joint research; training; and meetings/conferences, it was found that the individual academic researcher characteristics have a stronger impact than the 'macro-scale' university characteristics. In particular, the individual academics previous experience working in industry was found to be important as it enhanced their attitude towards building industry relationships.

Key Emerging Issue: Is fairness towards academics important for collaborative behaviour?

Other behavioural aspects of academics commercialising products were investigated through the research of van Burg et al. (2013) which provides evidence that cooperation and therefore innovation is adversely impacted when an academic entrepreneur feels they are not being treated fairly or are not happy with the commercial arrangements for a venture. The research of the quality of cooperation was sampled in two university supported spinouts and found empirical evidence that the quality of cooperation with university entrepreneurs was impacted by a perception of fairness. Two key drivers for the varying perceived fairness were 1) the amount of experience of the entrepreneur and 2) the amount of relationship capital that the entrepreneurs have when cooperating with the university. A practical application of their findings is that a post graduate student is likely to have low experience and relationship capital compared to a professor and therefore a difference in the perception of fairness of venture ownership for a potential project in a similar commercial situation. The concept of fairness is not limited to an academic's relationship with industry partners. It extends to the university environment where expectations and resourcing for teaching, research and commercialisation outcomes

are often unrealistic and/or require non-value adding activity that places academics into role strain (Garrett-Jones et al., 2005; Perkmann et al.).

The research of van Burg et al. (2013) also found that the rules relating to fairness in university-industry relationships are different to those applying to employer-employee relationships as discovered in organisation justice literature which had previously been assumed to be the case. Organisational justice rules include distributive, procedural, interpersonal and informational fairness (van Burg et al., 2013). The organisational justice literature is limited in not including the concept of unforeseeable uncertainty that is often encountered in entrepreneurial relationships. These differences provide evidence that applying theory and models from within an employer-employee domain may not transfer directly into entrepreneur-university or university-industry domain. This is important in the context of applying relationship marketing which has been formed in the employer-employee domain to the inter-organisational relationships.

An interesting discovery through their research was that "cooperative relationships between entrepreneurs and universities do not imply hierarchy and therefore have to be negotiated" (van Burg et al., 2013).

RESEARCH GAP 1: This is also the case with some relationships that are being explored in this study and supports the need to examine and not simply apply new product development models and theory in the inter-organisational domain. Important concepts that have been raised in this research and should be considered for this study include: the impact of fairness of venture control between individuals, collaborations and SME's with universities. These factors need to be considered at the relational level.

It is the individuals who are key to the knowledge transfer in this process (Allen et al., 2007; Azagra-Caro, 2007). Individual factors such as demographics, career frequency, productivity, attitude, motivation and identity play a key role in academic engagement (Perkmann et al., 2013).

SYNTHESIS GAP 2: The role of the industrial partners has been of less significance in these studies. Macro-level organisational factors are studied more than micro level factors (Foss et al., 2010). Ankrah et al. (2013) highlight this by asking the question, "how do the motives of, and outcomes for, individual actors in universities and industry correspond in government-sponsored UIRs for knowledge transfer?" They offer this as support for the importance of researching the case of the micro-level.

Summary: The UIR motivation literature stream is important for this research as it provides a framework for examining the motivation between actors engaging in knowledge transfer and as a reference for using multiple sources of evidence to understand the behaviour that motivates and drives engagement success between university and industry actors.

The limited literature on the motivation of university, industry and other individual actors for the initiation of these types of working relationships will be investigated by this research, as will the Australian business culture that has become comparatively high cost in a global context (Bucolo et al., 2014).

The measures and indicators that are used to compare performance between countries, organisations and individuals are important for benchmarking and gaining an insight on what success means in this domain. The measures for success and how

indicators from different domains interact to form a view of performance are considered further in the Section 2.3.

2.3 Successful university-industry relationships

In this section there were no literature reviews available so a traditional approach to the literature review was taken. The success of UIRs can be considered in terms of tangible outcomes such as scientific, educational and commercial output (Perkmann et al., 2013). It can also be considered in terms of intangible outcomes such as building trust in a relationship. To assist in understanding the successful relationship literature Table 2.2 provides a summary overview of research on the concepts relating to the measurement and indicators of successful UIRs.

Santoro (2000) examined tangible outcomes for university-industry collaborative ventures using a mixed methods approach with a focus on a conceptual framework developed for the study. This conceptual framework linked four relationships components: research support, cooperative research, knowledge transfer and technology transfer to tangible outcomes including: research papers, published masters' theses, doctoral dissertations, patents, patent applications, licences, and non-licensed products and processes which were considered indicators of a successful relationship.

Table 2.2 A review of the conceptual and theoretical research related to understanding success in university-industry relationship from a literature search on university-industry success with some data adapted from (Perkmann et al., 2013).

Author (s)	Sample	Subjects	Study aims / focus	Key findings	Analysis method
Santoro (2000)	(1) Qualitative (31 industry firms); (2) Quantitative (21 university research centres and 423 industrial firm with existing UIR relationships).	People in existing UIR relationships.	The study focusses on UIR within the context of industrial firms and university research centres in the US and examines factors that may impact on successful outcomes.	(1) Increased intensity of relationship increases successful outcomes. (2) Geographical proximity is a positive influencer. (3) Size of organisation and length of time in relationship not influencers.	Mixed methods
Agrawal et al. (2002)	(1) Qualitative (68 academics from 2 engineering schools); (2) Quantitative (Data set includes information about 640 patents and 5,132 papers assigned to the sample faculty).	Academics patenting	To explore the degree to which patents are representative of the magnitude, direction, and impact of the knowledge spilling out of the university (success) by focusing on MIT Departments of Mechanical and Electrical Engineering.	(1) patenting is a minority activity: a majority of the faculty in our sample never patent; (2) patent volume is positively correlated with paper citations, suggesting that patent counts may be reasonable measures of research impact.	Mixed methods
Barbolla et al. (2009)	Qualitative: 30 university researchers in Madrid, Spain in contract research UIR.	Experienced university contract researchers	The aim of the investigation is to understand what factors impact success and failure from a university researcher's view of knowledge transfer.	Technology, corporate usefulness, corporate capacity and corporate confidence are differentiators for success and failure of UIR projects	Semi-structured interviews

Perkmann et al. (2011)	Qualitative	Academics	Provides research and development managers with a tool for assessing university–industry alliances that is prospective, reliable and multi-dimensional.	What is a performance measurement system for university-industry alliances	Synthesis of literature
Genet et al. (2012)	Quantitative: 9447 patents from 3719 nanotech firms	Academics patenting	To investigate the model of knowledge transfer in nanotechnologies in depth with comparison to microelectronics and biotechnology companies.	Nanotechnology is similar to biotechnology that require small-medium firms as technology translators in a bridging role. Is very different to microelectronics sector which relied on large firms for knowledge transfer for success	Network analysis
Plewa et al. (2013a)	Qualitative – 132 University-Industry respondents in Australia	Academics involved in university-industry relationship	Investigates the influence of interrelationships between individuals on university-industry linkages.	Communication emerged as a consistent predictor of relationship success. Trust and understanding also had positive effects over some stages of relationship development.	Online survey; SEM

Santoro (2000) used multiple methods to investigate a cross-section of university relationships. The methods included qualitative research using in-depth interviews with 31 industry firms. A sample of 21 university research centres and the 423 firms they had relationships with were used for quantitative data collection to complete a survey which had a 47% response rate. The results from the study show a two-way relationship exists between the intensity of the university-industry relationship and the level of outcomes produced.

SYNTHESIS GAP 3: The results also show that the organisational size and the length of time that the relationship exists do not have a strong influence on the outcome although the geographical proximity of the parties does. These findings are important to this research as they support the notion that both new and smaller entities can be successful in developing processes and products if they are in close proximity to the researcher and/or knowledge provider.

Barbolla et al. (2009) conducted structured, in-depth interviews with 30 university researchers about their experiences carrying out university-industry contract research projects. The aim of this investigation was to understand what factors impact success from a university researcher's view of knowledge transfer. It was interesting that the researchers did not use patents or revenue as a measure of success. Instead, success was measured by a project providing a good technical result, and also being adopted by the industry partner. The factors considered to impact success were categorised into four major groups: 1) project features, 2) company involvement, 3) core competency and motivation of the university, and 4) the relationship among university and industry actors. The detailed factors for each of these groups can be seen in Table 2.3.

Table 2.3 Factors considered in the analysis of the technology transfer process, adapted from Barbolla et al. (2009).

Project features	Technology maturity Technical Risk Project viability and realism Definition of objectives at beginning of project University participation in project definition Usefulness of the project for company Company confidence in project results
Core competency and motivation of the University	Level of general experience needed to conduct project Level of specific experience needed to conduct project Research team motivation to transfer their work
Company involvement	Company capacity to put the project results into use Company experience in collaboration with universities or public research centres Manager support for the project Allocation of sufficient material resources Corporate team interest in assimilating the project results Corporate team experience in collaborating with universities Corporate team suitability in terms of number and qualification of its professionals Changes in the composition of the industry partner team during project development Internal communication
Relationship between individuals	Milestone achievement Company confidence in the research group Professional and personal relationships between teams Coordination between stakeholders Company involvement in monitoring project progress Ease of access to the necessary corporate information Flexibility for redefining milestones and methods between partners

Note: The factors in red bold type show factors that were found to have an effect on innovation project success.

The projects that were found to be successful used mature technology, had high usefulness to the industrial partner who, in turn, had a high capacity to put the results into use and the industrial partner had confidence in the university partner with a good understanding between them.

The detailed factors that contributed to failure included:

- 1) the technology was not feasible for the project,
- 2) had a high technical risk or used immature technologies;
- 3) the usefulness for industry was adversely impacted by poorly stated initial objectives,
- 4) allocation of insufficient resources or industry team professionals not adequate;
- 5) the industry partner did not have the capacity to adopt the results; the industry team were inexperienced in collaborating with the university as a knowledge partner.

It was interesting that Barbolla et al. (2009) also found the importance of many individual's intangible efforts impacting the success of projects. They identified a significant group of researchers who claimed that their relationship with the industry partner had begun long ago.

SYNTHESIS GAP 4: As with any research there are limitations. The sampled respondents came from the same university in Madrid and were only involved in contract research relationships. This prevents generalisability; however, it still serves as an important starting point for understanding success factors for UIRs.

Key Issue: How do you measure success?

The conversation for measuring commercialisation success is usually around financial monitors such as revenue and return on investment. In relationships, the measure is “unclear” and often not tangible for a long time (up to 10 years). Academic engagement has been found to empirically leave traces. A summary of typical indirect measures for academic engagement is shown in Table 2.4.

Table 2.4 Indirect success measures for academic engagement adapted from (Ankrah et al., 2013)

Measure	Source
Number of Spin-offs	Lissoni et al. (2008); Thursby et al. (2009)
Number academics directors of companies or patents	Lissoni et al. (2008); Thursby et al. (2009)
Instances of co-authorship by university-industry actors	(Liebeskind et al. (1996); Murray et al. (2007)
Records held by universities on industry contracts (best source, difficult to acquire)	Rawlings et al. (2011)

Key Issue: Are patents a good measure of early stage relationship success?

Investigating the effectiveness of university-industry relationship success measures further, Agrawal et al. (2002) conducted mixed methods research to understand if patents were a good measure of knowledge transfer. They quantitatively examined 640 patents and 5,132 papers over a 15-year period and the associated cited papers (49,975) and patents (6,074) at MIT. This was followed by qualitative data collection through face-to-face interviews to supplement data of 68 faculty members who had invented or patented technology.

Agrawal et al. (2002) found that patenting was a minor activity accounting for less than 10% of knowledge transfer from laboratories where it occurred. Their study also found that organisations that cite MIT patents are not the same firms that cite MIT papers indicating that these two possible measures are independent. These findings are

important to this research as it supports the view that patents alone are not a good measure of innovation success.

Perkmann et al. (2011) researched success measurement issues with the goal of providing industrial firms with performance measures to evaluate successful university-industry partnerships. In addressing the challenges of relationship intangibles, multiple objectives and the long term nature of the relationships, they created a framework and proposed metrics for the different stages of success. These included: input, in-process, output and impact. The input metrics of leverage factor, citation counts and industry income are good quantitative measures for providing background to an industrial firm about the capability of people they may have the opportunity to partner with. However, the data does not necessarily provide good insights into the quality of relationship and their ability to work cohesively with the firm in a joint collaboration.

To further explore factors that impact innovation success, a comprehensive study was undertaken by Genet et al. (2012) between 1990 and 2009. It examined 9447 patents from 3719 nanotech firms. It classified organisations by amount of annual revenue as: very large >\$40m; large > \$14m; medium between \$1.4m and \$14m; and small < \$1.4m and the type of market the technology applies. The research was conducted as a quantitative study utilising network analysis. The paper demonstrated that different innovation situations and technology affect successful innovation strategy. In particular, the biotechnology transfer model which requires small-medium firms as technology translators in a bridging role is very different to the microelectronics sector which relied on large firms for knowledge transfer for success. When researching innovation to understand success, it is important that the size of the organisation, key stakeholders and the innovation strategy also be understood.

Key Issue: Identifying successful relationships

The ability to identify a successful collaborator is important in this area of research. Although Plewa et al. (2013a) provides empirical evidence for a generalised framework, the framework does not extend to the initial stages of the relationship. An arbitrary approach is considered the best assessment of success for this research by developing an understanding that those involved in collaboration projects are contributing.

2.4 Individual university and industry actor experience

The review of success in Section 2.3 found that one source of value is created in the development of the relationships between individual actors, the social perspective. The social perspective is an important consideration for the creation of innovation projects where knowing how to quickly develop good personal working relationships allows individuals to plan the initial stages of interaction to create quicker, more effective mutual understanding.

The amount of research for understanding the factors that impact the behaviour of university and industry actors in the Australian context is limited. Most of the research has focussed at the macro level and on improving the university-industry commercialisation outcomes through organisations such as CRCs, centres of excellence and industry clusters (Couchman et al., 2004; OECD, 2009; Garrett-Jones et al., 2010). Garrett-Jones et al. (2010) argue that studies of cross-sector R&D have created empirical evidence on how best to work. They also discovered that little empirical evidence exists on a) how individual researchers view the impact of their contribution, b) how the functions of centres meet researcher expectations, and c) the implication on researchers who conduct other roles within Australian Cooperative

Research Centres (ACRCs). Their qualitative study informed by individual research scientists from public sector organisations working with ACRCs found that trust, governance and competition between functional domains which emerge from inter-organisational relationships have been inadequately recognised in the context of ACRCs.

SYNTHESIS GAP 5: These findings are evidence that individual motivation and inter-organisational working relationships have not been a focus for research of university-industry relationships.

Similarly, Foss et al. (2010) in a study of knowledge sharing in organisations, found that research was focussed on the macro or the collective/organisation level and paid little attention to the micro/individual level. The significance of this research is that knowledge sharing between individuals is one of the key ways that technical knowledge is transferred in the industry-university relationships.

SYNTHESIS GAP 6: Their finding that more needs to be done to understand micro-level knowledge sharing within an organisation provides further evidence of the research gap for the effects that individuals have in new product development.

Key Research Issue: What do individuals experience from successful engagement?

Successful academic engagement has been found to be experienced by academics when the following conditions exist in industry: positive corporate perception of project usefulness; company is able to integrate project outcomes to create value; and there is confidence in the university team (Barbolla et al., 2009). In contrast, industry experiences good collaborative relationships when the researchers

have a good reputation, mutual trust is developed and credible commitments are made when initiating the project (Couchman et al., 2004).

While the conditions that exist to attract engagement of partners is important, the benefits experienced by individuals when participating in successful relationships are also important. Ankrah et al. (2013) researched the benefits for university and industry actors of being involved in university-industry relationships and the main benefits that these actors experienced from working together on innovation projects can be seen in Table 2.5.

Table 2.5 The main benefits experienced by university and industry actors by working together. Adapted from Ankrah et al. (2013).

University actors (n=9)	Industry actors (n=11)
<ul style="list-style-type: none"> • Source funding for research work • Created business opportunities • Student exposure to state of the art technology • Stimulated technical advancement in key areas • Training/employment opportunities for students • Access to a wider professional network • Greater links with industry 	<ul style="list-style-type: none"> • More cost efficient research compared to in-house • Improved innovation ability/capacity, strengthen base • Exposure to new knowledge, better understanding of leading edge technology • Keep up to date with new technology • Solved a specific problem • Opportunity to access wider professional network

Key Issue: Does an individual's personality influence innovation?

An attempt to understand how individual people and their personality impact new product development was investigated by Reilly et al. (2002) who created a framework to understand the impact of personality on new product development (NPD) tasks. They separated radical and incremental innovation due to the differences in tasks to progress a NPD project. They proposed beneficial project outcomes are impacted by different types of individual personalities in NPD teams.

To understand how personality may impact New Business Development (NBD), Stevens et al. (2003) conducted quantitative research on how an individual's personality impacts key performance indicators. The research sampled a Fortune 500 chemical company over a 10-year period and involved 69 analysts who managed 267 projects through the early stages of development. This investigation measured the personality of the key analyst responsible for the early stages of the NBD process by 1) temperament index, 2) creativity index, 3) KAI index or 4) rain maker index and correlated these personality measures with the success of the NBDs.

The analysis of the data collected determined that: 1) highly creative analysts did more projects, redirected the projects more frequently, and made over 95 times more profit than low creative analysts when new business development concepts were commercialised, 2) implementing training of analysts in the process and having the right personalities involved has led to increases in the speed and effectiveness of new business development of over 900%, and 3) Myers Briggs NT temperament was highest on the rainmaker index and therefore the most likely to succeed managing the early stages of NBD projects.

SYNTHESIS GAP 7: Although the research by Stevens et al. (2003) was only based on a single company, it does provide an interesting starting point for understanding the impact that the right people involved in the initial stages of commercialisation projects can have. The importance of this study is identifying the impact that the individual with the right creative temperament at the initial stages of the development process can impart, and that "selecting the right people for the right roles dramatically improves the effectiveness of new product development" (Stevens

et al., 2003). This has significant implications for a relationship marketing approach which relies heavily on “people skills”.

Key Issue: Do individuals involved in innovation collaborate?

Finding the right people to be stakeholders for innovation activities is not the only aspect that needs to be considered. How people relate when brought together is also important. Ramos-Vielba et al. (2010) conducted a quantitative study to provide empirical evidence into university-industry collaboration measures. The study was conducted in an innovation "catch up" region in southern Spain and involved conducting face-to-face surveys involving 737 firms and 765 heads of research teams. Their research found that there were multiple factors and interconnections between university and industry and the position of actors in the R&D environment. It is interesting in that region that 43% of firms and 57.3% of research teams participated in university-industry interaction. This finding is important as Australia is seen as playing “catch up” in terms of innovation (Jones, 2014).

Summary: The need to research the initial stages of individuals relationship development for innovation success is stated well by the following quote: "only with a good grasp of the interconnection mechanisms and the processes of creation, maintenance and success of the nexus is it possible to adequately evaluate and redirect the stimulation policies which are usually unidirectional and indiscriminate, and as a consequence, inefficient and of limited impact" (Ramos-Vielba et al., 2010).

2.5 Relationship evolution

The evolution of relationships, inside and outside organisations, pertains to many domains. The evolution of internal working relationships, and external buyer-seller relationships have been researched extensively. The relationships that this study focusses on are between university and industry actors. However, with the changing innovation landscape stakeholders may also involve others, from a third organisation, such as intermediary technology translators. Understanding the characteristics in the evolution of different types of relationships is an important background for the research of university-industry relationships. A summary of the relationship evolution literature that has been reviewed has been included in Table 2.6.

The development of working relationships within an organisation has been examined in the literature review and commentary authored by Hutt (1995). He argues the basis of cross-functional relationships to be interfered by turf, interpretive and communication barriers through the working relationship development stages of orientation, exploration, testing and stabilisation. These are important development stages of working relationships within an organisation and although they may not apply directly to relationships between organisations such as academic engagement, provide some insight into factors that should be considered as a starting point with little research directly on developing university-industry relationships for commercial outcomes.

To further understand the impact that individuals have on innovation processes, Daniel et al. (2011) undertook empirical qualitative research examining four case studies of biotechnology innovation in Australia.

Table 2.6 Conceptual and theoretical research related to the evolution of relationships that can be applied to university-industry environment.

Author (s)	Samples	Subjects	Study Aims / Focus	Key Findings	Analysis Method
Ford (1980)	Not Applicable	Not Applicable	To examine buyer-seller relationships and form an understanding of: (1) what drives buyers to develop relationships with a few suppliers rather than play the field; (2) how do the relationships change with time; and (3) what are the implications of close relationships for the buying and selling organisations.	The implications of the review were that establishing relationships is important as "existing relationships between buying and selling companies in an industrial market are a powerful barrier to entry of another company". To overcome these types of market barriers market analysis, developing relationships and maintaining relationships are considered key.	Synthesis of literature
Morgan et al. (1994)	Sample size 204	Automobile tyre retailers	Test that successful relationship marketing requires relationship commitment and trust	Key mediating variable model found to be successful in maintaining successful relational exchanges	Quantitative: LISREL VII
(Hutt, 1995)	Not Applicable	Cross functional working relationships within a firm	Provide commentary on the formation and development of working relationships between marketing managers and other constituents within the firm	(1) cross-functional relationships in marketing interfered by turf, interpretive and communication barriers; (2) working relationship development stages of orientation, exploration, testing and stabilisation.	Synthesis of literature

(Bringle et al., 2002)	Not Applicable	Not Applicable	The phases and the dynamics of relationships are explored to provide service-learning instructors and university campus personnel with a clearer understanding of how to develop healthy campus-community partnerships.	(1) Phases of relationships: initiation, development, maintenance, and dissolution; (2) Dynamics of relationships: exchanges, equity, distribution of power.	Synthesis of literature
Couchman et al. (2004)	Case study	Australian CRC and Swiss industry partner	Examine the success factors and risks of a successful project.	Success of commercially focussed R&D collaborations are aided at project initiation by: (1) The reputation of researchers; (2) Development of mutual trust between partners; (3) Credible commitments made.	Case analysis
Couchman et al. (2009)	10 respondents	CRC managers: Australia in manufacturing and medical science technology	The aim of the study was to gain an understanding of how the CRC managers dealt with downside risk in projects with a commercial focus.	Managers deal with both performance and relational risks. The mitigation of these risks at both inter-organisation and project levels is through the formation of trust between partners.	Qualitative content analysis of in-depth interviews.
Daniel et al. (2011)	Qualitative: 4 case studies of biotechnology innovation in Australia involving 49 respondents.	Researchers through to CEO's	Understand the social processes that support innovations in new biotechnologies.	In the case of biotechnology, social capital was an independent success factor for acceptance and integration of innovation,	Case study

				highlighting that it was essentially a social process.	
Maine et al. (2012)	33 respondents (18 nanotechnology; 15 fuel cell)	US CEO's and/or Chairman	How do the successful value creation strategies of technology ventures differ in process vs. product-based innovation?	(1) Ventures exploiting process innovation faced greater uncertainty in their value chain positioning, market breadth, customization, and the changes required of their customers. (2) Product-based ventures benefit from prioritizing technology–market matching, alliance building and experimenting with Technologies in new value networks.	Qualitative: Case study
Plewa et al. (2013b)	30 respondents	Australia / Germany / Netherlands	Do university-industry linkages evolve through different phases? If so, what are the respective measures of success.	Communication, understanding, trust, and people are universal drivers for the evolution of relationships.	Qualitative content analysis of in-depth interviews.
Galán-Muros et al. (2016)	4,123 respondents	European academics from 33 countries	What drives university-industry cooperation in Europe?	(1) Identified drivers significantly affect the development of all cooperation activities, barriers have more diverse effects. (2) While drivers significantly limit research and valorization activities, they barely impact cooperation in education.	Quantitative: Regression analysis

There were 49 respondents who were researchers through to CEO's. The respondents came from tertiary research centres, government research organisations, commercial R&D organisations, and the general biotechnology industry. Their investigation found that at the micro-level, the politics of sense-making and relational networking, were important factors for technology acceptance and integration. In the case of biotechnology, social capital was an independent success factor for acceptance and integration of innovation, highlighting that it was essentially a social process. This finding is further evidence that relationship development is worth exploring in the wider domain of university-industry relationships. There "is no doubt that dynamic relationships start early in biotechnology as stakeholders interact to decide on research opportunities and potential pathways in furthering the development of innovations towards commercial goals" (Daniel et al., 2011).

The question of relationship evolution through university-industry linkages was explored qualitatively by Plewa et al. (2013b). There were 30 respondents interviewed from Australia, Germany and the Netherlands to understand if linkage relationships do evolve and if they did, what drove them and what did success look through the different stages. A lens was created upon social exchange theory to analyse the content of the interviews. It was found that communication, understanding, trust, and people were universal drivers for the evolution of the university-industry relationships.

Galán-Muros et al. (2016) conducted a quantitative regression analysis on 4,123 respondents from European academics from 33 countries. This is the first extensive quantitative study aimed to answer the question of what drives university-business cooperation. The results showed that personal relationships based on trust, commitment and shared goals were the major drivers for university-business

cooperation. The identified drivers were also found to be key for all cooperation activities. These are key constructs of interest in this thesis and will be central to the research conducted and the propositions explored.

2.5.1 Buyer/Seller relationships

On the surface the buyer/seller literature may seem a strange research stream to examine, however it is an important research area for commerce. It applies in many domains and has been further developed through sales and marketing interface. The advancement of the buyer/seller relationship to relationship marketing and supply chain management domains provides comparative insights that should be considered when examining the special case of the development university-industry relationships.

In the seminal review by Ford (1980) the different stages of buyer/seller relationships in industrial marketing literature are examined. Interaction approach theory sees the buyer-seller relationship taking place between two active parties rather than analysis of the aggregate market. The approach considers that either the buyer or seller may take the initiative to form a partnership. The research aim is to examine buyer-seller relationships and form an understanding of 1) what drives buyers to develop relationships with a few suppliers rather than play the field, 2) how do the relationships change with time, and 3) what are the implications of close relationships for the buying and selling organisations. The paper provides a summary of the stages of different types of buyer/seller relationships and the effect on relationship factors. The stages of the relationship include: The pre-relationship stage, the early stage, the development stage, the long-term stage and the final stage. The relationship factors considered between the organisations include: experience, uncertainty, distance, commitment (actual and perceived), and adaptation. The implications of the review

are that establishing relationships is important as "existing relationships between buying and selling companies in an industrial market are a powerful barrier to entry of another company" (Ford, 1980). To overcome these types of market barriers market analysis, developing relationships and maintaining relationships are considered key.

Although the research of Ford (1980) has not been applied to academic engagement, it provides insights into buyer-selling relationships where both parties are actively seeking partnership for mutual benefit. In this study, the university actors are engaging industry and industry actors are engaging suppliers of technical knowledge to improve their industry and/or business.

RESEARCH GAP 2: Factors that apply to these buyer-seller relationships also apply to academic engagement relationships and warrant further investigation.

Sellers wanting to improve the effectiveness of their interactions with buyers have invested resources into understanding the management of customer relationships, known as relationship marketing. The study of relationship marketing is grounded in social exchange theory which is used to explain the emergence and continuance of social relationships, where benefits are an incentive to the other party to provide value for continued association (Blau, 1964).

The seminal work by Blau (1964) is central to understanding the factors that influence relationship marketing which is referred to as all "marketing activities directed toward establishing, developing and maintaining successful relational exchanges" (Morgan et al., 1994). They extended this understanding when they developed a model of Key Mediating Variables (KMV) grounded in social exchange theory as shown in Figure 2.2. It can be seen that communication is important in

developing trust which along with relationship benefits are needed for relationship commitment which leads to cooperation between parties.

SYNTHESIS GAP 8: The role that new, improved communication tools such as social media has in the process of building relationship facilitators such as trust in the context of university-industry relationships is not well understood.

The KMV model is useful to assist in understanding relationships from both a macro-view and micro-view. It sets the context for this research. A micro view is also required to form an understanding of how relationships may change with interactions over time. Social penetration theory was developed by Altman et al. (1973) to explain how individuals discover additional elements of the other party's personality with either a positive or negative outcome.

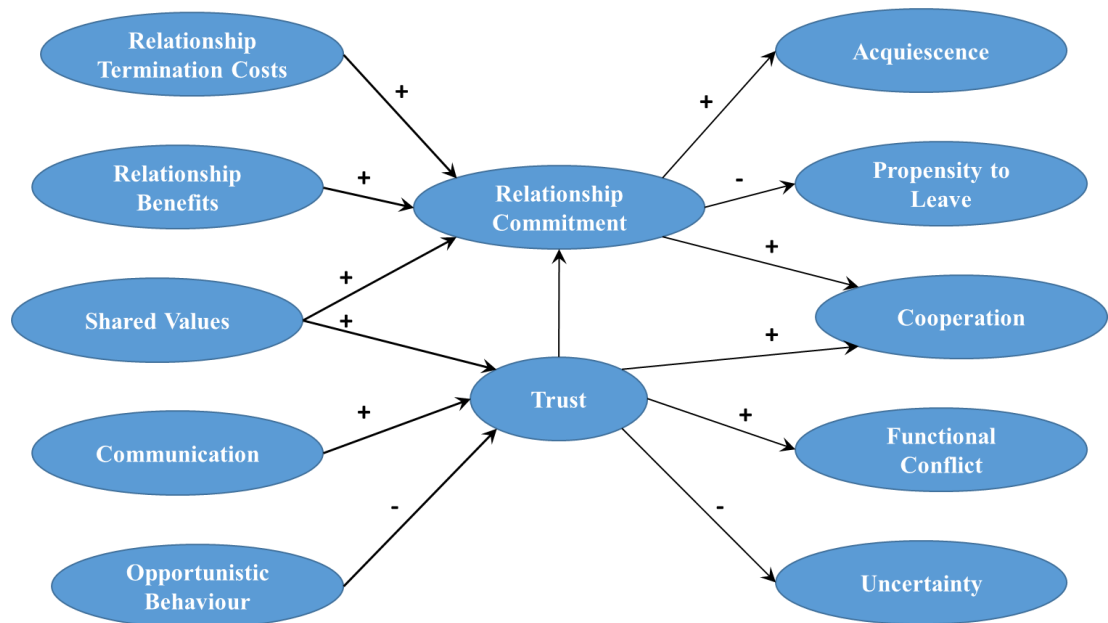


Figure 2.2 Key Mediating Variable (KMV) model for relationship marketing as conceptualised by Morgan et al. (1994). Positive and negative effects are shown.

The development of a relationship does not occur in a single interaction. It is the outcome of many interaction experiences. A model has been developed by Bruhn (2003) and grounded in social penetration theory to explain how relationships change over time depending on the outcome of interactions.

The relationship memory that is created through the outcome of repeated interactions can either be beneficial or a barrier to any relationship. It follows that managing early relationship interactions may be of importance to initiating and developing the early stages of university-industry relationships. The key mediating variables and relationship memory elements are essential for relationship initiation and development in dynamic situational environments and must be included in any conceptualisations.

2.5.2 University-industry relationship development

The small amount of literature on initiating and developing university-industry relationships is complimented by university-community relationships development and cases of relationship development within university researcher organisations.

Research analysing literature focused on developing university-community partnerships was undertaken by Bringle et al. (2002). With the aim to provide guidance about the development of individuals and the relationships they form.

SYNTHESIS GAP 9: While the paper does not provide information within the academic engagement domain it does provide information on the phases of relationships and the dynamics of relationships with university actors. The phases of

relationships discussed in this paper are initiation, development, maintenance and dissolution. The initiation stage is important and a focus for this study.

The initiation of a relationship may result from a planned or serendipitous event. For academic engagement it is more likely that these will be the result of planned events although it is noted that infrastructure needs to be in place to also take advantage of unanticipated opportunities. In planning to initiate a relationship, each prospective party need to 1) decide what type of relationship to pursue (if any), and 2) communication of the level of interest to the other person. The initiation of the relationship needs to be able to effectively assess the potential rewards and costs that may be expected and the capacity of each to fulfil the others expectations. In any relationship different parties have different expectations on what they want from the relationship and need to take this into account when forming their expectations.

The dynamics of relationships are discussed by Bringle et al. (2002) as exchanges, equity and distribution of power. The use of social exchange theory allows for consideration of the impact of dependency and interdependency in the relationship. Dependency is associated with relationship investment and satisfaction with high levels of commitment to the relationship. Interdependency occurring when dependency is mutual between parties. The party with the most power is proposed to be the party with the least amount invested in the relationship as captured by Waller's principle of least interest (Waller, 1938). All relationships have a competing commitment between the desire to uphold one's integrity and to be in a valued and rewarding relationship and are sometimes expressed as right verses liked. The best relationships, although difficult to achieve, are considered to be self-affirming and supportive.

SYNTHESIS GAP 10: Although the university engagement is with a community organisation and not an industry partner it provides a starting point for providing insight into some of the barriers that may be experienced in any relationship between the university and an organisation partner. The concepts of power, dependency and interdependency and type planned and serendipitous beginnings to forming a mutually beneficial relationship are key factors to be considered at the early stages of relationship development.

Examining relationship development within research organisations, Couchman et al. (2004) researched a case study of a successful international collaboration project between an Australian CRC and Swiss industry partner to produce contact lenses. The research aim was to perform case study analysis to examine project success factors and risks. The outcome was that the reputation of the researchers involved, the mutual trust developed between partners and individuals undertaking credible commitments were key factors for this projects success. The analysis also found that communication and team building were important success factors. The researchers also argue that the higher the number of credible commitments between partners, the more likely the project was to succeed.

SYNTHESIS GAP 11: It should be noted that this is a single case with limited application, but it highlights important factors that should be considered in future studies such as the number of interactions between actors. Although the focus is on the development of relationships within an organisation, it serves as a starting point to consider factors for similar actors, performing similar roles in cooperating organisations.

In another case, Couchman et al. (2009) researched 10 CRC managers of 4 CRC's involved in manufacturing technology and medical science technology to understand how CRC managers dealt with the downside risk in projects with a commercial focus. The study found that the managers deal with both performance and relational risks.

SYNTHESIS GAP 12: The mitigation of these risks at both inter-organisation and project levels is through the formation of trust between partners. The limited sample size and domain for the study restrict the application of the findings, however, it is the beginning of an argument supporting the creation of trust as a factor that needs to be considered when initiating successful new working relationships.

In a further case, a comparison of the types of relationships that need to be developed for technology innovation with different characteristics is described. The research by Maine et al. (2012) was an empirical qualitative investigation focussing on 12 ventures from process (nanotechnology) and product (fuel cell) based innovations. Interview of 33 respondents (18 nanotechnology; 15 fuel cell) provide data of the actors experience. In preparing for the study a review of nanotechnology commercialisation literature found that does not differentiate on scientific intensity, interdisciplinary, generic nature and dependence on process innovation. The literature also indicates that large firms are reluctant to initialise commercialisation of radical technology preferring to buy the technology when technology uncertainty and commercial issues overcome. A key part of the literature review was to investigate value creation by technology ventures and in particular market exploration and selection, breadth of markets and decoupling points. Maine et al. (2012) summarises recommendations for reducing market uncertainty.

The model developed through the study was to understand those that are important for value creation and included: 1) process innovation required by customer, 2) radical technology, 3) upstream position in the value chain, 4) requires complementary innovations, 5) multiple markets, 6) lack of continuity, observability and validation trials, 7) access to complementary assets, 8) access to finance, 9) demonstrated value, and 10) value created over time.

The researchers argue that the best nanotechnology ventures benefit from exploiting generic technology over multiple markets from an upstream or mid-stream position in targeted industry value chains. The use of hybrid business models that use licensing and manufacturing were found to maximise value potential and strategic alliances were seen as a pre-requisite. The nanotech ventures that had the most success applied technology-market matching, alliance building, and experimentation to a greater extent than product-based organisations.

SYNTHESIS GAP 13: The research is important as it shows that the type of innovation, product and process, have different success factors that need to be taken into account. Further work needs to be undertaken to understand the success factors for different existing and emerging technologies.

2.5.3 Convergence of university-industry relationships and relationship marketing

At the time of the literature review there is only one piece of research published that examines relationship marketing through the development of university-industry relationships. Plewa et al. (2013b) conducted qualitative research involving 30 semi-structured in-depth interviews in Australia and Germany/Netherlands to understand if

relationship development through its different phases had an impact on commercialisation success. The different phases of relationships were categorised. .

The research made use of the Actor-Resource-Activity (A-R-A) model to focus on individual relationship behaviour as it has strong support from IMP (Industrial Marketing and Purchasing) group researchers. Relational success factors rely on the individual actors in university-industry relationships. While social exchange theory was applied to explain changes in success factors, new institutionists theory was also applied to recognise that the transactions involved in university-industry relationships can take place within an organisation or alternatively in a market.

The outcome of Plewa et al. (2013b) research proposes a conceptual framework with theoretical and managerial implications. It found that the universal drivers for progressing university-industry relationships to commercialisation as: communication, understanding, trust and people. A key success factor was to have a pool of people who communicate well, have a mutual understanding and are trusted who can apply their expertise to different projects.

This research is important to this study as it relates the concept that university-industry relationships are dynamic and progress through different stages. The application of social exchange, interaction and new institutionists theory providing insight into the mechanisms that drive different stages of university-industry relationships.

SYNTHESIS GAP 2: The research is a significant starting point for introducing relationship marketing theory and principles into investigating university-industry relationships. The research does however have some limitations and

weaknesses that need to be addressed in future research. The omission of investigating the motivation for forming university-industry relationships is a key factor that should be considered in future research of the topic (Ankrah et al., 2013).

The stages of relationship development defined by Plewa et al. (2013b) are similar to models proposed for the development of buyer/seller relationships in industrial markets by Ford (1980) and internal working relationships by Hutt (1995) in that they are initiated, grow and then end (Figure 2.3).

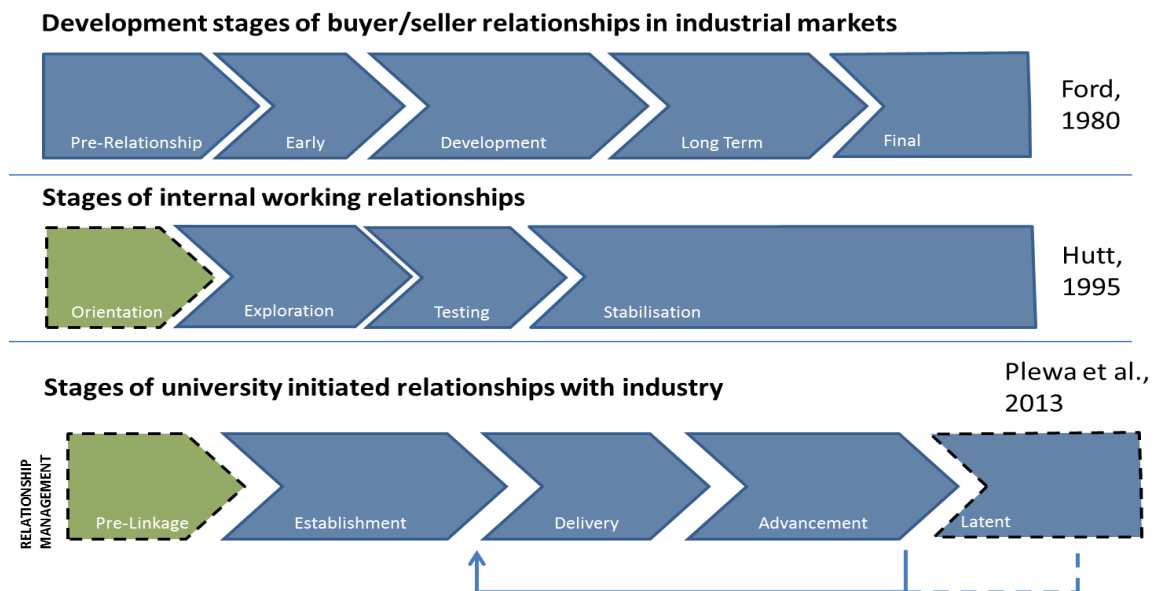


Figure 2.3 Comparison of relationship development stages between buyer/seller relationships (Ford, 1980), internal working relationships (Hutt, 1995) and university initiated industry relationships (Plewa et al., 2013b).

Summary: The different views of relationship development from the domains researched provide background to suggest that different types of relationships all mature in different ways. The definition of the relationship development phases by Plewa et al. (2013b) provides a starting point for understanding what are important

concepts to be understood at the initial stages of creating university-industry relationships.

2.6 Summary of Research gaps

The synthesis of the literature shows a broad overview highlights research gaps where this PhD research will focus. With the extensive research into the university-industry innovation system, there are still many aspects of these relationships requiring investigation. In terms of research gaps for why academics engage and the implications for their careers, the research agenda developed by Perkmann et al. (2013) provides an overview of important areas for future research into the differences between commercialisation and academic engagement as follows:

- 1) The consequences of academic engagement on university activities need to be considered and balanced. The competing commitments of academic research productivity with industrial support must be taken into account. Although most authors find industrial support does not negatively impact publishing of scientific articles (Blumenthal et al. (1996); Gulbrandsen et al. (2005); Lee (2000); Mansfield (1995); Perkmann et al. (2009) there is some evidence that over a career an inverse relationship may exist (Lin et al., 2006).
- 2) A concern also exists around the impact of external industrial support on academic research agendas. Although evidence exists to support the notion that choice of research topics are influenced by a projects commercial potential (Blumenthal et al., 1996), a bibliometric study (Godin et al., 2000) found no evidence that the direction of research is influenced by industry.

- 3) Scientists who believe science is a public good have been found to be less open to commercialisation (D'Este et al., 2011) which may help explain this difference in correlation between engagement and commercialisation. On the organisational level, ambiguous results were found correlating academic engagement with organisation-level research quality, while correlation existed between commercialisation.

The review of the literature for this thesis is broader than the relationship between academic engagement and commercialisation and also examines the literature streams that may influence the initial stages of developing relationships between university and industry actors through Sections 2.2 to 2.5. The gaps and themes addressed in this thesis have been highlighted in Table 2.7 which synthesises the gaps found in this literature review.

The relational framework for initiating university-industry relationships needs to extend the analytical frameworks for commercialisation to recognise the relational engagement activities that are more difficult to measure. The framework needs to incorporate university, industry and intermediary actors and understand the important factors for initiating enduring university-industry working relationships that are important for building an innovation culture in existing and emerging organisations. In many activities the use of new communication methods has allowed for improved efficiency and effectiveness. The development of these new technologies raises the question about the best way to communicate when individuals are initiating and developing the early stages of working relationships.

Table 2.7 The gaps in the literature discovered through the broad literature overview. Those marked in bold are the research gaps that are a focus point for this research.

Nature and complexity of university-industry relationships
<ul style="list-style-type: none"> • How do organisational level factors affect the characteristics of an individual's engagement activities? • What antecedents are there to academic engagement? How should working relationships be best initiated and developed? • What are the consequences of academic engagement on other academic outputs such as research and education? • What is similar and different about academic engagement and commercialisation? What mechanisms are important to each?
Motivation for university-industry relationships
<ul style="list-style-type: none"> • Motivation studies on industry actors and third-party actors significantly less than university actors, • What motivation factors currently exist in the local context? • What are the exchanges at the individual level of the organisation/s? • What impact does the type of relationship and culture from a different stage of economic development to innovative nations have on university-industry outputs?
Successful university-industry actor experience
<ul style="list-style-type: none"> • Factors for university-industry relationship success are not well understood with research contained mainly to specific institutions and of limited application.
University-industry actor experience
<ul style="list-style-type: none"> • Motivation and working relationships between individuals in different organisations have not been a focus of research, • The impact of micro-level knowledge sharing between individuals of different organisations on new product development is not well researched.
Relationship Evolution
<ul style="list-style-type: none"> • Buyer-Seller relationship development has not been applied to university-industry knowledge transactions, • Communication technology developments are not captured in initiating and developing university-industry relationships, • The use of relationship marketing for university-industry relationships has received little attention.

The speed of change with global competition places different challenges in front of people from different locations. When combined with the change and convergence of technologies, present innovators with unique scenarios to satisfy customers.

The convergence of relationship marketing and university-industry models brings together relationship development (Plewa et al., 2013b) and the analytical framework of the inputs and outputs of academic engagement (Perkmann et al., 2013) through individual factors as drawn together in Figure 2.4.

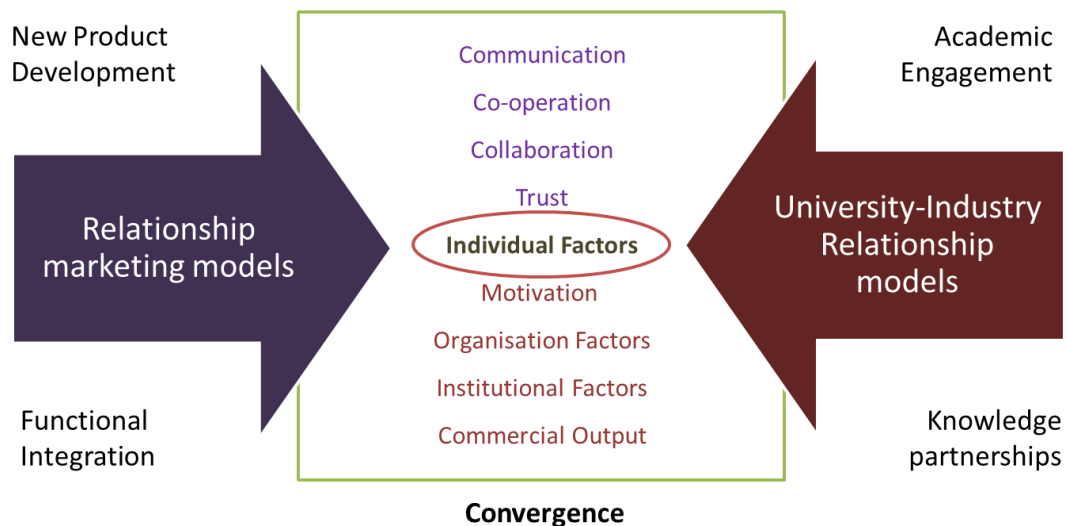


Figure 2.4 A diagram developed to show the convergence of relationship marketing (Plewa et al., 2013b) and university-industry relationship models (Perkmann et al., 2013). Note that individual factors are common.

Integrating the analytical framework and relationship marketing may provide further insight into the early stage antecedents and consequences of academic involvement. This is particularly relevant with potential new partners wanting to enter the increasingly competitive technology transfer market from the changing stakeholder landscape.

The gaps in the literature for university-industry relationships that are of most interest for this study are: relational framework, how to initiate relationships, best methods of communication, and local environmental factors.

3 THEORETICAL FRAMEWORK AND INITIAL MODEL DEVELOPMENT

3.1 Introduction

This chapter develops the theoretical framework for examining the initial stages of university-industry relationships. Its role is to explain the drivers and roadblocks to relationship development. It explains what relationship marketing is (Section 3.2). It then develops the theoretical framework for this thesis and explains the connection to relationship marketing, including the development of a relationship marketing lens (Section 3.4). This section draws heavily from Bruhn (2003) who synthesised the literature and delves deeply into the supporting theories e.g. neo-classic, neo-institutional and neo-behavioural paradigms. Doing so will support the development of the interview protocol used for this thesis. This research aims to determine the facilitators and roadblocks to relationship development by interviewing key stakeholders.

Then, in Section 3.4, two newly conceptualised theoretical models, based on the literature review, are presented with an explanation of influencers that may impact university-industry relationships (Figures 3.4 and 3.8). The first model developed represents the university-industry relationship drawn from the functional integration literature which incorporates organisational factors, while the second model is built on a narrower view of the key mediating variables for relationship development between individuals from the relationship marketing literature. A justification for their use will also be presented supporting the models and propositions that form the context for the research design and interview protocols.

3.2 Theoretical framework: relationship marketing

3.2.1 What is relationship marketing

The goal and early view of relationship marketing can be described as the establishment, maintenance and enhancement of relationships with customers and other parties for profit to meet mutual objectives (Grönroos, 1990; Bruhn, 2003). A number of different definitions for relationship marketing have been used by authors as the concept has developed. A recent review found 72 published definitions between 1982 and 2011 (Agariya et al., 2011). A summary of the more significant definitions is shown in Table 3.1 (Bruhn, 2003).

Table 3.1 Selected definitions of relationship marketing taken from Bruhn (2003).

Author	Relationship marketing definition
Berry 1983	Relationship marketing is attracting, maintaining and enhancing customer relationships.
Grönroos 1990	The goal of relationship marketing is to establish, maintain and enhance relationships with customers and other parties at a profit so that the objectives of the parties involved are met.
Shani and Chalasani 1992	Relationship marketing is an integrated effort to identify, maintain and build up a network with individual consumers and to continuously strengthen the network for the mutual benefit of both sides, through interactive, individualised and value-added contacts over a long period of time.
Möller 1992	Relationship marketing is about understanding, creating and managing exchange relationships between economic parties; manufacturers, service providers, various channel members and final consumers.
Grönroos 1994	Relationship marketing is to establish, maintain, enhance and commercialise customer relationships so that the objectives of the parties involved are met. This is done by mutual exchange and fulfilment of promises.

Morgan and Hunt 1994	Relationship marketing refers to all marketing activities directed towards establishing, developing and maintaining successful relational exchanges.
Sheth and Parvatiyar 1995	Relationship marketing is a marketing orientation that seeks to develop close interactions with selected customers, suppliers and competitors for value creation through cooperative and collaborative efforts.
Gummesson 1996	Relationship marketing is marketing seen as relationships, networks and interaction
Parvatiyar and Sheth 2000	Relationship marketing is the ongoing process of engaging in cooperative and collaborative activities and programs with immediate and end-user customers to create or enhance mutual economic value, at reduced cost.

The following definition will be used for this thesis as it captures the key elements from the other definitions, taking into consideration and encompasses stakeholder, decision, time-horizon and value dimensions.

“Relationship marketing covers all actions for the analysis, planning, realisation, and control of measures that initiate, stabilise, intensify, and reactivate business relationships with the [organisations] stakeholders – mainly customers – and to the creation of mutual value” (Bruhn, 2003).

3.2.2 Comparing transactional and relationship marketing

University-industry partnerships or collaborations involved in innovation may be purely transactional or complimented by a relationship. The “special status” of prospective partners is of interest when additional value is created that can be shared for mutual benefit.

A relationship possesses ‘mutual recognition of some special status between exchange partners’ (Czepiel, 1990).

This description captures that a relationship has a mutual component of interest that is more than simply the transaction between individuals.

*‘a succession of interactions does not necessarily lead to a relationship any more than repeat purchasing constitutes loyalty’
(c.f. Buttle, 1996).*

This second quote further illustrates the difference that repeated transactional exchanges do not necessarily involve an investment in the relationship by either prospective partner. The differentiation between transactional and relationship marketing has been evaluated by Bruhn (2003) as shown in Table 3.2. These criteria show how the differences between transactional and relationship marketing may be conceptualised.

Table 3.2 The differences between transactional and relationship marketing as developed by Bruhn (2003).

Criteria for differentiation	Transaction marketing	Relationship marketing
World view	Managing a company's product portfolio, setting and modifying marketing mix parameters to achieve optimal 4P configuration	Managing a company's customer portfolio, building long-term business relationships
Assessment horizon	Short-duration	Long-duration
Key concepts	4P's, segmentation, branding, etc.	Interaction, relationships and networks
Marketing focus	Product/service	Product/service and customer
Marketing goal	Customer acquisition	Customer acquisition, customer retention, customer recovery
Marketing strategy	Presentation of outcome	Dialogue
Marketing interaction	One-way communication, formal market studies	Interactive communication, mutual learning and adaptations

Promotion strategy	Non-personal advertising, brand and image management	Through personal interaction, developing identity as a reliable supplier in a network
Economic profit and control parameters	Profit, profit margin contribution, sales, costs	Additionally; customer profit contribution, customer value

3.2.3 Characteristics of relationship marketing

With the understanding that relationship marketing may be best represented by social penetration theory when examining the emergence and development of relationships as is the case for this thesis, the theory is characterised by eight dimensions (Altman et al., 1973). These are represented in Figure 3.1.

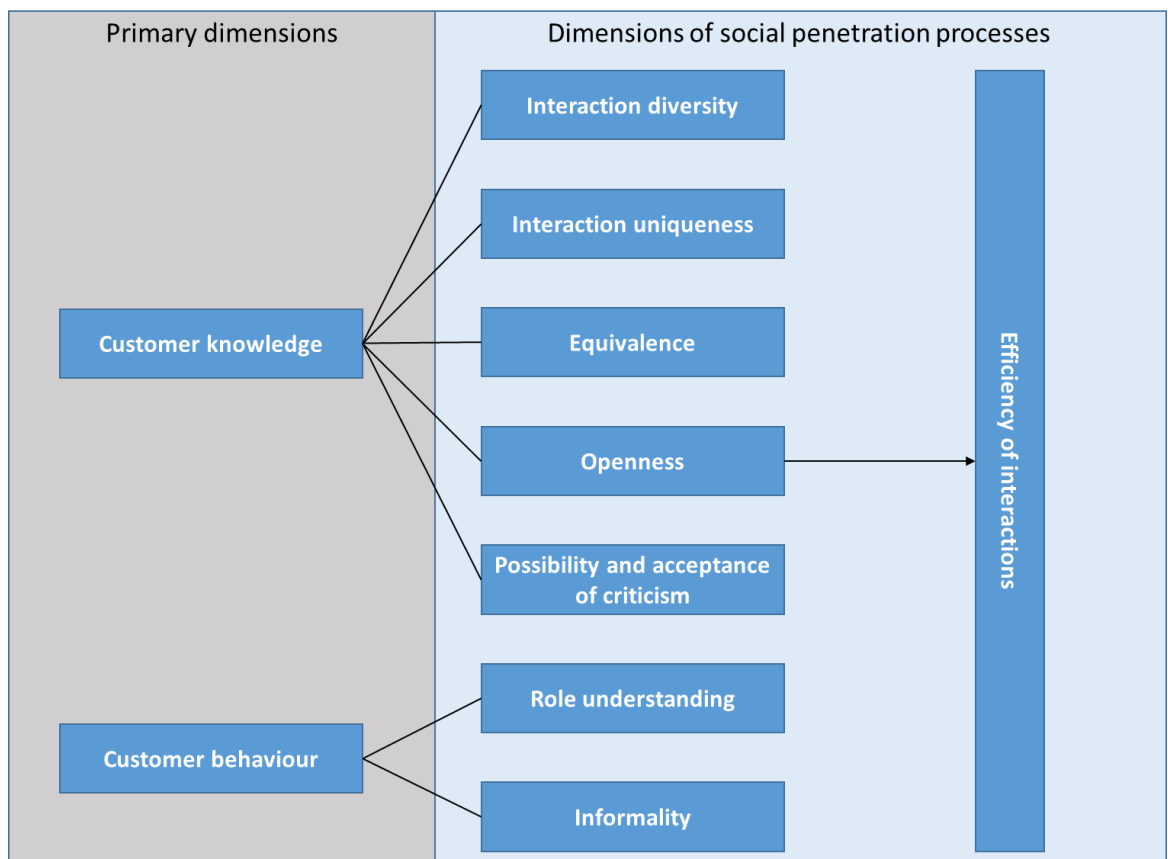


Figure 3.1 Dimensions for relationship emergence and development based on social penetration theory as illustrated by Bruhn (2003).

The dimensions of the process of an emerging and developing relationship that are associated with social penetration theory are used to help characterise relationship marketing concepts and are described as follows:

Interaction diversity

The diversity of interactions involves both the number of topics and the types of interactions. Increased interactions lead to an increase in the number of topics between parties. The interactions include verbal and non-verbal types.

Interaction uniqueness

During the time that parties spend together a number of actions that are unique to interactions take place that are unique and known to the parties.

Equivalence

Equivalence is reached between parties when they are able to communicate messages to each other in more than one way due to their knowledge of each other reaching a high enough level from previous interactions.

Openness

The openness between two parties tends to increase with positive interactions. It captures the amount that each party is willing to share with the other.

Possibility and acceptance of criticism

When parties are familiar enough with each other that they are comfortable to provide and accept warranted criticism.

Role understanding

When working on a joint project, an understanding develops for the other party roles with increasing interactions until a level of understanding allows for roles to be conducted with a minimum amount of communication.

Informality

The relationship grows, and the knowledge about the other party increases with interactions. The activities may be conducted without all the formal requirements completed.

Efficiency of interactions

The efficiency of interactions will improve with increased interactions using the first seven dimensions. Precise and rapid communication between parties improves as the knowledge of each partner increases.

In summary, these classifications may be used to structure the results sections arising from the content analysis in Chapters 5 and 6.

3.2.4 Levels of relationship marketing

To determine the level of relationship marketing that is experienced by parties, a simple system was developed by Berry (1995), to differentiate between different levels (Table 3.3).

Table 3.3 An indication of different levels and their characteristics of relationship marketing as shown by Berry (1995).

Level	Primary Bond	Degree of Service Customisation	Potential for sustained competitive advantage
1	Financial	Low	Low
2	Social	Medium	Medium
3	Structural	Medium-High	High

When each party is motivated to form a relationship for financial reasons, the degree of customisation invested by the supplier is generally low and there is a low expectation that any competitive advantage over competitors maybe sustained.

Comparatively, if an opportunity is customised to incorporate social reasons for the relationship to exist then sustaining a competitive advantage becomes easier.

The highest level of relationship marketing is argued to be experienced when there are structural reasons for the relationship to exist. The extra effort in creating high degrees of customisation are rewarded with a high potential to be able to sustain competitive advantage (Berry, 1995).

Focussing on relationships that operate with a transaction of knowledge for benefits between individuals from different organisations and considering a knowledge gap exists understanding the antecedents for academic engagement, it makes sense to investigate if relationship marketing has a role for initiating and developing the early stages of university-industry relationships.

3.3 Applying relationship marketing theory to university–industry relationships

3.3.1 Defining a university-industry relationship

University-industry innovation relationships occur when a university, industry or third party organisation exchange knowledge for some benefit. The relationship may take many different forms as discussed in Section 1. The type of relationship between the university and industry organisations will depend on the situation and the individuals involved. A model of a typical university-industry relationship as originated by an industry partner can be seen in Figure 3.2 (Bonaccorsi et al., 1994).

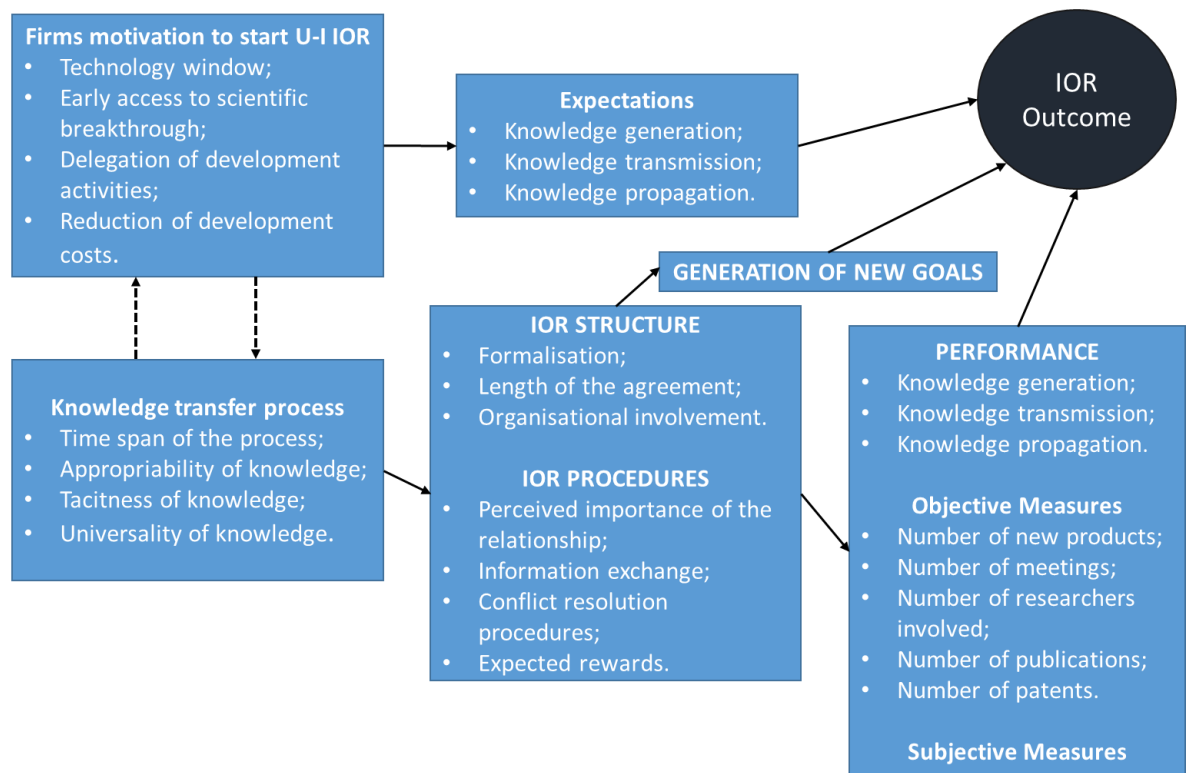


Figure 3.2 Industry initiated relationship (IOR) with university for knowledge transfer between universities and industry (I-R) as developed by Bonaccorsi et al. (1994).

The decision making executive of each organisation may not be aware of the exchange as the individuals involved will not have always entered into a formal

contract. The collaboration of these individuals from university, industry and third party organisations are the key to the development of university-industry relationships which are a precursor to innovation partnerships (Plewa et al., 2013b). These individual relationships will be further explored with the individual roles in Section 3.4.1.

3.4 Developing a model of influencers on actor behaviour

The development of a model of what impacts actor behaviour when initiating and through the early stages of university-industry relationships is important to better understand the interaction of key constructs in what is a fluid context of technology transfer and complex human relationships. It has been shown in the literature that academic engagement and relationship marketing models both have actor's "individual" factors in common (Perkmann et al., 2013; Plewa et al., 2013b). The individual factors, such as motivation, are important and can be dependent on the actor's role (Ankrah et al., 2013).

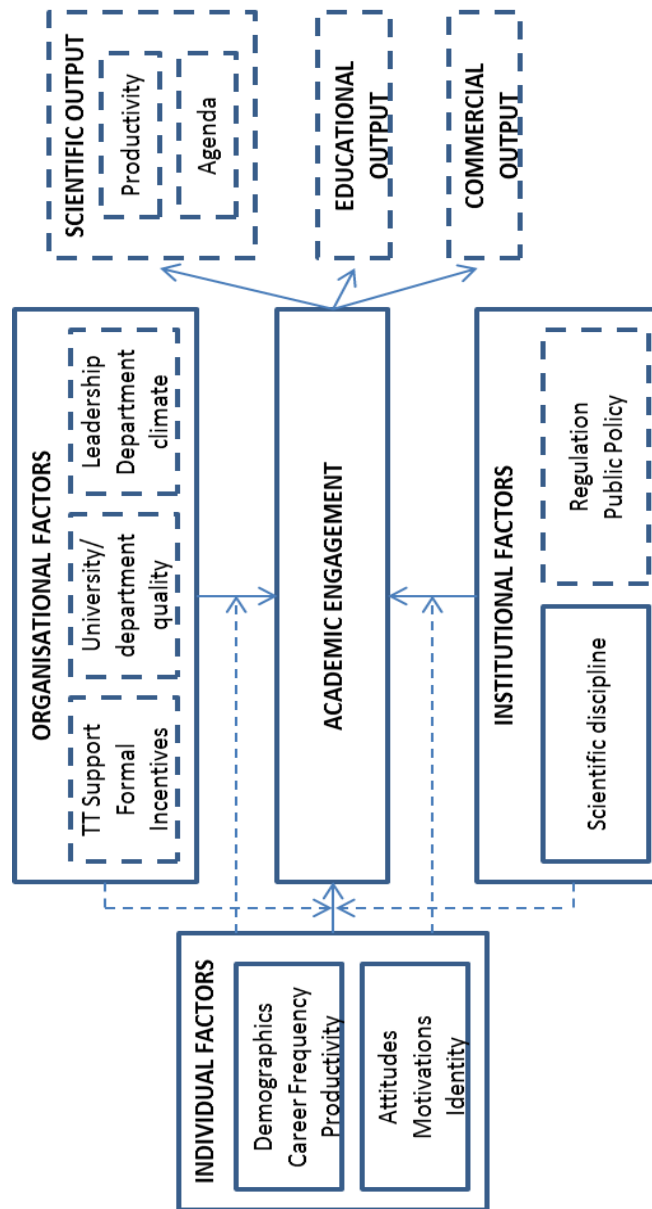
To develop a model for the initial phases of university-industry relationships it makes sense to integrate models combining the analytical framework of academic engagement (Perkmann et al., 2013) with models of relationship marketing in university-industry relationships (Plewa et al., 2013b). An adaption has been created for this thesis to assist interpret the possible alignment between these concepts, and is illustrated in Figure 3.3. This will help inform the interview protocol development.

In the analytical framework, commercialisation is an output of academic engagement. The framework alone does not describe the relationship development required for success. Integrating the phases of relationship development with the

analytical framework allows for antecedents and consequences of academic engagement to be further explored.

3.4.1 Significant actors in university-industry relationships

To best understand the relationship between universities and industry their existing internal university relationships must first be examined. The actors involved in university-industry relationships in the simplest form relate to an individual academic and an industrialist. Depending on the complexity of the partnering organisations and the proposed project, others may become significant for the type of relationship chosen.



Relationship Management Integration to Analytical Framework

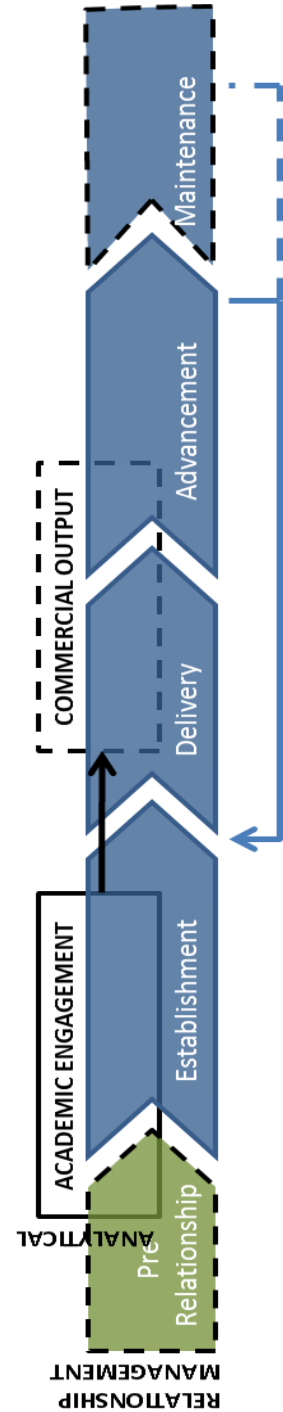


Figure 3.3 A re-conceptualisation of analytical framework for academic engagement to overlay relationship stages for commercialisation. *The integration of conceptual models showing the analytical framework developed by Perkmann et al. (2013) with relationship management phases as adapted from Plewa et al. (2013b). The commercial output is aligned with delivery and advancement. Analytically, academic engagement precedes commercial output. From a relationship perspective, engagement may continue through the latter stages.*

3.4.2 Examining innovation relationships within industrial organisations

To capture the innovation relationship experiences and perspectives from the industry partners we take a functional integration perspective, where key functions must work together to complete new product development related work (Gupta et al., 1986; Griffin et al., 1996). Within the industrial organisation there are different roles that an individual may be involved in for the innovation and commercialisation of a new product. These roles include the decision maker, and a design, operation and market manager. These different roles may be done by an individual, however are usually done by a number of people within the organisation. Successful development of new products often follows the integration and resulting mutual understanding between the individuals in these roles as shown in Figure 3.4 (Gupta et al., 1986; Ruekert et al., 1987; Olson et al., 1995).

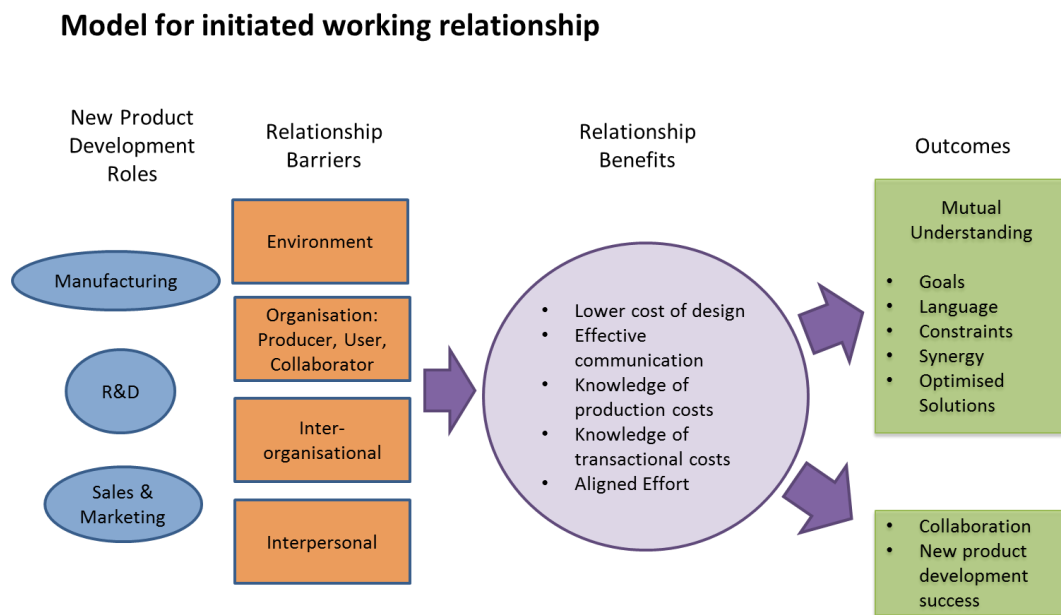


Figure 3.4 Proposed model developed by author to explain the roadblocks and drivers for the initiation of working relationships. *These form between actors to form a mutual understanding with the university as the provider of research and design expertise. Model adapted from Gupta et al. (1986).*

3.4.3 Examining innovation relationships within universities

University employees are generally less structured and have flexibility with regard to what they research and who might benefit. They have the opportunity to engage with others in a number of ways as described by Bonaccorsi et al., (1994). Although it is possible for individual academics to develop knowledge for industry in a tacit or independent contracting arrangement, it is usual for a group within the university to be involved in these situations such as a commercialisation unit or technical transfer office.

In addition to the university and industry actors, individuals from third party organisations may also be involved. These organisations may be professional intermediaries, industry bodies, or not for profit or government, where individuals can provide facilitation, technical translation, negotiation or funding support. Illustrations of the typical innovation relationships between individuals can be seen in Figure 3.5 for direct and Figure 3.6 for indirect partnerships.

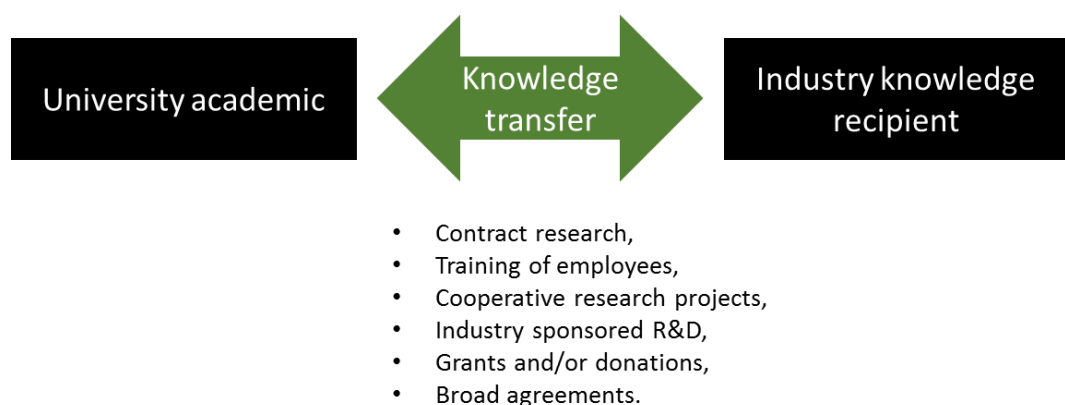


Figure 3.5 Common direct partnerships adapted from Bonaccorsi et al. (1994).

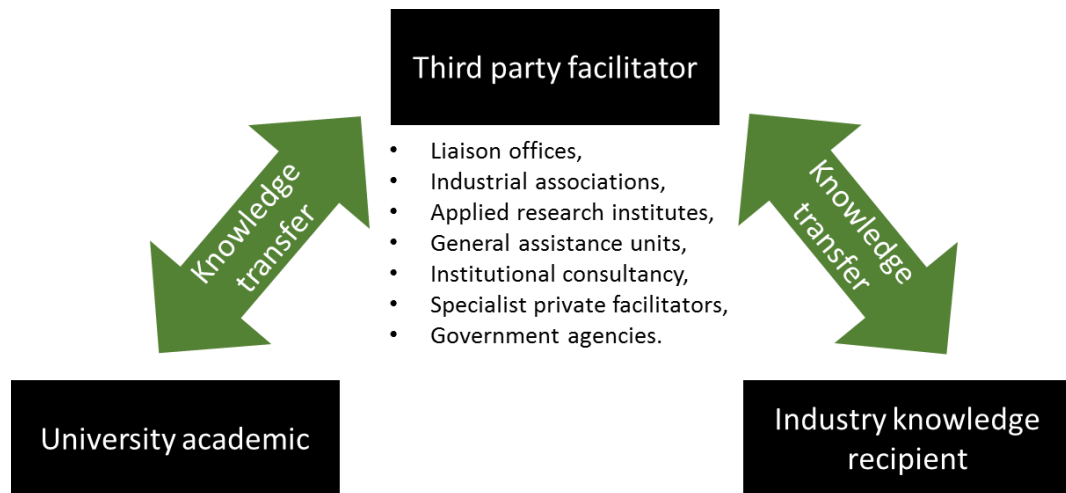


Figure 3.6 Common indirect relationships adapted from Bonaccorsi et al. (1994). The third party facilitator acting as an intermediary between the university academic and industry partner.

To be an experienced individual involved in university-industry relationships an actor may have taken part in a key role for a university, industry or third party organisation. They will have participated in an exchange of knowledge from a university for a benefit to industry. However, as individuals are free to work for different organisations at different career stages, it is possible that they may have experience from more than one organisation.

3.4.4 Influencers on initiating working relationships

In the previous sections, the complex nature of relationships has been identified. In this section we look at the foundations of relationships. Successful working relationships between actors from different roles and/or organisations rely on many factors to support the completion of required activities which is critical. With a focus on the relationship marketing perspective, the factors that are important are known as key mediating variables (KMV) which were reviewed in detail in Figure 2.4

and include: commitment, trust, cooperation, esprit d’corps and acquiescence (Morgan et al., 1994). These are accepted as the foundations of successful relationships.

The working relationships of the actor that are required to integrate design, manufacturing and market may be influenced by a number of factors that are explained further in the context of continuums as shown in Figure 3.7. The established relationship outcomes identified have been developed from the models discussed and the relationship marketing literature.

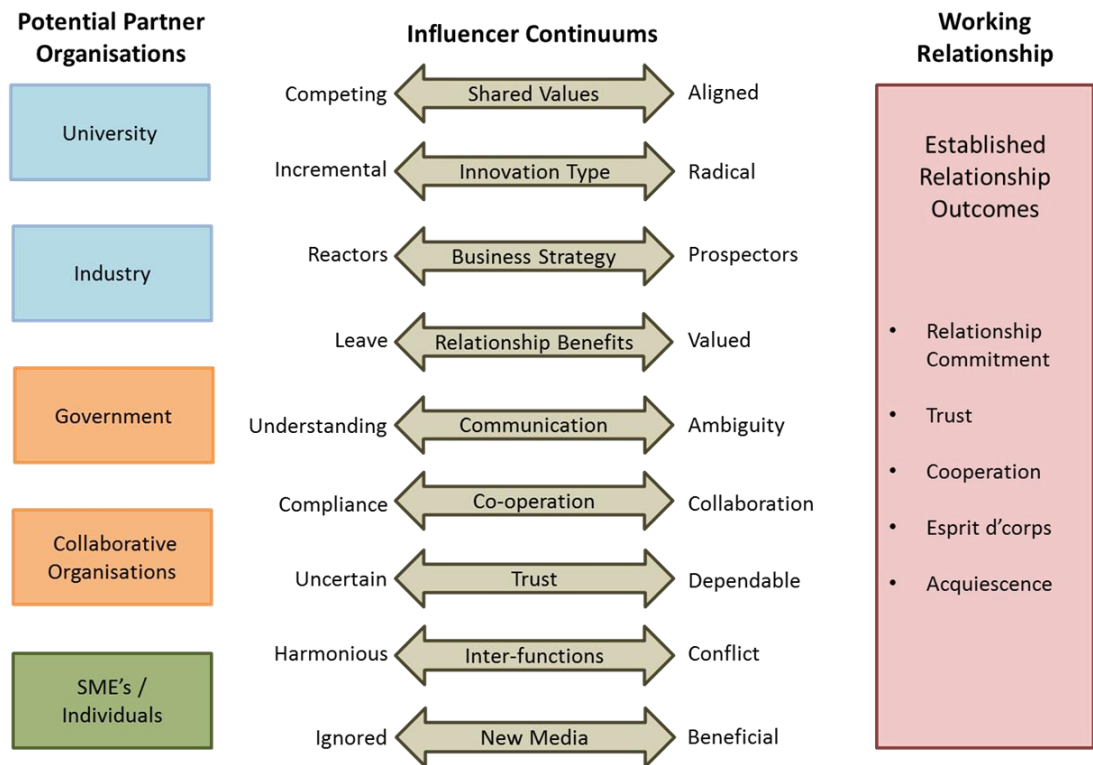


Figure 3.7 An illustration of the major influencers forming working relationships developed from literature by the author. It takes into account Key Mediating Variables to initiate cooperative relationships (Morgan et al., 1994) and the different types of organisations that may participate with falling costs (Baldwin et al., 2011).

3.4.4.1 Shared Values

Values are intrinsic to individual actors involved in working relationships. When one or more relationships are involved, the values held by an individual may either be aligned or compete with others. The more aligned the values are the more effective a team will perform (Dwyer et al., 1987; Haeussler et al., 2011).

3.4.4.2 Type of Innovation

An innovation is simply an invention that is of value to someone. The type of innovation provides an indication of the situational environment through the complexity and difficulty to commercialise an opportunity. Incremental innovations tend to build on existing technology where consumers are regularly purchasing the solution to fulfil a need. As a technology becomes more disruptive, the ability to implement it into existing processes becomes more difficult. Often disruptive technologies are developed more effectively in environments that allow for high levels of participation and have minimal bureaucracy (Olson et al., 1995).

3.4.4.3 Business Strategy

The business strategy that an organisation adopts can be grouped as reactor, defender, analyser or prospector. Progress through this continuum, from reactor to prospector, accompanies an increase in focus and resources used for finding new and innovative ways to satisfy the customer (Miles et al., 1978).

3.4.4.4 Relationship Benefits

The experience of being in a working relationship may be positive or negative. When positive an individual tends to feel valued with the benefit of wanting to participate while when negative there is a tendency for the individual to want to leave.

This factor is a key mediating variable for relationship marketing (Morgan et al., 1994). The motivational factors for university-industry relationships drive individuals from the status quo into a relationship. The only shared motivational factor between individuals from the university and industry organisations has been found to be stability. In the university stability is about reputation and funding while in industry it is attained through profitability (Ankrah et al., 2013).

3.4.4.5 Communication

Communication is key to relationship marketing. The role of communication between individuals working together is critical to a developing mutual understanding. When people first meet, there is a gap in the language and the knowledge that each party processes. In this situation, a significant amount of ambiguity exists. It is important to develop and pursue an opportunity that communication can occur between each party so that a mutual understanding is developed. The frequency and type of communication will have an impact on this (Morgan et al., 1994; Kodish et al., 2008).

3.4.4.6 Co-operation

The level of cooperation that exists between individuals will depend on the reasons that the working relationship exists and the reward structure that has been developed. The most fruitful types of relationships are often collaborative where each party gains from the experience of co-operating (Lindgreen, 2001; Gummesson, 2002). An issue with this type of co-operation is that project milestones may not be delivered when required. In contrast, co-operation that relies on compliance driven by the stakeholder agent is more likely to have timely delivery of milestones. However, this

approach is less likely to provide an environment where all the learnings related to the work, including new opportunities, are mutually understood (Gummesson, 2002).

3.4.4.7 Trust

Trust is a key component of relationship marketing with its development between individuals important. There are two types of trust that should be considered: cognitive and affective. Cognitive trust is formed rationally from how an individual is perceived in terms of demonstrated reliability and competency. Affective trust is the outcome of emotional responses to interactions. When individuals first meet, there is usually a high level of uncertainty of what to expect. First impressions will be based on intuition and affective trust. As the relationship develops, and actions are demonstrated, cognitive trust will develop to the stage that it will be possible to determine if the other party will be dependable (McAllister, 1995; Kyriazis et al., 2012).

3.4.4.8 Inter-functions

In the creation of new products, the key functions of research and development, marketing and operations are where the design, market and manufacturing decisions are made. The functions need to be optimised for the viability of a new product opportunity to be understood. It is acknowledged that the greater the conflict between these functions the greater the opportunity (Gupta et al., 1986). The journey of conflict to harmony between these functions characterises the effectiveness of the individuals contributing to the innovation as a team.

3.4.4.9 Geographical proximity

The geographical distance between key individuals has been shown to impact the likelihood of an opportunity to be developed into an innovation. It has been shown that many individuals clustered together have higher levels of innovation utilising the resources in the local area than individuals acting alone (Jacobs, 1972; OECD, 2009).

3.4.4.10 New Media

The introduction of information technology has allowed for communication costs to be significantly reduced. The use of new methods of communication using tools such as social media is used to improve interpersonal communication inside and between organisations (Smith, 2011). There are many people that choose not to use these tools for many reasons. Innovating new products involves a lot of communication inside and between organisations. These tools will form a continuum from ignored to usage in a beneficial way for key individuals.

3.4.5 Development of working relationships

The development of working relationships within and between organisations has been observed for different environments (Figure 3.8). Buyer seller relationships related to industrial markets move through stages from pre-existing, early, development, long term and final (Ford, 1980). Comparatively, the stages of working relationships from within an organisation develop from orientation, exploration, testing to stabilisation (Hutt, 1995). A model proposed for university initiated linkages has been argued to involve pre-linkage, establishment, delivery, advancement to a latent phase (Plewa et al., 2013b). This has been slightly modified for context of this thesis to pre-relationship, establishment, delivery, advancement and maintenance. The

use of the word “latent” was considered to imply a dormant characteristic. The use of “maintenance” acknowledges that relationships may continue and action taken to foster them after the formal aspects of a project have concluded.

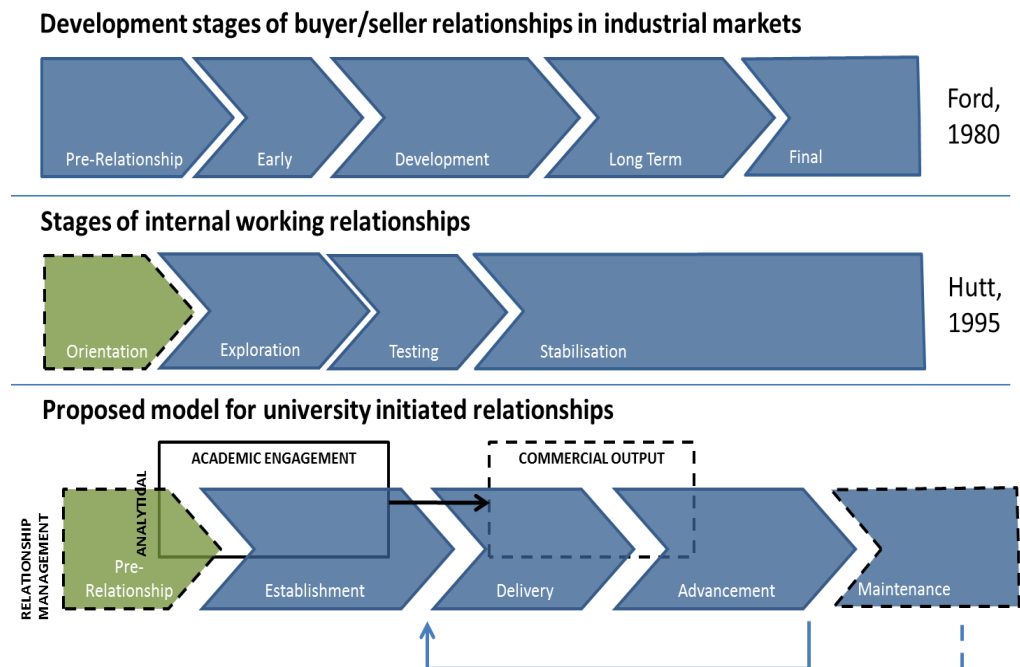


Figure 3.8 A re-conceptualisation of the relationship initiation and development model for university-industry. A comparison of relationship development models for between organisations (Ford, 1980) and within organisations (Hutt, 1995). The proposed university initiated relationship development model is a modification of the university industry linkage model (Plewa et al., 2013b).

The theoretical models provide the framework required to develop the interview protocols for actors and to postulate propositions. The models that have been developed from the review of literature and the conceptualisation of the influencer continuum are focussed on providing resources to effectively describe each actor’s experience.

3.5 Conclusion

On reviewing the literature, a significant effort has been exerted to understanding models for existing university-industry relationships. The knowledge gap in the antecedents to academic engagement and the lack of a mechanism to explain the behaviour provides an opportunity to investigate if the social exchange theoretical concept allows for actor experiences in university-industry relationships to be further understood. The lack of a well-defined mechanism for university-industry relationship initiation and development allows for a research design based on an interpretivist approach to understanding relationship marketing theory which is grounded in social exchange theory, an empirical positivist foundation, explains the observed and measured university-industry relationships and can assist identify roadblocks and drivers. Framing the research propositions against such a theoretical lens is the most appropriate way to capture the constructs of interest.

The landscape for stakeholders is changing with an increase in competition from reduced costs and the development of technology making mass production less relevant in some applications. Collaborations, SMEs and individuals have the opportunity to participate in the long innovation commercialisation process that did not exist until recently.

The integration of academic engagement and relationship development frameworks, with the development of the model for initiating working relationships have led to the proposed theoretical model of actor influencer continuums for university and industry relationships. These continuums are important for understanding if relationship marketing concepts are involved in the mechanisms that

create relationships that create innovations. These concepts form a basis for the research design, methodology and interview protocol.

4 RESEARCH DESIGN AND METHODOLOGY

The purpose of this research is to understand the drivers and roadblocks to the initial and early stage development of innovation relationships. It includes assessing if the university can be placed as the nexus point of the collaboration network with innovative manufacturers. The primary research question is to determine the facilitators and roadblocks to relationship development by interviewing key actors these being 1) university, 2) industry, and 3) intermediaries.

Essential to this research is to understand the thought processes and lived experience of these actors. The research design, method and analysis provide an approach which allows us to explore and form an understanding of actor experience when proceeding into the early stages of an innovation project.

The research context of additive manufacturing provides an opportunity to examine early stage relationship building in a range of scientific complexity as some of the applications are incremental while others are disruptive which may influence the motivation to form relationships.

4.1 Research Design

The research design can be structured in several ways depending on its objectives. It is important that the design support the research purpose. It is also important that the philosophical paradigms and research methodology are in alignment. This chapter explains the approach to the research methodology and the data collection procedures that were used (Dawes, 1987; Creswell, 2007).

4.1.1 Approach to research and methodology

It is established practice to position research according to the philosophical paradigm and approach that best supports the research question. This thesis interprets the experiences of actors involved in the phenomenon of initiating and the early stage development of new university-industry working relationships.

4.1.1.1 Philosophical paradigms

The purpose of this research is to interpret the experience of actors to understand what mechanisms are involved in the initiation and development of university-industry relationships so that a model may be formulated, which makes interpretivism the most suitable philosophical paradigm for this thesis.

The use of a quantitative approach was not pursued as the complexity of developing an understanding of the drivers and roadblocks from interviews of the three different types of organisations was difficult. The process to operationalise measurement to allow reliable quantification of attributes was not considered to be possible without a well-constructed theoretical model. Choosing an interpretative approach to first understand the important constructs for effective university-industry relationships will provide the framework to later collect data to quantify, analyse and deduce the magnitude and inter-relationships involved.

4.1.1.2 Research question and lens

The primary research question involves understanding actor experience to develop an understanding of the mechanism/s that underpin the best practices for initiating and developing relationships between university and industry actors.

The relationship marketing lens (Section 3.4) is appropriate as it captures initiating and developing working relationships. It involves the key mediating variable model (Figure 2.4) which has a focus on cooperation which was described as an outcome of relationship commitment and trust (Morgan et al., 1994). It also incorporates the types of potential partner organisations progressing innovation and is related to the model suggested by Baldwin et al. (2011).

4.1.2 Theory connection with expected research outcomes

I expect to find that, in addition to the analytical outcomes (Perkmann et al., 2013), that some social and behavioural attributes will be present when initiating university-industry relationships. The collection of data will focus on gaining background information relating to participants (Plewa et al., 2013b) to help understand attributes of those contributing to the research.

When the participants discuss the formation of innovation projects, it is expected that their experiences will have a component related to: motivation (Ankrah et al., 2013); social exchange and relationship development (Bruhn, 2003; Plewa et al., 2013b); Communication and trust (Grönroos; Kyriazis, 2005). It is from the extension of social exchange theory to the initial stages of university-industry relationships that important concepts were derived and explained in section 3.4.4 and shown in Figure 3.8, that form the conceptual basis for the research.

Most participants on the macro-scale of motivation will be motivated by stability, while on the micro-scale, their personality and the organisation that they work for will have an influence on an independent mix of motivational factors (Ankrah et al., 2013).

The characteristics of the social exchanges during the initial stage of relationship develop is likely to be different to those during other stages relationship development as found by (Plewa et al., 2013b). The levels of communication, trust, relationship commitment, benefits of having the relationship, cost of not being in the relationship and opportunistic actions are all potential influences (Morgan et al., 1994). The type and frequency of communication, and the level of trust present of special interest to participants active in new product development (Bruhn, 2003; Kyriazis, 2005). The research propositions are restated here to allow for the connection with the expectations to be shown.

P1) Determine drivers and roadblocks to relationship development between university and industry by interviewing key stakeholders.

P2) Universities can become a nexus point for university-industry partnerships through using a proactive relationship marketing approach during initial relationship phases.

P3) Social media is used during the initial stages of relationship development.

4.2 Data collection procedures

A common method of data collection in a phenomenological approach is in-depth interviews (Leedy et al., 2005). This method was used for a pilot study (Appendix C) to orientate semi-structured interview protocols that were modified and tested (Appendix D) before adoption of the final protocol for the main study (Appendix

E). The main interviews were conducted using the interview protocol 3 as shown in Table 4.1.

Table 4.1 Questions used for the final semi-structured in-depth interviews with the university, industry or intermediary participants. *The protocol was adjusted for the current participant experience. The sources of groups of questions have been included. Nexus behaviour determined from motivation group of questions.*

Section (source)	Question
General: Information about the interviewee (Plewa et al., 2013b)	What kind of linkages with industry/university are you involved in?
	How many projects/relationships are you involved in?
	When did those partnerships commence?
	Have you been employed in industry/at university previously?
Motivation: (Ankrah et al., 2013)	What was your motivation to get involved with university/industry?
	How did you first get involved with university/industry?
	How was first contact made?
	What happened?
Individual relationships: (Plewa et al., 2013b)	Would you call your interactions with university/industry to date a relationship?
	Briefly describe the kind of relationship you are engaged in
	How long has it been running (e.g. several projects or one project, length of time)
	How many people are involved on both sides?
	How much is involved (how important for you)?

	Would you consider the project/s you are most interested in as incremental or disruptive or radical in nature?
Relationship development: (Plewa et al., 2013b)	What would your ideal relationship with industry look like?
	How did the initial relationship come about?
	What was important for the relationship success at this initial stage?
	Have you come across any relationship road blocks? (relationship, process/technical, administrative) What would have helped speed up the process?
	What would you say is success at this stage? How would you define it?
	What agreement/s did you have (written or tacit); please comments on agreement development.
Relationship Investment: (Kyriazis, 2005)	Did you experience any roadblocks in developing the relationship in terms of resourcing or time?
Communication: (Bruhn, 2003) (e-collaboration) →	What are your preferred types of communication for university-industry relationships?
	Can you describe ways you have communicated when developing and maintaining a good business relationship? A poor one?
	Do you find new communication and collaboration methods useful?
	Can you describe the pattern of communication that occurred with a good university-industry relationship that you have been involved in?
	What is your preferred communication method for knowledge transfer?
	What is the communication like, what could be improved?

Bi-Directional Communication (Kyriazis, 2005)	What has been your experience with communication from university/industry?
Other: (Plewa et al., 2013b)	How does your organization manage/plan to manage industry relationships?

The interviews were planned to take between 45 and 60 minutes in duration. The interviews were organised to be conducted in a quiet place free of distractions, and were recorded with a digital recording device and then transcribed.

The interview protocols were subjected to two pilot tests which included at least one academic who had experience with the method to ensure that the protocol was satisfactory. The interviews continued until saturation of themes was reached from each group of university, intermediary and industry actor interviewees (Yin, 1994). The data was collected from 36 respondents who agreed to participate in the interviews.

4.2.1 Locating interviewees

Participants were selected from potential actors who had involvement in initiating and developing a relationship for innovation and technology projects with a university. They become known to the researcher through attending academic engagement events or referrals from potential actors, selected participants and/or the academic engagement event organisers. Prospective participants at the academic engagement events were met during session breaks, and if an interest was expressed in the research area, contact details were exchanged and a formal invitation to participate was made through email. Referred participants were initially contacted by phone and/or email in an informal way and if they responded in a positive way, a

formal invitation to participate was emailed. The formal invitation included a participant information sheet and consent form.

Before an interview took place, the prospective participants were checked to ensure that they were a university, intermediary or industry actor with university-industry collaboration experience related to at least one innovation project. These actors are important as they have come from different life worlds and have different viewpoints on the phenomenon of initiating and developing the early stage of working relationships for innovation projects. The industry actor was a key target as they were often the recipients of academic engagement efforts. The convenience sample used meant that potential participants had either a direct and/or indirect innovation relationship with the Australian Research Council Centre of Excellence for Electromaterials Science (ACES) which incorporates an Additive Manufacturing Fabrication Unit. This group was chosen as there were coordinating engagement activities in different geographical locations, were a collaborative group of people willing to support the research and additive technology provided actors involved with a continuum of incremental through to disruptive innovation projects.

4.2.2 Gaining access

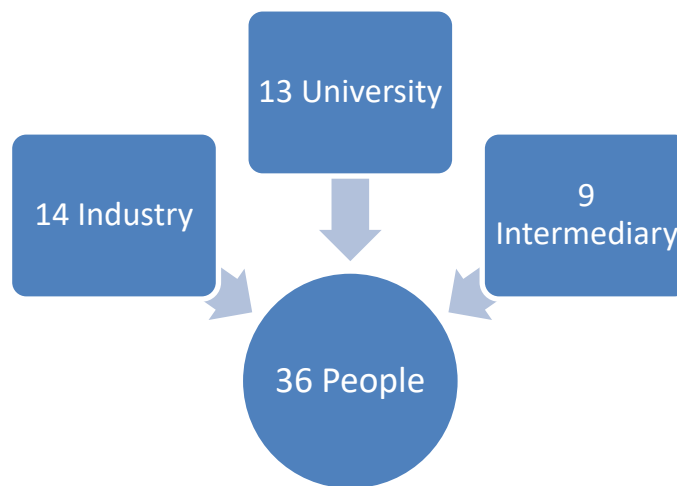
All participants consented to the process as outlined in ethics approval HE12/271. The participant information explaining the interview process to prospective participants has been included in Appendix F.

4.2.3 Sampling

The initial participants were asked to recommend further suitable participants, where appropriate, using the snowball technique (Dawes, 1987). The participants

chosen from the snowball technique were not limited by the type of technology that was central to their engagement. A review of respondent sampling was completed after interviews.

The planned participant scheme for actor type was: twenty industry, ten university and ten intermediary participants. The actual participant numbers currently employed in each role are shown in Figure 4.1.



The intent of participant variation was to capture insights from a broad

Figure 4.1 Breakup of participants current organisation for the study which was designed to capture information from the different actor viewpoints on university-industry relationships. spectrum of viewpoints across university and industry experience. The sampling from each grouping achieved this spectrum of viewpoints as some actors had innovation project experience in more than one organisation type. The experience viewpoints that were captured in the sampling are shown in Figure 4.2.

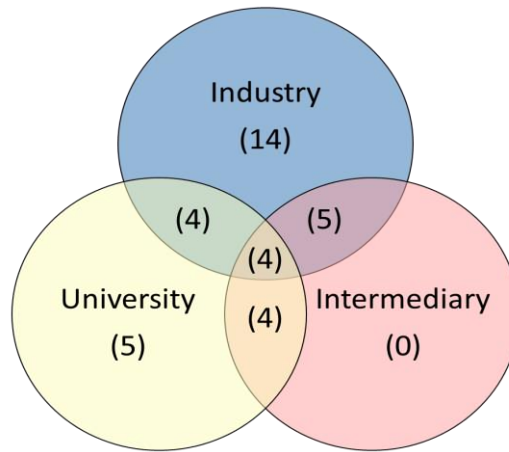


Figure 4.2 Breakup of each participant's innovation project collaboration experience by organisation type employment. It is interesting that all intermediaries had experience performing a project role in at least one other type of organisation.

The details of participants who were invited to participate in the study has been broken into two tables to assist with presenting the information. Organisation attributes for the participant and the interview protocol used, and if they are willing to be quoted in the research are listed in Table 4.2. Information relating to the characteristics of the participants, such as their specific organisation experience, is included in Table 4.3.

Table 4.2 The details of the respondents who participated in the in-depth interviews where the data collection took place.

Participant	Role	Actor Type	State	Country	Protocol	Quote
1	Innovation Manager	Industry	NSW	Australia	1	Yes
2	Business Development Manager	Industry	NSW	Australia	1	Yes
3	Manufacturing Engineering Manager	Industry	NSW	Australia	1	Yes
4	Business Owner	Industry	NSW	Australia	2	Yes
5	Commercial Manager	Industry	NSW	Australia	2	Yes
16	Business Innovation officer	Industry	NSW	Australia	3	Yes
17	General manager, innovative SME	Industry	NSW	Australia	3	Yes

20	Technical manager, innovative SME	Industry	NSW	Australia	3	Yes
21	Chief technical officer, medical company	Industry	N/A	UK	3	Yes
26	Industry technical officer	Industry	VIC	Australia	3	Yes
27	CEO small innovative company	Industry	VIC	Australia	3	Yes
29	CEO Start-up	Industry	VIC	Australia	3	Yes
30	Business Development Manager	Industry	VIC	Australia	3	Yes
32	CEO, SME medical	Industry	VIC	Australia	3	Yes
6	Lead Researcher	University	NSW	Australia	2	Yes
9	Research group lead	University	NSW	Australia	3	Yes
10	Professor, Research Director	University	N/A	Taiwan	3	Yes
11	Commercial unit officer	University	NSW	Australia	3	Yes
13	Chief clinician	University	VIC	Australia	3	Yes
14	Chief research officer	University	VIC	Australia	3	Yes
18	Chief researcher, commercial, operational managers	University	VIC	Australia	3	Refer
19	Lead researcher, Associate Professor	University	NSW	Australia	3	Yes
22	Lead commercialisation unit, Technical manager	University	NSW	Australia	3	Yes
23	Lead Researcher, company owner	University	NSW	Australia	3	Yes
28	Professor, Research Director	University	VIC	Australia	3	Yes
33	Lead commercialisation unit	University	VIC	Australia	3	Yes

34	Lead researcher, engagement facilitator	University	QLD	Australia	3	Yes
7	Industry group CEO	Intermediary	VIC	Australia	2	Yes
8	Consultant CEO	Intermediary	NSW	Australia	3	Yes
12	CEO	Intermediary	NSW	Australia	3	No
15	Business Cluster Manager	Intermediary	NSW	Australia	3	Yes
24	CEO NFP facilitator company	Intermediary	VIC	Australia	3	Yes
25	General manager/business development in intermediary company	Intermediary	VIC	Australia	3	Yes
31	Innovation Specialist facilitator	Intermediary	VIC	Australia	3	Yes
35	Owner facilitator company	Intermediary	NSW	Australia	3	Yes
36	Government innovation facilitator manager	Intermediary	NSW	Australia	3	Yes

In contrast, the characteristics of participants and the types of projects that they are involved in was captured in Table 4.3. The participant number, role and actor type are consistent with Table 4.2. The type of innovation projects that are mostly undertaken by the participant are captured in the “innovation type” column. The number of years’ experience working in university-industry innovation projects is shown in the “experience” column.

To provide some further clarity on participant experience, a low number of collaboration projects has been flagged. Participants who have been involved in less than five innovation projects in their career are highlighted in the “<5 projects exp.” column. Only industry participants were found to have this attribute. The final column

provides details of the different types of organisations each participant has undertaken innovation experience. It provides a detailed view of the summarised data in Figure 4.2.

The academic participants can be considered typical of those with a scientific research focus wanting to commercialise their knowledge. The industry and intermediate participants all collaborate with industry to bring new scientific knowledge to market. They differ mainly in the level of complexity of the knowledge and the reason for utilising the knowledge. The innovation type provides insight to these differences for each participant.

Table 4.3 The characteristics” and experience of respondents who participated in the in-depth interviews.

Part.	Role	Actor type	Innovation type	Experience (years)	< 5 Projects Exp.	Organisation experience
1	Innovation Manager	Industry	Defender	0-5		Industry
2	Business Development Manager	Industry	Analysers	0-5		Industry
3	Manufacturing Engineering Manager	Industry	Defender	10-15		Industry
4	Business Owner	Industry	Analysers	0-5		Industry
5	Commercial Manager	Industry	Defender	5-10		Industry
6	Lead Researcher	University	Prospector	5-10		University
7	Industry group CEO	Intermediary	Analysers	>15		Industry; Intermediary
8	Consultant CEO	Intermediary	Prospector	>15		University; Industry; Intermediary

9	Research group lead	University	Prospector	10-15		University; Intermediary
10	Professor, Research Director	University	Prospector	>15		University
11	Commercial unit officer	University	Analysers	5-10		University; Intermediary
12	CEO	Intermediary	Prospector	10-15		University; Industry; Intermediary
13	Chief clinician	University	Prospector	10-15		University; Industry
14	Chief research officer	University	Prospector	>15		University
15	Business Cluster Manager	Intermediary	Analysers	0-5		Industry; Intermediary
16	Business Innovation officer	Industry	Prospector	>15		Industry
17	General manager, innovative SME	Industry	Prospector	10-15		Industry
18	Chief researcher, commercial, operational managers	University	Prospector	10-15		University; Industry
19	Lead researcher, Associate Professor	University	Prospector	5-10	Yes	University
20	Technical manager, innovative SME	Industry	Prospector	5-10		Industry
21	Chief technical officer, medical company	Industry	Prospector	>15		Industry
22	Lead commercialisation unit, Technical manager	University	Prospector	>15		University; Industry
23	Lead Researcher, company owner	University	Prospector	5-10		University; Industry

24	CEO NFP facilitator company	Intermediary	Analysers	>15		Industry; Intermediary
25	General manager/ business development in intermediary company	Intermediary	Analysers	0-5		Industry; Intermediary
26	Industry technical officer	Industry	Defender	0-5	Yes	Industry
27	CEO small innovative company	Industry	Prospector	0-5		Industry
28	Professor, Research Director	University	Prospector	>15		University
29	CEO Start-up	Industry	Prospector	5-10	Yes	Industry
30	Business Development Manager	Industry	Prospector	0-5		Industry
31	Innovation Specialist facilitator	Intermediary	Prospector	10-15		University; Industry; Intermediary
32	CEO, SME medical	Industry	Prospector	0-5		Industry
33	Lead commercialisation unit	University	Prospector	>15		University; Intermediary
34	Lead researcher, engagement facilitator	University	Analysers	>15		University; Intermediary
35	Owner facilitator company	Intermediary	Analysers	10-15		University; Industry; Intermediary
36	Government innovation facilitator manager	Intermediary	Analysers	0-5		Industry; Intermediary

4.2.4 Recording the collected information

The collected information was in the form of both a hard copy interview protocol that had notes marked on it during the interview and the recorded interview that was later professionally transcribed.

4.2.5 Resolving issues in the field

Preventative actions were taken to ensure that any issues that occurred in the field were minimised. These included following the participant protocols that were established in ethics approval HE12/271, planning to arrive at interview premises early, and having a spare recording device. Contingent actions included travelling with a mobile phone and having questions pre-printed with a blank copy of the consent form. The only issues experienced in the field were with a participant who was not able to attend an interview and a participant who had less time than planned. The missed interview was rescheduled and conducted as a phone interview. The interview with less time than planned had less open-ended checks for understanding.

4.3 Data analysis and validation

4.3.1 Data analysis method

The data analysis was conducted once interviews had completed. The interviews were transcribed professionally by an external company (www.scribie.com) as interviews occurred. To ensure quality of transcriptions, random sections of the audio were selected and compared to the transcript. The analysis protocol for the transcripts were conducted as described in Section 4.1 by (Creswell,

2007). The content analysis was undertaken to explore the themes of adopter experience using the following steps:

- 1) The researcher provided a full description of their experiences of initiating and developing early stage university-industry relationships. This was to help set aside the researcher personal experience.
- 2) Develop a list of significant statements about how individuals experience collaboration.
- 3) Group the significant statements into larger theme groupings.
- 4) Create a textural description of what the participants experienced.
- 5) Provide a structural description of how the experiences happened.
- 6) Develop a composite description of the phenomenon including the themes and structural description.

4.3.2 Representing themes

Once the analysis of the actor experience was complete, content analysis was used to help describe the experience from the actor view point. The themes that were interpreted through the analysis were described in a way that reflected the use of the lens described in Section 3.4.

4.3.3 Validation

A process of validation for any study is important for the acceptance of the work by peers. For a qualitative study with a foundation in interpretivism, it is important for the study to be considered well-grounded and the findings well supported (Creswell, 2007). The validity concepts of credibility, transferability, dependability and confirmability are appropriate for the paradigm of the study (Miles et al., 1994).

Credibility

The credibility of research being truthful and making sense can be assessed in many ways. The involvement of actors from the three different perspectives of the organisations provided triangulation of the experiences of the drivers and roadblocks to relationship development. A comparison of the different actor groups was not possible as the descriptions related to textual units that were derived from the interview transcripts that were captured from actor experience from more than one type of organisation. The credibility of the findings is supported by the level of overlap between the proposed models in Chapter 3 and the interpretation of results in Chapter 7.

Transferability

The initial participants selected were approached at ACES academic engagement events. However, the participant experience of university-industry relationships was not limited to projects with the ACES organisation. Actors recalled experiences that had occurred in different internal and external environments to their current situation. The sample also included two international participants (UK and Taiwan) and their responses were similar to those of domestic participants. By assessing how different theoretical models fitted with the thematic descriptions the researcher was able to propose a transferable reconceptualised theoretical model.

Dependability

The data collection and analysis was undertaken by the researcher with the objective of the study being dependable. The main protocol used for data collection was developed from two earlier protocols in an iterative manner to ensure consistency

and relevance throughout the data collection. The analysis was conducted on professionally transcribed interviews using nVivo® to map textural units with descriptions. The descriptions and textural units were reviewed by an experienced qualitative academic researcher and differences were discussed and amendments made. After amending, the descriptions and textural units were then reviewed again by a more experienced qualitative academic researcher who highlighted some minor differences of descriptions for textual units and were addressed.

Confirmability

Pilot studies were completed to improve qualitative research skills. Skilled qualitative academics reviewed results and interpretation to ensure that these aspects were completed competently. The researcher documented their perceptions towards the topic before collecting data to assist minimise bias. This has been included in Appendix G.

4.4 Conclusion

A qualitative approach was used to tease out the real issues. The qualitative, interpretive approach taken to this research and the methodology used have been described. The connection between the analysis and the relationship marketing lens developed in Section 3.4, which was used for coding content, has been explained. The data collection processes have also been explained to assure research process validity.

The next two chapters present the results of the research, Chapter 7 will provide an explanation of the interpretation. Chapter 8 will then draw the conclusions from these analyses.

5 DETERMINING ROADBLOCKS TO EARLY STAGE RELATIONSHIP DEVELOPMENT

5.1 Introduction

The purpose of this research is to understand the drivers and roadblocks to the initial and early stage development of innovation relationships. It includes assessing if the university can be placed as the nexus point of the collaboration network with innovative manufacturers. The effectiveness of this research needs to capture the critical stages from which working relationships develop. From initial orientation, exploration, testing and stabilization, each stage needs differing commitments from the stakeholders. The clear focus is from the perspective of the university having a business development manager/s tasked with performing this role as prescribed below.

There are numerous participant experiences in this research that highlight gaps in the expectations between those working in different roles and/or organisations. These gaps can be observed as barriers for initiating and developing mutually beneficial working relationships where the situation, processes and outcomes may be impacted. These participant experiences are interpreted, grouped, and described in Section 5.2 as shown in Figure 5.1.

As outlined, a relationship marketing lens has been chosen to interpret participant experiences. This context is not easy to convey, especially with the situation of a complex and turbulent external environment. Organisations often use business development managers to carry out their relationship marketing activities. To assist the reader a contemporary view of how a person would behave in a nexus role is presented. The reference is captured by both the contemporary view (Table 5.1) and a specific marketing Business Development Manager (BDM) role description is also

included to demonstrate the characteristics of somebody engaged in best practice (Figure 5.2).

Chapter 5: Determining Roadblocks to early stage relationship development	
5.1	Introduction
	<p>5.1.1 Relationship contact and communication</p> <p>5.1.2 Best practice development of business relationships</p> <p>5.1.3 The normative business development approach</p> <p>5.1.4 Applying a BDM approach to interpret roadblocks</p>
5.2	Participant roadblocks experienced through a relationship marketing lens
	<p>5.2.1 Roadblocks to getting the relationship started</p> <p>5.2.2 Cultural and language barriers</p> <p>5.2.3 Organisational differences</p> <p>5.2.4 Relationship roadblocks between university and industry people</p> <p>5.2.5 Barriers to decision making in partnerships</p>
5.3	Summary of roadblocks to initial and early stage relationship development
Chapter 6: Drivers for relationship initiation and early stage development	

Figure 5.1 The structure of Chapter 5.

The reasoning for this is to show the comprehensive nature of such roles and the responsibilities within them. Shown are two views, university as initiator/nexus and industry acting as initiator/nexus. To fully unpack the relationship formation, Table 5.1 is an idealised view of what should happen with the university as the nexus, and industry as a nexus. This is important because it shows the fine detail of initial relationship contact and communication.

Table 5.1 An idealised view of what is expected from stakeholders acting as the nexus partner for innovation in university-industry relationships developed by the author from university and industry position descriptions such as that shown in (Appendix H).

What is expected of a nexus partner/driver in chasing relationships?	University being proactive	Industry being proactive
Chase new prospects	Cold call people who you think may wish to use the product and/or service.	Cold call people who you think may have the technology or knowledge.
	Understand if they are open to talking about opportunities to work together.	Understand if they are open to talking about opportunities to work together
	Understand what their major issues and needs are – what they need help with?	Understand what their major technology strength are – what type of funding they need?
	Determine if you are able to help them, if so develop a proposal	Determine if you are able to help them, if so develop a project task brief.
	Ask University Network for Referrals	Ask Industry Network for Referrals
How	Visit people work sites (face-to-face)	Visit potential university campus (face-to-face)
	Phone introduction (ask to meet)	Phone introduction (ask to meet)
	email introduction (ask to meet)	email introduction (ask to meet)
	email invite to an event	email invite to an event
	join local business and industry associations	join local business and industry associations
	Attend local networking events	Attend local networking events

	Advertise in local media	Advertise in local media
	Talk to people at local community events – word of mouth	Talk to people at local community events – word of mouth
	Use social media to broadcast messages	Use search engines to find technical expertise and contact information
	Attend technical conferences (face-to-face)	Attend technical conferences (face-to-face)
What is expected of a nexus partner/driver when being contacted	Respond quickly	Respond quickly
	A single point of contact	A single point of contact
	Clear communication on how processes work / how does progress look	Clear communication of what is expected from work and its value
	Concise communication	Concise communication
	Present with high cognitive trust – energy, behaviour	Present with high cognitive trust – energy, behaviour
	Approachable	Approachable
	Principled approach	Principled approach
	Able to communicate the mutual benefit of building a working relationship / who benefits and how?	Able to communicate the mutual benefit of building a working relationship / who benefits and how?
	Able to understand if it may be beneficial to meet, and organise a meeting at the industry site?	Able to understand if it may be beneficial to meet, and organise a meeting at the university?
	Listen and understand what the issues are at the industry site before advocating solutions	Listen and understand what the constraints are at the university before deciding upon research objectives.
	Able to prioritise what is available that may be the most benefit to industry (for each site visited)	Able to prioritise what technology has the most benefit for market
	Deliver on any commitments made	Deliver on any commitments made
	Manage the organisational misalignment of goals and objectives from the industry person being engaged	Manage the organisational misalignment of goals and objectives from the university person being engaged
	Introduce and edify into technical community	Introduce and edify into industrial community
	Create the community for the new industry if it is viable and does not exist	

Note: The differences between the approaches that may be taken by a university actor verses an industry actor in the role of the nexus of an innovation project are shaded in yellow.

5.1.1 Relationship contact and communication

There are a number of essential activities for business development that are independent of the organisation type acting as the nexus. In fact, the unshaded activities in Table 5.1 can be considered independent of the product or service as well. In contrast, the activities that are shaded in yellow represent where the action needs to be modified and take into account the relevant position of the stakeholder providing the nexus. These differences are mainly due to the different situation, processes and cultures that exist between university and industry organisations.

5.1.2 Best practice development of business relationships

In a best practice theoretical model for the initial and early stages of developing working relationships between universities and industry, the key actors involved in engagement are expected to behave similarly to Business Development Managers (BDMs). The BDM role typically includes: engaging with new business prospects, identifying new opportunities within the market, maintaining existing business relationships, as well as updating and maintaining records within a Customer Relationship Management (CRM) system. The example in Figure 5.2 provides a typical business development manager role description. The role description is to provide a dimensional reference for interpreting actions described by participants relating to initial and early stage relationship development.

The Role of the Business Development Manager

A Business Development Manager works to improve an organization's market position and achieve financial growth. This person defines long-term organizational strategic goals, builds key customer relationships, identifies business opportunities, negotiates and closes business deals and maintains extensive knowledge of current market conditions. Business Development Managers work in a senior sales position within the company. It is their job to work with the internal team, marketing staff, and other managers to increase sales opportunities and thereby maximize revenue for their organization. To achieve this, they need to find potential new customers, present to them, ultimately convert them into clients, and continue to grow business in the future. Business Development Managers will also help manage existing clients and ensure they stay satisfied and positive. They call on clients, often being required to make presentations on solutions and services that meet or predict their clients' future needs.

Job Description	<p>The primary role of the Business Development Manager is to prospect for new clients by networking, cold calling, advertising or other means of generating interest from potential clients. They must then plan persuasive approaches and pitches that will convince potential clients to do business with the company. They must develop a rapport with new clients, and set targets for sales and provide support that will continually improve the relationship. They are also required to grow and retain existing accounts by presenting new solutions and services to clients. Business Development Managers work with mid and senior level management, marketing, and technical staff. They may manage the activities of others responsible for developing business for the company. Strategic planning is a key part of this job description, since it is the business manager's responsibility to develop the pipeline of new business coming in to the company. This requires a thorough knowledge of the market, the solutions/services the company can provide, and of the company's competitors. While the exact responsibilities will vary from company to company, the main duties of the Business Development Manager can be summarized as follows:</p>
New Business Development	<ul style="list-style-type: none"> • Prospect for potential new clients and turn this into increased business. • Cold call as appropriate within your market or geographic area to ensure a robust pipeline of opportunities. • Meet potential clients by growing, maintaining, and leveraging your network. • Identify potential clients, and the decision makers within the client organization. • Research and build relationships with new clients. • Set up meetings between client decision makers and company's practice leaders/Principals. • Plan approaches and pitches. • Work with team to develop proposals that speaks to the client's needs, concerns, and objectives. • Participate in pricing the solution/service. • Handle objections by clarifying, emphasizing agreements and working through differences to a positive conclusion. • Use a variety of styles to persuade or negotiate appropriately. • Present an image that mirrors that of the client.

Client Retention	<ul style="list-style-type: none"> • Present new products and services and enhance existing relationships. • Work with technical staff and other internal colleagues to meet customer needs. • Arrange and participate in internal and external client debriefs.
Business Development Planning	<ul style="list-style-type: none"> • Attend industry functions, such as association events and conferences, and provide feedback and information on market and creative trends. • Present to and consult with mid and senior level management on business trends with a view to developing new services, products, and distribution channels. • Identify opportunities for campaigns, services, and distribution channels that will lead to an increase in sales. • Using knowledge of the market and competitors, identify and develop the company's unique selling propositions and differentiators.
Management and Research	<ul style="list-style-type: none"> • Submit weekly progress reports and ensure data is accurate. • Ensure that data is accurately entered and managed within the company's CRM or other sales management system. • Forecast sales targets and ensure they are met by the team. • Track and record activity on accounts and help to close deals to meet these targets. • Work with marketing staff to ensure that prerequisites (like prequalification or getting on a vendor list) are fulfilled within a timely manner. • Ensure all team members represent the company in the best light. • Present business development training and mentoring to business developers and other internal staff. • Research and develop a thorough understanding of the company's people and capabilities. • Understand the company's goal and purpose so that will continue to enhance the company's performance.
Education	Business development management positions require a bachelor's degree and 3-5 years of sales or marketing experience. An MBA is often requested as well.
Other Skills and Qualifications	Networking, Persuasion, Prospecting, Public Speaking, Research, Writing, Closing Skills, Motivation for Sales, Prospecting Skills, Sales Planning, Identification of Customer Needs and Challenges, Territory Management, Market Knowledge, Meeting Sales Goals, Professionalism, CRM, and Microsoft Office.

Figure 5.2 An example of a business development manager role (businessdevelopmentmanagerjobdescription.com, 2015).

5.1.3 The normative business development approach

In the context of a university engaging with industry, the execution of the nexus role can either focus objectives on the outcome of commercialisation, or concentrate on connecting the right people from university and industry, at the right time, to initiate

working relationships between the people who create and deliver projects that contribute value to all stakeholders. This is the fundamental purpose of any nexus partner.

Viewing this as a business development process, the following key stages should be considered: awareness, exploration and expansion. The first stage is where the BDM will make initial contact. This contact often involves meeting in person, shaking hands, introductions, providing a short summary of their value proposition and listening to the potential client's response. If the client has interest in exploring a possible relationship, they provide opportunities and resources to advance to further interactions (Dwyer et al., 1987).

The middle stages focus on exploring the potential clients' needs and the value they place on these needs. The BDM should be considering what resources and whom in their organisation can assist with resolving the potential clients' needs. This stage may require a number of interactions or visits involving a range of people from each organisation to develop a mutual understanding of potential opportunities with the potential client.

The final stage involves the BDM expanding the relationships through developing a value proposition for the potential partner to consider. It should provide value to all relevant stakeholders associated with both organisations. It should also consider the potential partner's priorities and when would be the best time for their organisation to participate in the proposed working relationship.

5.1.4 Applying a BDM approach to interpret roadblocks

The business development manager approach draws upon relationship marketing theory. Theoretical frameworks that provide the most appropriate lens for

the initiation and development of relationships were outlined in Chapter 3. Models such as Morgan and Hunt's KVM model (1994) and Huang and Wilkinson's (2013) dynamic model of trust in dyadic business relations help describe the mechanisms that influence relationship development and advocate the common drivers of values, behaviour and communication which influence trust and commitment.

The effectiveness of the relationship development is understood through the interactions, outcomes and environment that are developed. These are an outcome of the expectations that have come from a firm's resources, intentions and trust in the other party. The resulting actions can be observed as behaviour towards the other firm (Huang et al., 2013).

5.2 Participant roadblocks experienced through a relationship marketing lens

A relationship marketing lens was used to interpret roadblocks that were experienced by participants. Participant text was explored from the perspective of a BDM attempting to initiate engagement and develop working relationships with potential partners.

The following section illustrates the roadblocks experienced by participants in this context by relating the participant past project experience into sub-themes that contributed to the following five major themes:

- 1) Roadblocks to getting the relationship started,
- 2) Cultural and language barriers,
- 3) Organisational differences,
- 4) Roadblocks between university and industry people, and
- 5) Roadblocks to decision making in partnerships.

5.2.1 Roadblocks to getting the relationship started

5.2.1.1 Unaware of who the appropriate contact is

In situations where a nexus is searching for a potential partner, it is important to understand who the best person to contact is. Some participants found it difficult to find the appropriate person within a university to communicate their needs to.

I wouldn't have [the first] clue how to contact anyone here ... (Industry Participant 20).

But there was some confusion over who does stuff and what's the relationship and if I have a contract with [university organisation], who's it with (University Participant 18).

Once you know exactly what you have to do, it doesn't probably take that long, but it takes a while to figure out who actually has the Non-Disclosure Agreement (NDA) for this particular situation ... that takes time (University Participant 19).

I navigated [for a company who was not able to easily understand] the who's who to talk to and to talk to academics on how best to situate themselves and would they be interested in doing a research project with them (Intermediary Participant 15).

Some university participants were aware that it was difficult to navigate around the university system to initiate new relationships. Intermediary Participant 15, who was independent to the university, took on the role of BDM to assist an industry participant act as the nexus to initiate a new working relationship. Participants from other universities had implemented a BDM type approach and placed a single point of contact to facilitate the initial contact with potential industry partners.

5.2.1.2 No timely response to initial contact

At the initial and early stages of the development of a relationship, the level of communication that is related to the length, depth and frequency of interactions has an influence on the interactions that occur during interpersonal relationship development. Some people experienced a breakdown while attempting initial contact from those they believed would be interested in exploring a new working relationship. This breakdown occurred from either no response, or a slower than expected response.

... the most important thing was feedback and response time. Not to keep anybody waiting (University Participant 19).

So I actually rang a number that when unanswered and they haven't responded either via email or via telephone call. So at the end of the day I don't really know whether they are a suitable supplier to fulfil a need because they haven't really bothered to respond to the initial enquiry (Industry Participant 1).

Again the first [direct] contact between him and the academic after that workshop was facilitated by somebody else. It still had to be organised by somebody else because I have heard this a lot is that a business hears about a specific researcher and they decide to contact them directly and as often as not they never hear back (University Participant 11).

The university [didn't] always [respond] to my communication (Industry Participant 16).

The difference was that with [a university], was that [they] never responded back and I got nothing out of two or three times. I think that ... If there's no response after three goes maybe... I'm too busy to worry about it (Industry Participant 20).

You don't get a prompt response out of anybody (Intermediary Participant 35).

... you're tending e-mail and it could be a couple of weeks before people respond, and I'm not used to that 'cause I get an e-mail and I really try very hard to respond the same day (Intermediary Participant 15).

The comments above indicate that there was a lack of timely communication by universities at the initial stage. This is a common issue within organisations wanting to develop new business. The BDM role was created to address these issues. This role is expected to research and build a relationship with potential and new clients, and respond quickly when contacted.

5.2.1.3 Roadblocks at initial interaction stage

Participants in the nexus role indicated that they had encountered roadblocks during their first interaction with potential partners when it was not able to be conducted personally. The level of trust that was developed through communication was perceived to be adversely affected by both the nexus and prospective partner. This then influenced their decision to continue exploring the potential working relationship.

And one of the things about email, of course, is you lose a lot nuances of the communication. My voice is pretty monotone at times, but I'm pretty expressive, in the face. That's the whole thing that's missing ... I like to talk to somebody after I've met them, cause I can sort of picture what their face is like, but it's hard if you've never seen the face (University Participant 22).

If I can't have them face-to-face, I don't really think they exist (University Participant 28).

... you might even find at a certain point, things start not going so well and maybe people are getting a bit terse with each other or whatever. And then you suddenly think, "Gee, we haven't had many face-to-face meetings for a while ... (Industry Participant 21).

But when you wanna talk about nitty-gritty, I find emails slow and cumbersome, you can't mark mathematics up in it very easily. So, you can't talk about technical stuff very easily or mathematics very easily using email. And usually a lot of the emails I send out are about when we're gonna have a face-to-face meeting (Intermediary Participant 34).

Each prospective partner preferred personal interactions to develop the initial stages of a new working relationship. The role of non-verbal communication is important for allowing nuances to be detected and acted upon during the initial conversations. The BDM understood the importance of interpersonal communication.

5.2.1.4 Cost of travelling to prospective partners

An interesting barrier encountered by BDMs is the time and cost associated with travel to a prospective partner's location. If the prospective partner happened to be a significant distance away, the investment in initiating the relationship can be high.

Well I am in that role now and in this role you are constantly being pushed I guess by one node and it's very hard to get information from other nodes and really the only way you can get that is to travel more regularly ... you have to be present ... (University Participant 9).

Stop asking people to come to your location is the first step, come to see them. And once you've engaged with them, they will come and see you (Intermediary Participant 24).

... partly because of our project and our relationship with them are setting up a facility in Melbourne. They're in the process of doing that so it's attracting global industry back to Australia but getting someone from Canada to come to Melbourne is just incredibly hard. It really is a horrifically long flight ... (University Participant 18).

The BDM role needs to assess the potential reward that a prospective partner offers to their organisation by weighing the effort and costs against the potential benefit.

5.2.1.5 Inability to explain the value proposition

A barrier encountered by some participants was that the prospective partner was unable to explain the value proposition of the activity that they were undertaking. This gap in communication meant that it was difficult to make a well informed decision

to continue with another iteration of the relationship development process (Bruhn, 2003). The communication gap included the ability for a person to translate the message to the intended audience in both the communication style, context and amount of information.

I think it was nine professors from [a university] came and sat in my office and made a presentation of how good they were, [chuckle] quite embarrassing really, and told me everything that they were doing and then I said "Okay so what do we do?" Basic question, what do we do? I [had] listened to them for an hour and half ... Well, nobody knows. So I said "So you as professors have come here, you have not researched my company, you haven't researched what we manufacture, you haven't researched the domain in which we build" (Intermediary Participant 24).

It is hard for them to even understand the benefit, for us to even convey the benefit of the broader good of... We facilitating it. What's the value of the facilitation? It's not easy (Intermediary Participant 25).

I think it's really interesting where, in terms of communication styles, having Researchers who were obviously hugely knowledgeable in particular areas but don't have the ability to actually engage or connect with people or describe it in a way [the general community can understand] (Intermediary Participant 36).

Until you actually understand their business, possibly better than they understand their business. They might be looking for something that's not really what they wanna be looking for so a whole lot of stuff can be lost in translation so you need the right sort of interface there to be able to do that (Industry Participant 33).

A nexus, like a BDM, will be unable to consistently deliver meaningful messages to potential partners without researching them prior to the initial meeting. A lack of this groundwork will also create difficulties in assessing the level of trust you have in the potential partner. The lack of preparation in the cases above affected the communication context, style and amount of information communicated. The impact

was that the value proposition was unable to be communicated effectively to the other people, so the role of the BDM becomes even more critical.

5.2.2 Cultural and language barriers

5.2.2.1 Differences in culture affecting communication

A difference in culture between people can become a roadblock for those with effective communication skills within their culture. This barrier to communicating the value proposition can be amplified in the initial and early stages of a new relationship. Participants experienced these communication issues when low familiarity in culture existed. The participants noticed differences occurred between countries, but tended to be more prevalent when occurring between countries of western and eastern cultures.

So the German was the industry partner, he was constantly frustrated with someone [French] from my team, because they weren't focused on details, he saw them as being laissez-faire, and it was really a clash of styles (University Participant 18).

Japanese are different. They want things in writing. They're not, and I think, lot of people on the Australian side didn't understand this very well. They don't like the talking bit too much (University Participant 19).

The Americans, the exact opposite. It's all talking; "Let's worry about the paperwork later." So, there are some cultural differences you have to worry about ... (University Participant 19).

Again, different countries have different cultures and they're quality perceptions [are] not always the same as what ours will be and so you will get a miss match of understanding ... (Industry Participant 1).

Ditto with Asia, so the amount the lag phase between you start making phone calls and doing emails. The lag phase is directly proportional to the lack of cultural parallel. The wider the gap the more time you got to spend in their face literally (Intermediary Participant 8).

.. In [a company,] unfortunately I got myself into an antagonistic relationship with a lot of people, in Japan just because of their nature. So that just reflected... the performance, we didn't perform as well (University Participant 22).

... when we go to Asia and you have to do the Asian culture, it's a lot more different and so again I still try and get that personal type relationship but then I understand that there is a formal process to go to... (University Participant 9).

In a similar way to people's inability to explain the value proposition, differences in culture can block effective communication. The lack of understanding of the other person's culture, in the cases above, were impacted by the hierarchy, cultural style, order of communication types and the way language was used. In planning for an initial contact, the BDM needs to assess any cultural aspects that require addressing. Ineffective planning prior to an initial meeting to understand and account for cultural differences was found to have impacted the nexus in the cases above.

5.2.2.2 Language differences between people

A difference in language between a nexus and prospective partner was a significant contributor to roadblocks in communication between people from different countries and regions. The use of translators can be challenging as they need to understand the context of what is said to ensure that the translation keeps the same meaning in the other language.

I have developed a bit of understanding of him so I know when we have to step up and say this is the situation don't worry about it so sometimes as exacerbated by a researcher whose English is not his first language ... You don't want those language barriers to get in the way of a fantastic partnership (University Participant 11).

This was a big Japanese company, little American technology based company in San Diego. [The Japanese rang but the Americans hung

up thinking they were sales calls]. I'm not joking. And the Japanese are going oh not good They [had to send someone] over to knock on the door (Intermediary Participant 8).

... do not allow what you say to be translated literally into something really rather insulting to be mistranslated into a tin of worms instead of how is your family (Intermediary Participant 8).

Language differences can lead to miscommunication. Until an increase in familiarity of both social and physical workplaces allow for work group norms to establish. The BDM was not always aware of inconsistencies in interpretation. In these cases, when people spoke different languages, misunderstandings were found to occur through the ineffective translation of specific words and concepts.

5.2.2.3 Miscommunication caused by different life worlds and jargon

The difference in language extends to technical jargon used by people from different disciplines referred to in academia as invisible colleges (Crane, 1972), and slowed the process of people coming to a mutual understanding. The nexus needed to be aware of these differences for interpretation of concepts and ideas.

... talking terminology that loses the average Joe ... I saw the room was with a bunch of manufacturers. Not a lot of them would have had University background and so it was bad enough having to drive through the gates of the University (Intermediary Participant 36).

... when you're working in a multidisciplinary team, you constantly have to translate what's happening for other people. So, you have to translate what they're telling you into your own specific discipline area, and you have to translate your discipline area [to] those other people (Industry Participant 21).

But this is an interesting one because there is also a miscommunication from some translators, if they don't actually get what you are saying, the professional translator can actually skew your story, we went through this with the [newspaper] article, (University Participant 14).

We do speak a different language from academia, and this is very important that we understand what we're all talking about so it provides a nice link (University Participant 18).

Technical words or jargon specific to a discipline created confusion, especially when a word could have multiple meanings dependent on context. These differences in language contribute to communication barriers. In preparing for interactions between people from different life worlds, a BDM explores technical jargon from both worlds to understand where potential differences in understanding may exist.

5.2.2.4 Too formal in the early stages

Roadblocks can occur from the tone of communication that a nexus takes to express ideas and concepts. An appropriate tone is important for the effectiveness of a prospective partner attempting to assess a proposal. This is especially the case at the initial stages of a relationship when first impressions are made.

I try not to do things too formally but the universities are usually very formal and that doesn't really work when you're trying to negotiate deals. They can be quite forthcoming and abrupt in their negotiations and so that puts people off as well (Intermediary Participant 31).

... you need formal at some stage but informality is good to get going, it's a lot more open. I think the communication is a big key and how that happens (University Participant 9).

Certainly be formalised eventually but it is not a good idea to introduce that kind of language too early because I think that is what has gone in that particular case in dealing with another university that formal language was introduced too soon and just put him right off (University Participant 11).

I can do formal but it just takes a lot longer to get anywhere (Intermediary Participant 15).

Well, I'm very informal. So I would have to say that I'm not really a formal person but that's just because of me (Industry Participant 20).

The BDM role is responsible for maintaining balance in the tone of the communication. This is particularly important in the initial and early stages when developing rapport and exploring value in a new working relationship. Formal communication processes tend to impede the development of new relationships. In the situations above, the relationship had not developed as well as it could have because of the use of formal communication in the early stages.

5.2.3 Organisational differences

5.2.3.1 Business stakeholder's agenda to create wealth

A university nexus roadblock caused by differing organisational agendas was described by participants as a situation where academics struggle with the thought of people making significant amounts of money from their idea. The reward for executing an innovation program and managing the associated risks was not fully appreciated.

I do think there has to be more relationships happening between industry and academia ... But academia need to realize that industry is about making profits, pure and simple. It's about selling product. It's not about curiosity. It's not about helping people's healthcare. It's about driving returns to shareholders ... (Intermediary Participant 31).

And that culture is so poorly understood within... There's some guys that are making money off it, but they also took a lot of responsibility and risk and employed a lot of people, and academics just struggle with that context, I think, in many instances (Industry Participant 23).

But I do think [acceptance of industry needing to make profits from innovations] is a huge barrier to commercialising academic research and ideas. It is understanding that it has to make money, for someone and everyone, for it to actually become real (University Participant 23).

Being able to effectively communicate the amount of work that takes place within a business to commercialise a new product is an important role of a BDM. People who have not had the opportunity to experience the product development process are unlikely to comprehend the intensity of work that is required to translate an idea though to commercialisation.

5.2.3.2 Lack of common goals

The different agendas between stakeholders at an organisational level created roadblocks for people wanting to innovate new products. These different agendas created misalignment and impacted the behaviour between groups of people working on projects.

[the major roadblock when developing relationships is] a lack of common goals or a lack of shared expectations (Industry Participant 21).

When that commercialisation activity is controlled inside of the university, it's only single-sided, so, whilst they might purport to look after [potential partners], they're acting within their own policy framework and [reward structure and they will be limited in the support of partner goals] (Intermediary Participant 25).

If you have an unequal relationship, there's... We're wired to be fair, I think. And if it's unequal and there's some asymmetry there... There always will be some [level of] asymmetry, but there's some asymmetry that is very hard to overcome and there's resentment that builds up (University Participant 22).

Yes, first one is the disconnect in your goals and their goals ... If you as an academic institution approach an industry and you have no common goals you will fail. (Intermediary Participant 8).

... they get their research grants... What funds them is their papers. So we're never gonna have a focus on industry. [Industry has a focus on getting things done in a timely fashion. Researchers by their nature, are interested in how things work]. When they're asked to do something for the industry, that's boring, it's got a finite time scope and all the rest of it, and by definition is not research (Intermediary Participant 35).

The BDM needs to have enough experience and acumen to be able to understand these competing drivers, which when not aligned, can become barriers. They then need to be able to take this understanding and apply it to the situation to influence stakeholders at the right time to optimise the outcome.

5.2.3.3 Internal division within industry partner

In situations where the leadership direction breaks down because of a lack of buy-in from some of the stakeholders, the BDM needs the capacity to be able to assess the amount of momentum within the organisation to proceed with the innovation project.

Leadership and that's the missing element. If the leadership was there, the results will certainly be redirected for a more effective result (Industry Participant 7).

We've got some of the best research, some of the best healthcare. There's no shortage of money. We just have a lack of leadership (Intermediary Participant 31).

The owners were clashing and that created a massive roadblock in terms of being able to project forward where... Business managers within that larger entity had these fabulous ideas for research, and we'd start at the process and it just didn't go anywhere because of the blocking of the owners (Intermediary Participant 36).

If the BDM believes that the inertia does not exist within the organisation, they need to communicate with all stakeholders and work through the leadership barriers internally. It is only once these issues are addressed that a BDM can develop a plan to maximise stakeholder satisfaction.

5.2.3.4 Business risk barriers

Companies in general are risk adverse. A business has an obligation to its stakeholders to generate a profit. When business risks occur they have a cost. A key success factor is the executive teams' ability to manage risks. An unhelpful outcome of a business's approach to risk management can be a perception that risky decisions are avoided.

The biggest thing is, it's easy to not make a decision, it's tough to make a decision and take the risk ... (Intermediary Participant 24).

Academics don't understand often, that a business person is carrying insurance risks, staff risks, could be environmental, management risks, and a lot of them are just putting hard-earned cash into it. (University Participant 23).

"This is what was working. We tried this... " And taking risks, I take massive risks. So the showcase was, it was my profile on the line. Because I said, "This is gonna work. I believe in this. We should do this" (Intermediary Participant 15).

And it's my experience that any kind of decision at the end has to be at fairly high level. And I guess it's just risk avoidance; nobody wants to put their name on the paper if things backfire. But getting those kind of signatures is, I guess, taking longer and longer (University Participant 19).

And risk is something that universities only focus on financial risk and reputational risk, but they need to consider the other risks that are involved as well. By not doing something, the risk of not doing something is as big as doing something (Intermediary Participant 31).

This risk management by industry may appear non-essential to a university nexus. Unmanaged risks can become problematic to the research project when decisions need to be made by stakeholders. A BDM working with a skilled management team will balance the resources and discipline to manage risks within the required decision timeframes.

5.2.3.5 Time pressures between organisations

Industry are consistently under time pressure; this is a constant. Perspectives on innovation deadlines between university and industry organisations are very different. In industry, completion time is an important factor for competitive advantage. The pressure for industry to deliver sooner continues to escalate.

And things are just getting faster and faster so having people that are used to meandering or doing things at their own speed is a risk to any business minded people that want to interact ... you need to keep that creativity and research minded approach, quality, deliverables, but you need the business and marketing type guys that can create deadlines (Industry Participant 4).

The great complaint of industry from the relationships that they have in the CRC is speed, commercial focus. Just simply don't get the job done fast enough. (Intermediary Participant 8).

And, one has to be realistic that [the university professor is] a busy boy and he's fairly high-level profile within the university, etcetera. I suppose the association with [university professor] is fairly important to us because he is ... the head ... we need to be realistic enough to know that we are a fairly small player in some of the things that the university is involved with ... (Industry Participant 16).

What we'll be able to do is, we've missed the round intake this year, so actually what we can do is wait 12 months, we can get our proposal together and then we wait another six, seven, eight months before we know whether the proposal is successful, and then we aim at a three to five-year window of research after that. So, we're looking at about five to seven years from now in completing a project. And this might be in response to somebody that's saying, "Well you know, I've got a business decision to make in the next six months" (University Participant 34).

I've been involved in so many meetings where the very first thing that comes out of an academic's mouth is "Ah yes, we should apply for an ARC linkage grant" (University Participant 34).

The role of a BDM is to understand the timeframe for required deliverables for mutual benefit of partners. This may involve some creative negotiating to find

potential solutions such as: arranging research projects into smaller projects that can meet objectives of both partners; finding additional partners to contribute; or, committing to a more suitable time to revisit the opportunity.

5.2.4 Relationship roadblocks between university and industry people

5.2.4.1 Value barriers in partnerships

Seeking different value from relationships was an issue. An unintended consequence of entering a partnership can sometimes be the ill-informed perception of value between people from the stakeholder organisations. Academia does not understand the value of products and not having the ability to negotiate a fair outcome was experienced as a roadblock for some participants.

Unable to recognise and assess value

So [academics], going out to market themselves and to make new networks where they don't necessarily see the value, I completely get why they're a little bit reluctant to do so (Intermediary Participant 15).

They need to understand the markets and make sure that what they're doing internally is relevant to a market pool and to concentrate on trying to push out technologies into the world that has no interest to industry, solving problems for industry that don't exist. I think they need to be more engaged (Intermediary Participant 31).

Well I think we need new manufacturing industries and we need people who have the skills and the insight to be able to provide value for those industries. At the moment, such people don't exist really, there are small interested groups and individuals, but we don't have anything on the necessary scale to be able to, well to even conceptualise what the application might be (Industry Participant 13).

Academics poor at negotiating

"You don't get what you deserve, you get what you negotiate." And you have to negotiate it, and you have to be given the freedom to negotiate it, and then have the support from the university as well to understand that there is a range of scenarios under which you can operate (University Participant 23).

So having a very firm view having good negotiator an excellent negotiator professional negotiator is absent on the academic side. Whereas its' core, it's a core skill on the industry side. Knowing when to give, knowing when to stand firm, knowing when to pitch, knowing when to back off, knowing how to read the body language of the person of the table who will be a trained negotiator is absent in academia (Intermediary Participant 8).

In addition to people from both organisations understanding the value concept in the different worlds, they also need to negotiate conditions for projects that deliver a mutual benefit for a sustainable relationship. Sometimes an intermediary, such as a BDM with their knowledge of stakeholder organisations, rather than a hybrid-academic would be useful to assist in this type of conversation.

5.2.4.2 Poor attitude towards the industry partner

Arrogance and indifference are not the way to start a relationship. The attitude that a nexus has towards the prospective partner can be observed in the language and behaviour that they use to communicate a proposal. A poor attitude towards a prospective partner can inhibit the development of a working relationship.

They're just too arrogant. They're a bureaucracy unto themselves. Look, they're all clever people, they've studied hard to get where they are but why adopt that attitude, why can't they just be friendly? (Industry Participant 27).

But, he came out to the customer, and the customer said "oh well, you know I'd really like to do a tool library ... ' and he said "Oh no, you can't do that." And everything that the customer said, he just kept saying "nope, can't do that. Nope, that's not in scope. No, that

will cost too much, no that's not possible" (Intermediary Participant 35).

And yet one of the guys said, "Yeah, I don't go and talk to university, 'cause any time I go and talk in there the first thing they ask for is \$5,000." And they said, "No, we don't do that." And this guy's got a Ferrari, he can afford the \$5,000. But he said no, the principle is that that's what happens. You talk money before you talk results (Intermediary Participant 24).

The classic story that I was told was there was about a group of eight universities where the message came on down from on high that they needed to get more industry funding and so the academics and this is often a very broad grasp... But the academics would go out to the industry part, the industry and say, "This is my project, I want you to fund it" (University Participant 33).

I think that people... Mismanagement of people relationships is probably the biggest barrier to most things in the world, and there's all types. Academics should just drop their egos, that's number one. (University Participant 23).

In these cases, the nexus did not engage in a respectful way with the prospective partner. An effective BDM would invest time to develop an understanding of the prospective partner to ensure that the message engaged them in a relationship as well as the business transaction.

5.2.4.3 Lack of mutual understanding between people

A fundamental relationship barrier of no “real understanding” exists at times. The different agendas, skills and expertise do not create a level of awareness that allows for people to recognise the value of work completed in those different life worlds (Dougherty, 1992).

Everyone needs awareness across everybody's interests ... If you could facilitate really open discussions upfront, and just map out, "This is why we're doing this," and if industry doesn't get the benefits of the research ... (University Participant 23).

... the initial phase takes a really long time. Then once they do that, they need to really build up an awareness of what each other can bring to the table (Intermediary Participant 15).

Oh, yeah, that's the way to put it. Because what will happen is if you step away when they don't have that mutual understanding, then that's gonna ... go off the rails ... Some academics just get industry and they understand, others don't. So those are the less experienced, if you like, you will generally spend more time with as well so there's a bit of hand-holding that goes on there (University Participant 33).

While only one industry participant had, experience working in a university, it was interesting that over half of the university participants interviewed had experience working in industry. A BDM works to limit any misunderstandings from other stakeholder involvement. It would be expected that forming a mutual understanding would be more difficult for those university and industry participants with isolated experience as they had not experienced the other stakeholders' life world.

5.2.4.4 No appreciation or awareness of others skill set or capabilities

Without an understanding of the capability profile of a prospective partner, it can be difficult to coordinate interactions. Searching online is the most efficient way to find this type of information. However, not everyone has developed an effective online presence, which restricts internet search access to prospective partner profiles of their capability.

And part of it was like "I gotta get on the blogs, gotta get on to these social communities to communicate what the brand means and even R&D stuff and the learnings that we do, but we just don't have the time. We just don't do it (Industry Participant 20).

I have absolutely no presence on social media (University Participant 28).

And the website reflected wrong things (Intermediary Participant 15).

The skills and time required to develop an effective online presence were barriers. Although an online presence is not necessarily a BDM responsibility, the message on what an organisation is looking to attract is. Providing a message to prospective partners whom you wish to create a working relationship with, that allows those searching for you to make an informed decision to seek contact, is valuable.

5.2.4.5 Effort to invest in new relationships

The start/stop decision is a key one and can be problematic. The work that is performed through the initial and early stages is focussed on the interactions between partners. The effort in understanding the potential benefits of working together, risks and costs are balanced with the effort of investing in the relationship. In the initial stages, effort is centred around deciding whether to commence and/or continue working together (Bruhn, 2003).

.... but then we don't really get the repeats, be it because of opportunity, timing, and all the things that we spoke about, or is the university system such that those contacts, people moving to different areas or different... They're moving out. So, out of the university. And the same could be said for business as well, where you might have a person that's working within our business, and had formed a strong relationship that goes somewhere else... (Industry Participant 17).

Because a lotta times, the researcher goes and the business relationship goes with him. And that's gonna be some... And that's an issue with the university, and you see that the way they operate. Because, [a university] spent a ton of money bringing a whole bunch of people in, and they basically displaced their internal people. So, the culture's all gone ... (University Participant 22).

Participant experience indicated that investment in the relationship required work. People moving to new roles were a barrier. The BDM needs to consider the

resource levels needed to invest in a relationship with the potential benefits with prospective partners.

5.2.5 Barriers to decision making in partnerships

5.2.5.1 Unable to prioritise resources for innovation

A lack of prioritising effectively for innovation is a barrier. Organisations need a clear innovation plan. The BDM needs to be able to identify opportunities, and also understand the key drivers before advocating new business. The prioritisation of strategic tasks becomes difficult within and between organisations as they become constrained by time and resources. This has allocation implications in terms of ineffective execution and chasing “dead ends”.

Yeah, [clients] put [innovation workshops] up as a priority ... I think the challenge is when you've got smaller enterprises where it's family owned or not a lot of resourcing, they don't have the time to actually stick their head above the daily grind often and that's always a challenge (Intermediary Participant 36).

So, they understand that things do slip out, they also understand that other priorities come up in business, so I think they're mindful of those (Industry Participant 30).

Yes, however one of the problems within the university sector is, and it's a common problem that we've learned, is when universities don't decline work and they continue to load up a person's hours, their percentage man hours. So, their hours of the week may actually be loaded up to 150% (Industry Participant 32).

You know, I've come up with project ideas that are my priority, and they say, "That's not our priority, 'cause that's not gonna happen in the next two years (Industry Participant 23).

So one of the things that [upsets me] continuously here, don't tell me you're too busy, you just tell me I'm not a priority (University Participant 22).

... some relationships you could spend, you could be talking to them constantly and constantly and then all of a sudden something will

happen in their business and then they won't talk to you or they are gone (University Participant 9).

... a follow up phone call and time delays and then you have to find the people who need to get you the information etc. or prepare it. So it's really, it comes back to the time and how that all fits in with your priorities (University Participant 9).

Even though we tried to fill it in a way that was going to benefit them, there was some really interesting opportunities, the owners kept saying, "Yep, I can understand that, but now is not the right time" (Intermediary Participant 36).

A BDM role has to understand the context of the prospective partner organisation to ensure that proposal adds value to both organisations. In the cases above, it was not the right time for the prospective partners to commit to a proposal. Missing in the situations described above are the underlying reasons as to what needs to change, and when the right time would be to recommence exploring the relationship.

5.2.5.2 Bureaucracy barriers: IP issues

Bureaucratic barriers raise their ugly head in the systems that are designed to promote innovation. The innovation systems do not always provide a timely, intuitive workflow. When bureaucracy occurs, a BDM needs to understand other organisation systems and be able to have solutions that focus on maintaining stakeholder relationships.

So I guess some of the hurdles are internal university systems and getting those to be more effective has been a critical part of getting the centre to become successful. Things like contract and development and [person] just spoke to how he's been able to streamline that and get it working more effectively. That's been a major barrier (University Participant 18).

We had legal issues, IP issues, where students would self-promote a concept that they had done as part of an [industry] project ... They said that they've worked with [our company], or worked for [our company], or this is a product [of our company], when really it's

just a student work. So there were some issues that we had to deal with ... (Industry Participant 20).

There's lots of hurdles, financing, regulatory, and governments. Universities are a hurdle as well, even for industry I commercialise technologies all over the world, and I find Australia the most difficult country to commercialise, period (Intermediary Participant 31).

Too top heavy, too slow, and in some of the bureaucracies, if we want one thing done, then it's got to go through three or four different departments in the one bureaucracy (Industry Participant 27).

One of the problems with taking a long time to negotiate, is that people will change, ... And because it's a relationship thing, you have to rebuild the relationships. So it gets back to the whole "making things fast". It depends on your networks as well (University Participant 22).

A BDM is in an ideal position to understand the limitations of the university systems and to have created work arounds. They are the best person to contact about navigating the systems. They also have a unique perspective of the university system that would be valuable to those responsible for the design and effectiveness of these processes.

5.2.5.3 Industry roadblocks from policy and process failures

Industrial organisations are adversely impacted when policy and processes fail to improve the effectiveness and efficiency of the organisation. With industry providing the interface to the market and end users, participants experienced roadblocks around the ownership of IP, restrictions placed on communication from non-disclosure agreements, poor performance and decision making.

.... whereas sole traders are a little bit more... They wanna be more hands on, they wanna still own the IP. I think there's problems around building those contracts with the university because there's concerns on handing over that ownership so they're quite

proprietary. So, rather than progress things, they seem to shelve them because they can't nod out an agreement with the university, and they don't have the capital to invest in it themselves ... (Intermediary Participant 15).

And a lot of the work that we do is under non-disclosure agreements so there's military people, there's medical people, you'd like to talk about but you can't because it's obviously something which is which they're working on that you can't discuss openly (Industry Participant 2).

And that was really relationship building because the product kept breaking down, kept not doing what it was supposed to be doing, they promised that it would be ready in May, and it was ready in September or January the next year. So there was an awful lot of relationship, management, and expectations because companies not used to getting a product that gets delayed, doesn't work, crashes every time they use it (Intermediary Participant 35).

And the reality is that the people that you deal with on the project or the project development or whatever, aren't necessarily the people who are making decisions at the end of the day. So while they have the best of intentions... The cold, hard decision making for businesses isn't necessarily around relationships (Industry Participant 16).

If you map out your project plan sort of thing, if there's a place where a new decision maker comes into the process, who hasn't been involved earlier, if you see that, that's my fault detector, if I see that there's a fault with the process... (Industry Participant 21).

The BDM is a valuable ally to navigate any inadvertent barriers from industry policies and processes. BDM organisational knowledge allows them to convey opportunities to a prospective partner without betraying confidentiality. The BDM also is able to use this knowledge to ensure information reaches key stakeholders before critical decision are to be made.

5.2.5.4 Roadblocks from ineffective university commercialisation offices

The BDM relationship with the commercialisation office can become dysfunctional when roadblocks between the university commercialisation office and

researcher are driven by different objectives. The university commercialisation office holds an important stakeholder role to ensure that knowledge generated by researchers within the organisation creates a value stream for the university.

University commercialisation office not a key driver

The university doesn't have a relationship. I think that's a fundamental flaw. It's the researcher that has a relationship. The university provides an umbrella and a halo ... (University Participant 22).

University commercialisation office aversion to risk

... I think a university's view of commercialisation is we have got smart people here working on IP that we own and that we want a royalty but we are not prepared to take any more risks than the researchers who are doing the research (Industry Participant 5).

[The commercialisation officers have limited ability and] there's a lack of understanding [that] creates the fear, which creates the risk, which results in an unusable relationship. (Intermediary Participant 31).

University commercialisation office not professional

It's critically important, in fact it's actually the most frustrating part of my job is dealing with universities ... transfer office ... [the commercialisation offices cause frustration through a] lack of market knowledge, lack of technology commercialisation systems, lack of investment, just a complete lack of understanding what commercialisation of a product looks like (Intermediary Participant 31).

... I see a lot of researchers just hand everything over and say that's [commercialisations] job and they can do it, I don't have time. So I think it's going to have to change ... if we are still going to have traditional researchers in those roles who aren't understanding the needs of industry, it's not going to happen and that's my experience (University Participant 9).

When the university is acting as the nexus, the single point of contact is usually a commercialisation officer whose reward system and motivation is aligned with the objectives of the university. A BDM approach differs from a commercialisation officer in that they are ensuring that a mutual benefit is experienced by all stakeholders who contribute.

5.3 Summary of roadblocks to initial and early stage relationship development

The roadblocks that were encountered of a nexus initiating and developing the early stages of a new working relationship have been explored through the relationship marketing lens of a BDM.

There's always internal roadblocks. You don't necessarily have the system setup; you don't have people with the right skills to be able to do the relationship management that you need or the pitching or whatever it is. So having a highly qualified workforce is absolutely vital to industry engagement for people to understand the technology, that are people persons or people that have high emotional intelligence. A sort of high intellectual intelligence (University Participant 33).

The key themes that participants experienced impeding the relationship development and therefore the advancement of innovation projects were collated in Table 5.2.

Table 5.2 Resulting key themes impeding relationship development.

Roadblocks to getting relationship started
Unaware who the appropriate contact is; No timely response to initial contact; Barriers at initial interaction stage; Cost of travelling to prospective partners; Inability to explain the value proposition.
Cultural and Language Barriers
Differences in culture affecting communication; Language differences between people; Miscommunication caused by different life worlds and jargon; Too formal in the early stages.
Organisational differences
Business stakeholder agenda to create wealth; Lack of common goals; Internal division within industry partner; Business risk barriers; Time pressure between organisations.
Relationship roadblocks between university and industry people
Value barriers in partnerships; Poor attitude towards the industry partner; Lack of mutual understanding between people; No appreciation or awareness of others skill set or capabilities; Effort to invest in new relationships.
Barriers to partner decision making
Unable to prioritise resources for innovation; Bureaucracy barriers: IP issues; Industry roadblocks from policy and process failures; Roadblocks from ineffective university commercialisation offices.

Four sub-theme roadblocks stood out from the rest and were considered significant as identified in Table 5.3.

Table 5.3 The four sub-theme roadblocks that were most significant

	Sub-theme
1	Unable to prioritise resources for innovation
2	Miscommunication caused by different life worlds and jargon
3	No timely response to initial contact
4	Differences in culture affecting communication

The next chapter provides insights from participant experience on how to overcome identified roadblocks. It will expand the implications and provide insights that participants experienced when engaging in the initial and early stage development of a new working relationship.

6 DRIVERS FOR RELATIONSHIP INITIATION AND EARLY STAGE DEVELOPMENT

6.1 Introduction

Chapter 6 provides the context for examining the drivers for the early stages of relationship development between people from different organisations as shown Figure 6.1.

Chapter 5: Determining Roadblocks to early stage relationship development

Chapter 6: Drivers for relationship initiation and early stage development	
6.1	Introduction
6.2	Drivers for initiating and developing early stage working relationships
<div style="text-align: center; padding: 10px;"> 6.2.1 Communication drivers that facilitate interpersonal relationships 6.2.2 Drivers that develop interpersonal trust 6.2.3 Drivers for individuals building interpersonal relationships 6.2.4 Shared and accepted values </div>	
6.3	Summary

Figure 6.1 The use of Chapter 6 to explain the drivers for relationship initiation and early stage development from the research.

The most obvious way to describe the drivers would be to mirror the roadblocks discussed in Chapter 6, however, there is no direct relationship between the roadblocks and drivers. For example, the driver sub-theme “need for initial contact to occur face-to-face” has an impact on four of the major roadblock themes.

Therefore, the approach for the interpretation of participant experience of relationship drivers is best communicated through the relationship marketing lens

(Section 3.4), which ensures consistent interpretation and language. This supports the basic proposition of relationship marketing, person to person interaction.

6.2 Drivers for initiating and developing early stage working relationships

6.2.1 Communication drivers that facilitate interpersonal relationships

6.2.1.1 Initial meetings are most effective when they occur face-to-face

The key theme identified by all participants from each of the organisation types was the need for face-to-face communication through the initial stages of developing a prospective working relationship between university and industry representatives.

Comfortable, informal communication style

The communication style used by people is often influenced by what is appropriate for the situation. For example, court proceedings require a different communication style to a wedding reception. It is important that the appropriate communication style be used for the initial interaction between prospective partners.

...I think that initially, it's about communication skills. Some people are just really good, comfortable communicators, not being overly formal, putting stuff on the table, not having too many hidden agendas and those sorts of things. And that's what we've found is good about [university professor], it's on the table, he's a damn good communicator, very comfortable, it's not formal ... [it needs that face-to-face interaction] (Industry Participant 16).

... and because it's come from an informal structure, or lack of structure, that I know they're good people and when I ask them to do a good deed, they can't say no (Intermediary Participant 15).

The communications, when it's informal is great (Industry Participant 20).

Yeah I like, I prefer informality, you need formal at some stage but informality is good to get going, it's a lot more open. I think the

communication is a big key and how that happens (University Participant 9).

The communication style the participants found to be most appropriate for the initial interaction between prospective partners was comfortable and informal face-to-face conversation. It provided the best environment for sizing up prospective partners.

Sizing up the prospective partner

The initial interaction provides the platform to be able to ascertain if a prospective partner is somebody you wish to explore a potential working relationship. There needs to be interest in both personal and practical attributes in a similar way to social relationships.

Or there's also the things that you, I guess they call them the "unknown unknowns." By meeting face-to-face or going somewhere to see somebody, what that does is, it opens up things, things that you discover or things that you find out ... Or maybe raises questions or gives you answers, where you wouldn't have even thought of the question in the first place (Industry Participant 21).

... and face-to-face is good. I mean, the face-to-face that we've had have been good. I think both sides have learned a little bit out here, so we've had a little bit of show and tell on both sides. Been able to support them with some materials, so they can see that we're interested in that sort of thing (Industry Participant 16).

In the initial stages of the relationship, the face-to-face, visiting each other, seeing each other facilities, talking, actually being able to see people's expressions when you're talking with them, because that will give you a pretty quick summary as to whether or not you can trust a person (Intermediary Participant 35).

like RSVP or those other styles of dating things, so the photo or the bio, if you like, might get someone's interest. But when you talk to them that's when you think, "Oh, yeah, it looks like I wanna take this further," and it's the same sort of things. So they're sizing you up in that original conversation and they think, "Oh, yeah, they get it, they understand my needs as much as I understand my needs," sort of thing. Thus communication is widely important (University Participant 33).

... but before we discuss anything, it's a face-to-face meeting, period. Because I need to know I can work with that person. If there's any element in there that I don't feel comfortable with we just won't work together, even if the deal's fantastic (Intermediary Participant 31).

The key benefits while sizing up the prospective partners were identified by participants to be experiencing body language and responding to nuances. Face-to-face communication where both verbal and non-verbal communication takes place were central to an effective initial interaction with a prospective partner.

Creating momentum

The interactions during the early stages of a relationship can also benefit from face-to-face communication. The non-verbal aspect of face-to-face communication open up opportunities and triggers for further discussion that are not intuitive when participants are not physically together.

... at the start of the thing, you have a lot of face-to-face contact just to get things up and running, and that generally gives you some momentum and you solve problems and you move forward ... (Industry Participant 21).

... but certainly face-to-face is important because you do get through a lot. A lot of things that you can do face-to-face and just bang, bang, bang, bang (Industry Participant 16).

In terms of relationship ... face-to-face is absolutely important. If you ever have a sense of miscommunication or something that is misunderstood. Then, I think, just pick up the phone right away and sort it out if that's the only option, if you can't meet face-to-face. Don't let any of the things that are potentially small [become an issue] (University Participant 19).

The use of face-to-face communication was experienced by some participants as a driver for creating momentum in the development of the working relationship and

in creating a mutual understanding. Issues faced by prospective partners were able to be dealt with effectively over short periods of time.

6.2.1.2 Possible options when face-to-face is not possible

Skype®, phone and email are three examples given by participants that were able to augment face-to-face communication. Participants found other modes of media play an important supporting role to support face-to-face communication. However, despite the emergence of people using social media to support face-to-face communication, some still preferred to communicate face-to-face and not electronically.

... The nice thing about emails is asynchronous, so you can deal with it when you want. But, the email is just to get to the point where it's, "let's have a meeting." And in a meeting is when you meet face-to-face. (University Participant 22).

We use Skype® a lot and it would be really interesting to see how social media is going to influence a lot of these relationships especially with the new wave social media coming in (University Participant 9).

Today you can actually really easily communicate, and some industry partners I never actually physically meet. You have Skype® or other meetings, and you can still progress things very well that way (University Participant 23).

And so if I've sent an email out and I don't think they've got to it, I'll send them a text message 'cause they always check their phones (Intermediary Participant 36).

When the nexus was not able to communicate face-to-face with prospective partners early in the relationship, other forms of communication were found to assist. Skype®, email, and SMS benefited some participants, although were not considered as effective as face-to-face communication.

6.2.1.3 Making a personal connection

The making of a personal connection was experienced by some participants as a key moment when initiating a relationship with a possible future collaborator. The intent of building a personal bridge with a prospective partner was also beneficial for communication during further interactions.

... you gotta find a personal connection with everyone. There has to be some personal bridge, and this you know, find some shared experience, find something that you can log your ear on ... If you have a laugh together then you're on the way ... (University Participant 22).

... so I tell people I know a thimbleful about their business, but that's all I need to know to make those connections, and then they can explore the relationship afterwards (Intermediary Participant 15).

The things that I've shared with you today, that was story telling so that, I swept you up in my passion and you got excited, "Oh, wow that was a great idea and that was fantastic". It was all in the story telling. If I had got out my metrics and measurement, it would be lost in translation, but because I connected with you as a person, it worked. We need to do that (Intermediary Participant 15).

I don't think you get anything done without good person-to-person, two person relationships. It's the person part of that that's really important (University Participant 28).

And I think, the [centre of excellence]'s communication is quite good. There's a human face to every technology (Industry Participant 21).

The participants acting as a nexus were committed to forming a personal connection early in the relationship. It was considered to be worth the effort. Some participants described their first contact in a similar way to the initial interactions at any social occasion.

6.2.1.4 Developing a mutual understanding is important for decision making

Participants considered the establishment of a mutual understanding through communication and relationships to be an important milestone for determining if an ongoing working relationship was worth investing in. The creation of mutual understanding can be observed across many facets of the relationship and occurs by: visiting the potential partner location, sharing ideas over a meal.

Visiting the potential partner location

It was considered to be beneficial for academics in the initial stage of the relationship to visit prospective industry partner sites, in order to create a better contextual understanding of their partner and improve communication.

... so that the uni-folks will get out and visit the industry person and to the extent possible, actually spend time there. It tends not to happen very often, except on those big projects. But part of the reason for that is supposedly the clever technology not by sitting in uni, but to get them out to see the real world, to get them involved in the dirty aspect of, "This is how the industry does it," which, but the how in the aspect of, how industry does it (Intermediary Participant 25).

Site visits massively important, yes. I think, too, more and more exposure to different cultural frameworks. Every organization is different in the way its staff operates. It's very different, and having an appreciation of that too. Also, I think individual communication styles and ways of actually engaging are so important (Intermediary Participant 36).

in this [inter-university] programme go to visit company in the new technology area and to know their demand and also on their needs and also talk to the company. Then we will do the promotion work. We have to ask our professor to demonstrate their technology and invite the industry people to listen to the presentation (University Participant 10).

... when I went back and talked to the clinicians, they all looked at each other and said, "Well, actually there're no reason why we shouldn't do that." And then when they made that change they came

back and it's like, that's made a real difference (Industry Participant 21).

But come to them where your market is, and accept it's a commercial relationship. And I think that's absolutely critical, you have to engage with the companies. And it's word of mouth afterwards as much as anything (Intermediary Participant 24).

The impact of academics visiting industry sites was not limited to “seeing is believing” in order to aid understanding, but it also moved the conversation from a theoretical focus to an application focus. This then provided evidence to prospective partners that there was sincere interest in their enterprise.

Sharing ideas over a meal

Social interaction is a key to relationship building. It provides a setting where personal information and insights can be shared outside the rigors of work. It is a time that people are familiar with building personal relationships with their family.

So it is very much a marriage of people and ideas and just being able to communicate and get along. So yeah, coffee sessions, dinner sessions, those cannot be undervalued at all. You can create ideas in a very formal room in a setting, but you also just have to let go, brainstorm, have some good wine and food and create things that way (University Participant 23).

And doing the induction and all of that, and it built this camaraderie, 'cause we were trapped together. I booked all the accommodation, we all had to stay at the same place. I got us all to have dinner. We all had breakfast altogether, and then away we went (Intermediary Participant 15).

By the end of the year, you're being invited round to their house for dinner. When you go to their country to visit them. So you really build up some very, very strong relationships and we're really proud of that ... you would think these people are family (University Participant 18).

Sharing a meal was promoted by some participants as an ideal setting for developing a deeper and broader understanding of other people. At the early stages of a relationship it helped prospective partners communicate and build social awareness. When done well over a period of time it built strong relationships akin to that of family.

Confirming the translation of language

When communicating a message, the message sent is not always received as intended. A good practice for important messages, was to check how the message has been received by a proxy or the intended participant.

[After getting some English translated to Korean] ... I engaged a second [person] and I said here is a document in Korean I want you to translate it back into English ... [and they said] it doesn't make sense. So I then got them to translate ... the English into the Korean ... gave [the new translation] to a professional translator [who] translated it into English. Came back pretty similar to what I said ... (Intermediary Participant 8).

the professional translator can actually skew your story, we went through this with the [newspaper] article, we were really lucky, [the journalist] did a great job, she allowed us one edit, but occasionally things can be not communicated properly and I am a bit wary of that (University Participant 14).

They might be looking for something that's not really what they wanna be looking for so a whole lot of stuff can be lost in translation so you need the right sort of interface there to be able to do that (University Participant 33).

The misinterpretation of an important message by either a translation service or journalist had been experienced by some participants. When differences in language exist, it was found to be important to independently verify the competency of the language translation service before engaging in important communications.

6.2.2 Drivers that develop interpersonal trust

6.2.2.1 Earning trust by meeting partner expectations

Whether during the initial stages of relationships where trust can be earned by responding to prospective partner communication expectations, or later, when the developing relationship is enhanced by delivering on needs that have been committed to, the nexus will drive success by meeting the prospective partners' project expectations. In the early stages of a relationship these expectations were met by showing interest in following up and delivering on partners' needs.

Showing interest by following up

An expectation when contacting someone is that they will respond to the message if they are interested in continuing or developing a relationship. Trust is developed between people if someone commits to do something and they do it. Following up on even the smallest commitments at the initial stages of a new relationship establishes some trust.

... if industry contacts me, I need to get back to them as soon as possible to show that we are motivated and still want to be involved, I think if I leave that long, they really see me as someone who is not committed and doesn't want to be involved, and so you need to be able to get back to them with the information or at least be communicating that you are trying to get the information (University Participant 9).

People are in an environment where they're in the room with other competitors, and it's not something you can easily establish trust and rapport with. So, it's about following up and showing that you're actually interested in their business and asking the right questions, and from that you then start to get a gist of how you may be of service ... It's about actually having those personal relationships because people do business with people, not organizations (Intermediary Participant 15).

If I've been contacted by an industry partner, then I'll star it so I don't forget it and then I always try to get back to them and apologize

if I've taken more [time than the next day, for example]. I'm very mindful of that. Industry partners take longer to get back so always try to be more responsive than they are (University Participant 33).

But it's not about my delivering on a service. It's about where they're at in their business at the time and if there's a need. So, it's really just keeping top of mind with people and nurturing that relationship (Intermediary Participant 15).

Some participants who had prospective partners following up on the business basics of messages or requests for information experienced an increase in the level of interpersonal trust. During the initial stages of the relationship these were important interactions.

Delivering on partners' needs

Showing a genuine interest, following up and delivering on partner needs provided evidence to prospective partners of what behaviour to expect in a prospective working relationship and indicate the level of cooperation that may be possible.

It's more a relationship. There's collaboration, because one, we had to... Well, there was discussion at the beginning, for example, what they're capable of doing. What we wanted to achieve, what we wanted to try. And during the whole process there is cooperation between the two (Industry Participant 26).

Universities that do it very well you can benchmark. MIT, Harvard, Stanford, a lot of the big Universities over in America which are not Government funded, they totally get where the money is. They totally understand the drivers in potential either philanthropic or industry partners. They do a really, really good job (Intermediary Participant 8).

So, the Institute of [research area] is another key institute which is really industry focused ... Through the policies the university's created and the structures that they've created, it's very positively leaning towards engagement with industry (University Participant 18).

..... sent him over and he went over and smiled sweetly and did the deal. And he said you've been hanging up on me and it's just not

cool. And after that all was well and they went out for a beer, they went to ball games (Intermediary Participant 8).

Prospective partners had an expectation that commitments would be complete when agreed, otherwise some communication received to renegotiate the task if an unavoidable delay occurred. These types of interactions were experienced by participants as earning interpersonal trust.

6.2.2.2 Communicating the value proposition to prospective partners

The ability for the nexus to communicate the value proposition is essential for partners Marketing communications were used and seen by participants as a way to engage with the community through a general message. Having a specific message for a specific market segment and using those in the existing network to leverage relationships was found to be advantageous.

Promoting their value through marketing communications

You've gotta have a lot of quite good material that present in terms of marketing and communication material, that presents a value prospect to the industry. And what I've learned over these years is that whether an industry will or won't come on board with a project, it's a business decision. And at the end of the day, they've gotta see the value in it for their business (University Participant 34).

Yes, communication to the general public would be fairly critical and convincing people that this idea has merit, so showing that conceptually it's a great idea, you really have to show at an early stage that it's a feasible project as well and that is one of the key criteria that we get assessed on when we put grants in (University Participant 14).

Use accessible communication mediums

I realized the power of marketing and communication. It's paramount to maintain those very important relationships and also getting new relationships. So yeah, spending, having some of your resources around marketing and communications, especially

communications. I think is a really, really good idea (University Participant 34).

We made introductions and they'd upgrade their website and get funding for that. So a whole host of different ways on how to communicate and how they communicated what their business was about (Intermediary Participant 15).

We developed a capability directory so that we could provide everyone of our members a sole trader to multinational all looked exactly the same in the booklet. They were all promoted exactly the same. They listed their capability and capacity. We had people come in and talk to them about what is your capability and capacity and how you should market yourself (Intermediary Participant 15).

Communication of marketing messages were experienced as providing a supporting function to estimate the credibility and trust of a prospective partner. Marketing messages provided reference points for prospective partners to access information such as testimonials and word of mouth on websites, catalogues and social media. Participant experience indicated that a message was more effective when modified for the relevant audience. For example, the messages for media outlets should be different to those used in abstracts for academic peers.

6.2.2.3 Developing trust through interactions

In addition to the cognitive trust that is established through reputation and personal assessments made during initial meetings, experienced participants also found that communicating quickly after the first meeting and delivering on commitments were effective ways to keep developing trust.

I actually terminate based on people. If I don't trust the person I'm working with, I terminate. Well, we have lots of termination points (Intermediary Participant 31).

Positive, trustworthy, very open relationships where you can really tell them about what and who potentially you are working with to maintain that trust and professionalism (University Participant 9).

So you develop a reputation with key people that you are trustable, they trust you and you trust them and you can just do so much more for them, there is nothing worse than having a conversation about technology where you can't say anything, it's a very [unproductive] discussion (Industry Participant 3).

... a person who deal with industry, must be responsible and also reliable and show that you are sincere attitude toward the company people and I think also provide a helpful information for them and gradually you can build up this relationship (University Participant 10).

So, you need to have the personal relationship and the trust, but from that you need a structure and agreed milestones, and an agreement. Otherwise, you end up scot-free and that's just a disaster (University Participant 18).

Yeah, look the whole thing needs to be about having a personal relationship, and by that I don't mean having to go to each other's places for barbecues and things, but being able to actually connect as two people rather than and I think being able to have a common language between both (Intermediary Participant 36).

Building trust through interpersonal interactions such as visiting the other persons work place, open and clear communication on expectations, being honest about capabilities and current capacity, helping explain unfamiliar systems and having integrity around confidential conversations have all been experienced by participants.

6.2.2.4 Intermediary driving the development of trust between universities and industry

In some cases, introducing an independent third party to assist in bridging language and cultural differences was found to be useful. Introducing an interpreting/facilitator role with specially trained people has been useful as trust can be quickly developed and maintained.

The value of the intermediary or the neutral actor, as it were, is the fact that it's actually looking for the well-being of the greater good for all the players involved. When that commercialisation activity is

controlled inside of the university, it's only single-sided, so, whilst they might purport to look after somebody else, they're acting within their own policy framework and will behave a particular way and they will only be able to go so far (Intermediary Participant 25).

It has worked out. Some folks will be chatting with the industry, uni-industry sort of linkage, but what tends to happen ... because we do have that rapport going with industry, because we do have a rapport going with the university, it's just for them to communicate individually, it becomes... They've got to go through that trust building stage as well. So, for a single project, we tend to be that we'd be a conduit for them (Intermediary Participant 25).

It is about there are two elements to it, there is the bridging a gap sometimes between a researcher and a business so there is an interpreting role there but because our job, my job, I am out there all the time whenever I see that guy I will say hello and ask him how things are going so I am also the researcher's agent out there as well (University Participant 11).

I work closely with business advisors who get to drill down into organizations quite intimately, and they're the ones that will come to me and say I've just been talking with this organization and they've got this brilliant idea, they don't see it as R&D, but there's a real opportunity and that's when I'll then set up a time and go out and have a chat (Intermediary Participant 36).

As well as providing a valuable service in bridging language and cultural gaps, some participants found that the use of intermediaries was useful when a project was considered where the investment in building trust between the organisations required facilitation.

6.2.2.5 Interactions between individuals need to create value for a sustainable relationship

The value that can be created through people working together can come from both internal and external sources. The differing agendas between university and industry organisations created differences in what was valued by the different people in projects.

The interactions valued by university people

The reward system for university academics is geared towards publishing articles to gain a reputation. Those with the best reputations more likely to receive funding to continue their research.

I find a quest for getting a [paper] published and I guess for building relationships in terms of why would industry keep coming back to me, okay because we can get the job done and meet their demands or meet their needs or give them something (University Participant 9).

but if the project was really gonna be successful, we'd like to be able publish at least some of this work, so that it can help us with our getting, attracting funds, being able to demonstrate that the university is doing good work (Industry Participant 21).

You get hammered at the university by other academics about, "You have to publish", and that's the only thing that counts (Industry Participant 23).

And what are the success stories that come out of the universities that we can actually publicise and publish, that yes, real engineering is taking place and real, tangible results have come out of it ... (Participant 24).

The experience of participants was that academics valued interactions that allowed them to focus on theoretical concepts and that had research significance. These interactions created opportunities to publish which enhanced their reputation within their community and standing with funding organisations.

Interactions valued by industry people

The focus for industry was on creating monetary value. Industrialists are instinctively looking for more efficient and effective ways to get work done. However, they rely on new knowledge for innovation to maintain competitive advantage.

One of the things about relationships is you need to, it's this whole thing, you need to provide value, and you can't always be asking for

something. You have to provide some value back, not only when it's paid for, you know what I mean? (University Participant 22)

... the visit is just one day so [selected academics on bus] go in and in one visit they come out with say, 70 or 80 ideas and then the business can then go through and work out which are the ones they think fits with their plans and then they'll go back and say, "Well, these three we want to work on." And then they will organise a relationship with the academics around that (Intermediary Participant 36).

And it was a hard sell to begin with, because we didn't have that value. So we had to develop that value through creating really good events with creative good networking, market intelligence (Intermediary Participant 15).

The other thing that we also focused on was making sure that people get value for money. So that when they do get the money, they know when they come to [university entity], they're gonna get 110% of value out of it. 'Cause we know it's difficult to get a hold of those funds for R&D, so we wanna make sure they really walk away thinking ... "We spent our money well here," and get a lot of value out of it ... So, we really do go that little bit extra with all of our customers (University Participant 18).

A positive experience for industry participants occurred when academics took the time to understand their business, providing them with meaningful insights related to their business and assisted industry to understand ideas that were new to them that could deliver competitive advantage through innovation.

6.2.3 Drivers for individuals building interpersonal relationships

6.2.3.1 Starting a new working relationship between people

A desire to engage may be encouraged from a media source such as an article or word of mouth. The level of interest generated could trigger an action to follow up and learn more when two or more people are unaware of each other's existence.

I think it's getting the right people at the table at the right time, and I think it's... I think the university should get to the table whether

they believe there's a value or not because unless they're at the table, they're never going to know. And I know everybody's time poor, but I have coffee meetings with no expectation ever, and I do the most beautiful, magical business two years down the track because of the coffee meeting I had no expectations (Intermediary Participant 15).

I love to hear about what their wants and needs are and I really enjoy industry coming along and you showing them and them raising an idea and then you go okay, well we have also got another capacity or we have got this, so I guess it's like building a relationship, I mean we start out at the disco and you say hello and then you start talking (University Participant 9).

We just sort of said, "Hello." And then basic simple we had to work together. So our expectations were quite low. [chuckle] It was definitely a learning process. We didn't even know in what aspect they could assist. And to be honest, we barely really brushed on probably what they could assist us with (Industry Participant 20).

In the initial stage of forming a relationship, the prospective partners have a low amount of information about each other. Each person needs to gain an understanding of whether they would like to work together some time in the future and what potential projects could be done together. Assistance to navigate through unfamiliar places and systems benefits people.

6.2.3.2 Leveraging off existing relationships established trust

The investment in establishing a new working relationship can be significant. Some participants preferred to check within their existing networks to understand if their need could be fulfilled.

Well, personally speaking, it's been a good relationship for a long time... And, you know, it's been pretty simple project. And of course we've got this double aspect of the guy's already worked with [the university] before. So, there's a trust aspect there that didn't have to get built. Not by me anyway (Intermediary Participant 25).

A classic example with our company is that we've commenced a project with [a university] on statistics, and we then found a person within the university who was just a fantastic, experienced person,

and then we brought that person into the company as a permanent employee, and then that established a very tight relationship with that university (Industry Participant 29).

You end up leveraging your existing partners and using them more because you already have the relationship with them so it's much easier to engage them and the likelihood of success is much higher (University Participant 33).

What you really want to do is leverage off relationships. So, what I did was, the university already has a number of relationships with various industry partners and there are individual academics with various relationships with industry partners. And so, what I would do is kind of arm those academics, or arm those that already were in the relationship with the company to start talking about [inter-university organisation] with that particular company (University Participant 34).

Some of the relationships that [academic] has established over the last 12, 13 years you would think these people are family. They really do help what we do here and I think we get on really well and that just encourages projects to become larger, more complex. More people are being introduced. They go off and talk to their friends and their colleagues and then you start to see people coming in from every direction (University Participant 18).

Leveraging existing relationships to make referrals for engaging potential members was also experienced as a beneficial approach. Initiating relationships in this way reduced the risk of forming working relationships with misaligned people. The approach also had the benefit of the person coming with strong existing relationships with a partner organisation.

6.2.3.3 Genuine interest in partner success

The difference between a transactional and relational interaction is the level of interest in the partners' success at the conclusion of the project. Good will is generally created when genuine interest in the success of a prospective partner is demonstrated rather than behaving opportunistically.

... if you're genuinely coming from [wanting] to help a customer, [and] if what I'm offering, or what they want is not what I'm offering, or what I can do, then I'll point them to where they can get it better. So, it's always having in mind what's best for customer, even if it's not you, and that works better for you long-term-relationship wise, because the customer will then refer you to others when they do see the need (Intermediary Participant 35).

And we are seriously starting to see diversification and innovation in the region here because as part of what we got to do, we got to talk to local industry, we've got to find out what they're doing but we can be of benefit to them if they can be of benefit to us (University Participant 6).

If you are genuinely interested in what they are doing and I am most of the time, I rarely come across something I find boring but if I am generally interested it makes me ask more questions and get a better understanding of them and most of the time they like that. It obviously opens up the possibilities much wider (University Participant 11).

Genuine interest towards prospective partners was viewed by some participants as valued assistance. Sometimes the assistance was repaid to the nexus immediately, but the good will created could also be paid in some other way in the future.

6.2.3.4 Nexus leadership for building trust in relationships

At a certain point in the initiation of a new working relationship, a stage will be reached where a commitment will need to be made to complete a project. Once committed to a working relationship the people involved in a project need to ensure that appropriate teams and leadership are put in place to ensure that tasks are completed as expected.

... with any of these relationship[s] you need a champion who is going to take the lead and be the broker or whatever for that relationship, if no one is prepared to be that champion, the relationship is going to fall away, the project is going to go slowly...

and so you need people to step up and be prepared to be that person ... (University Participant 9).

Yes, so you can have a person who is getting and organising meetings and what needs to go out for the meetings and making sure that everyone is there and let's keep going and chatting but ultimately you need people to invest, someone to take the lead and then get the right people to be investing time into that relationship (University Participant 9).

... it's important that there be relationships all across the line but there has to be a point of contact that's responsible for maintaining a service level agreement [/expectation] ... that has to be maintained and that has to sort of match what the organization trying to project (University Participant 22).

... and you need to be able to deliver, I mean this is part of the hard keys of that interaction so if you say yes we'll get it done, and you don't ... [the] relationships broken (Intermediary Participant 8).

Now we have been talking to Aerospace, we're talking to a lot of... [people]. They have standards and those standards are incredibly high. We've gotta match it. If we wanna play with these guys, we've got to match it (University Participant 18).

The commitment of people to form a working relationship for a project is an outcome of a nexus leader who can balance the accountability for delivering on the objectives of the project and provide relationship support to engage team members in the project objectives. The participant benefits from working relationships were found to be influenced by the level of commitment and accountability from the key people involved in the partnership.

6.2.4 Shared and accepted values

6.2.4.1 Reputation of prospective partner

Being able to assess the credibility and reputation of a prospective partner is important for those initiating new working relationships. Understanding the

believability of another party involved assessing the reputation of a person delivering knowledge.

And a bit about their background and their track record, if you like. So, I think that's an important thing to get across ... [1) What is the information I am being told? 2) Who is telling me this information? 3) How much do I believe, how much do I trust what they're telling me?] And that comes from something to do with my understanding about maybe how honest and reputable they are, it maybe comes about, do they really know their stuff? (Industry Participant 21)

We make prototypes of products we make. It might be completely different to the final product, but make some prototypes, get some ideas, get some input from surgeons. We've got a scientific advisory group of probably five surgeons that we consult with, over dinner we talk about it and chew the fat about what's gonna happen and what they think. "Here's a product", or they get some ideas (Industry Participant 32).

It's a pretty good relationship. And what will take it from a good relationship to a valuable relationship will be to try and find one or two projects where we can formally start working together. And that's what we're working towards (Industry Participant 5).

Partner reputation was considered to be important to both university and industry participants. The level of trustworthiness of a prospective partner can be performed by testing their knowledge and responsiveness against existing knowledge or using a specialist group of people to provide advice when needed.

6.2.4.2 Marketing message to build brand and reputation

Marketing and media is another source of information where the skill of discerning what is credible was used by participants. The use of marketing materials and disseminating important information to prospective partners through the media and community groups was identified as a way to facilitate the creation of important new working relationships.

... but it also needs to go out to the public and whether that's through media, media is one way but doing I guess community work and going to Probus Clubs or other clubs and societies to try and get the messages out. They are probably my ways of preference and I guess another way obviously of getting that knowledge transfer out is to get industry to have implemented a product (University Participant 9).

And so, with [inter university organisation], we worked quite hard on developing materials, developing a good website, developing marketing materials that we could get out to a broad industry audience (University Participant 34).

If you go on as a scientist on the radio to say that, well, their council will love you. And you absolutely do it with your rigor. You're not selling out, but you are communicating important research to mainstream rest of the world' (University Participant 23).

It is credibility. We also wanna build up our reputation as being a quality outfit as in a place you can go. We can do real high-end research and we know that they're being looked after, protected as the very latest available technology is being maintained to the highest levels. We are calibrating our kit. We are looking after our staff. We are training them to the highest degree. So it's really important to do that and also build on it (University Participant 18).

So the relationship could have come about in terms that I may have read media story and I want to contact someone or I have seen, I have read a paper and seen who they have been sponsored by or something like that or I have just heard about a company or someone has introduced to someone and so it's like yep, I will follow up on that (University Participant 9).

The use of the media by the nexus needs to focus on the value proposition presented to a broad audience. Some participants embraced media and used it to broadcast the benefits of their research. Preparing messages for different mediums is a proactive way to ensure a value proposition can be communicated to a broad audience. Web sites were an important inclusion for a collection of marketing materials.

6.2.4.3 Past trust formation – exploring the relationship

The people involved in forming new working relationships need to be able to identify common values and those they can accept from prospective partners. Successful completion of innovation projects relies on the behaviour of participants in meeting their individual organisations goals and objectives.

First of all, the university talks about [working with industry]. The head of university is all on about wanting to make that known that [university] wants to be known for that. So the leadership of the university talks the talk, and I think then that built structures, some are good, some are... They're improving, but to be able to walk the talk (University Participant 18).

Everyone needs awareness across everybody's interests ... If you could facilitate really open discussions upfront, and just map out, "This is why we're doing this," ... (University Participant 23).

So yeah. So it's really comes down to how we share, I think, more so than actually who owns it at the end of the day, sort of like, "How do you build a win-win situation out of this?" Those sorts of things (Industry Participant 16).

They want to generalise it and we just thought ok we're happy to go to the specific area if you want to work in. And that basically got them jumping with joy, [and offer technical knowledge]. We get the [outcome] for what we want to get, they get the opportunity to write up the paper at the end of the given period with all the results. And that's basically how it's got to that point (Industry Participant 2).

When the nexus is able to understand and facilitate the acknowledgement of shared values and the acceptance of key values that are different, participant experience was that the working relationship was more open and stronger for attaining the objective of the partnered innovation project.

6.2.4.4 Clarity of partner project deliverables

It is important that the person who is looking for prospective partners have a clear understanding on what their needs are from a partner and communicate them early. Clear communication during the exploration of prospective partners ensures that all potential mutually beneficial projects are considered.

..... but if I think about from an industry point of view I think the industry partner needs to absolutely understand what they want from that relationship and be able to put that on the table early in the relationship and ensure that the university is aligned to that as opposed to going down the path of doing some research and ending up in some argument over IP rights or commercial outcomes (Industry Participant 5).

There's various ways that we describe them and there's contract research part relationships where companies just come in and say "Right, I want you to this. Here's our problem. Solve that problem for us." There's partnership-type activities where they might sponsor a PhD student or an engineering design project. There's collaborations where we work together with other companies as part of a bigger group. It's all of those standard ways of describing activities (University Participant 18).

We have transactional relationships, sort of another term, where they come in, pay for the services and then go away. They come back another time and pay for services and they're the type of people where they've not engaged in the vision of the university at all, you're not strategically aligned with them, all you are is a single service provider. The value of those transactions over time can be quite extensive so they're the bread-and-butter ... (University Participant 33).

I've learned with industry, kind of building on that relationship, maintaining contact, not just seeing it as a kind of consultancy; just a transaction of money and service (University Participant 34).

The nexus in the cases above were clear on their requirements for a successful relationship. It should be noted that clarity around deliverables is not always possible. Especially projects with high levels of uncertainty and/or complexity which need to deal with the associated ambiguity.

6.2.4.5 Developing a new industry community

Innovation requires input from many people to be successful. Industry has been a successful integrator of design, marketing and manufacturing functions for the development of new products. A group of people from different organisations have been successful in building communities to develop new products and have diverse requirements depending on situation and location. Being able to disclose and accept differences between organisations is important for building communities.

Yep being able to I guess generate a relationship where you can talk openly about the direction that the company might like to go in and how it would align with research goals or how you could assist those research goals for ... input into that in a company and therefore the company just wasn't seemingly interested for that directive of people who wanted to sell you something or market something to you (University Participant 9).

But you have to just respect their personal agenda, and it's not a block to being able to work together. At the same time, those people with worth agendas, have to recognise other non-financial altruistic agendas. And as long as everybody can just be very open about that... I found that all the projects and relationships I've worked with, really work best when everyone is just open about their objectives and agendas, and anyone being secretive is just very difficult to work with (University Participant 23).

It probably is now, I think, [the university] are almost like they've started planning how [our company projects] fit in their... into their [academic programme] ... I guess I instigated it myself but it's now a bit more of a two-way sort of a system (Industry Participant 20).

The development of innovation communities such as existing business relationships and clusters were experienced by some participants as way to build a network of working relationships for competitive advantage in a geographic location. The communities relied on disclosing and accepting differences to be successful.

6.3 Summary

In this chapter the drivers that were experienced by participants of the best ways to initiate and develop the early stages of a new working relationship were explored through a relationship marketing lens. The key themes that participants experienced that drove relationship development and therefore provided a strong basis for the advancement of innovation projects were related to the situational environment shaped by the nexus, which is a major finding of the research and will be explained in the following chapter.

The summary in Table 7.1 captures the key findings that will inform the discussion in Chapter 8 of note are the significant factors acting as drivers of relationship development. These are:

- 1) Initial meetings are most effective when they occur face-to-face,
- 2) Developing a mutual understanding is important for decision making,
- 3) Interactions between individuals need to create value for a sustainable relationship, and
- 4) Trust is developed through repeated positive interactions.

These themes and sub-themes can be applied to different situations. Understanding the impact that they may or may not have in different situations is useful for nexus partners driving the innovation process. This is important as the significance of each relationship driver changes with the situation. For example, the need for developing a mutual understanding will have higher significance in a complex, uncertain project.

The next chapter provides a discussion of the results, the theoretical and managerial implications for the participant experience of roadblocks and drivers.

These implications are used to reconceptualise a best-practice model for the initial and early stages for the engaging a new working relationship.

Table 6.1 The key findings from participant experience of initiating and developing new working relationships. Note the highlighted (red text) are the significant factors acting as drivers of relationship development.

Principled Nexus Behaviour	Communication drivers that facilitate interpersonal relationships
	Initial meetings are most effective when they occur face-to-face;
	What can help when face-to-face is not possible;
	Making a personal connection;
	Developing a mutual understanding is important for decision making.
	Drivers that develop interpersonal trust
	Earning trust by meeting partner expectations;
	Communicating the value proposition to prospective partners;
	Trust is developed through repeated positive interactions;
	Intermediary driving the development of trust between universities and industry;
	Interactions between individuals need to create value for a sustainable relationship.
	Drivers for individuals building interpersonal relationships
	Starting a new working relationship between people;
	Leveraging off existing relationships established trust;
	Genuine interest in partner success;
	Nexus leadership for building trust in relationships.
	Shared and accepted values
	Reputation of prospective partner;
	Marketing message to build brand and reputation;
	Past initial trust formation – exploring the relationship;
	Clarity of partner project deliverables;
	Developing a new industry community.

7 DISCUSSION, THEORETICAL AND MANAGERIAL IMPLICATIONS

7.1 Introduction

The themes that were derived from a relationship marketing lens of participant innovation project experience in Chapters 5 and 6 provide the context for interpreting the meaning for researchers and managers wanting to be more effective. The analysis of drivers in Chapter 6 provided an insight into the benefits of Principled Nexus Behaviour (PNB). Striving to always act in a principled way helps to mitigate the risk of destroying a working relationship quickly through an opportunistic action. The lens provided the facility to distil new working relationships and their development from the initial to the early stages. In this chapter the focus is on the interpretation of results related to:

Determine the drivers and roadblocks to relationship development between university and industry by interviewing key stakeholders. The driver and roadblock themes were conceptualised from the perspective of a Business Development Manager (BDM). The important drivers that prevent and rectify roadblocks in the early stages of relationship development were established.

Universities can become a nexus point for university-industry partnerships through using a proactive relationship marketing approach during initial relationship phases. The focus on innovation around the world to become more effective and efficient has occurred from falling design and communication costs leading to increased competition. Universities, as creators of new

knowledge, hold a powerful position for the future development of new products. It is important to understand if the traditional university structure has the capacity to become a nexus point for new university-industry relationships.

New social media technologies have a role in facilitating communication and cooperation. These new technologies have already played a part in the reduction of communication costs that have led to increased competition. It is expected that some participants may be using internet based technologies to assist in the initial and early stages of relationship development.

Support the relationship marketing approach discussed by Plewa et al. (2013b). The models developed from literature in Chapter 3 were attempts to conceptualise the main drivers and dimensions active in the initial and early stages of relationship development. The drivers and roadblocks encountered through participant experience are compared.

Adapted Ruekert Framework for nexus driving initial and early stage relationship development for innovation. A number of models are considered to best represent the drivers and process required for the effective initiation and development of new working relationships.

7.2 Drivers and roadblocks to relationship development

The participants experienced organisational differences which were strongly linked to values and objectives between each of the entities. A driver for overcoming this roadblock was to share, or at least understand and accept each organisation and

individuals' values and objectives. Having shared values and developing trust was important for relationship commitment.

The development of relationships in the initial and early stages does not occur systematically or in sequence. Static models fail to convey the way that informal interactions, in different situational environments and through their interdependence, arrive at different decisions on how the prospective relationship should proceed (Figure 7.1).

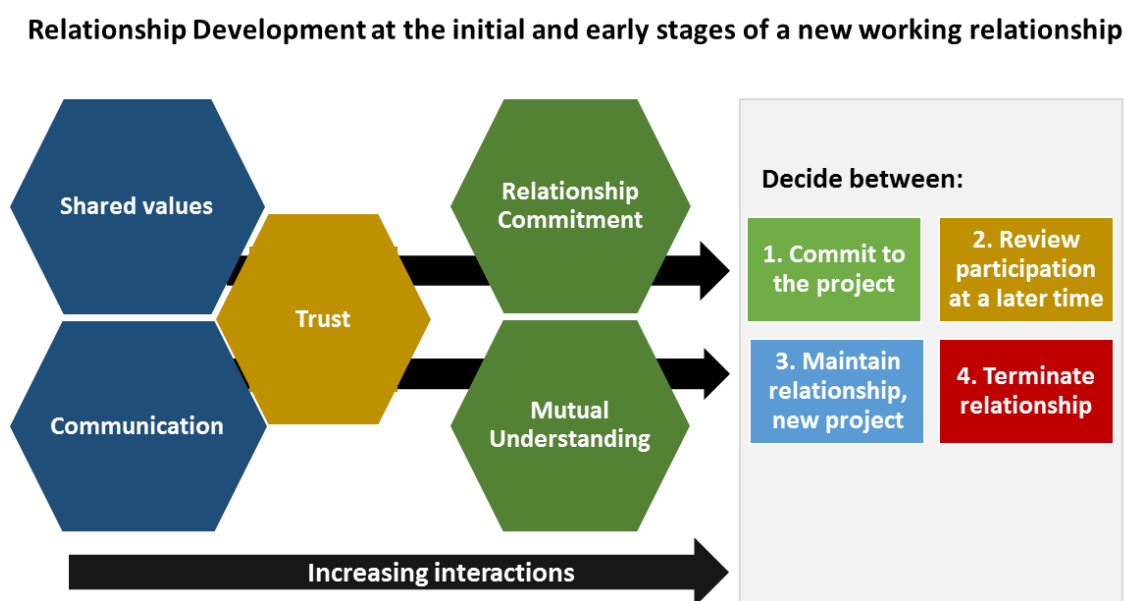


Figure 7.1 The development during the initial and early stages of a new working relationship as experienced by participants in the study. *The main drivers, that are in hexagons, develop the relationship in an informal way and are situation dependent. Principled Nexus Behaviour (PNB) facilitates the whole relationship development process to overcome encountered roadblocks.*

A decision is made at some point of the relationship development process to either: commit to the potential project; review participation at a later time; maintain the relationship but not proceed with this project; move on and look for other prospective partners.

The interdependent nature of relationship development through successive interactions can be seen by examining the relationship driver sub-themes (Chapter 7).

The four major sub-themes: developing trust through interactions; initial meetings face-to-face; interactions between individuals create relationship value; and developing a mutual understanding are all reliant on a positive experience from the interactions. The situational environment had an effect on the rate of progression and order in which the required information is collated to make an informed decision.

The central theme driving the initial and early stage interactions was described by participants as “trust”. Trust was essential for both the development of mutual understanding and a relationship commitment before a decision to co-operate was made. Without trust, neither a mutual understanding nor relationship commitment can be developed to the level required to decide to enter into a successful co-operative partnership (Morgan et al., 1994).

Trust in the early stages of university-industry relationships

The development of new products for commercialisation is a risky business for those who make an investment. It has been shown that trust is essential between key people for successful innovation (Grönroos, 1990; Couchman et al., 2009; Plewa et al., 2013b). The establishment of trust in relationships in this study was found on multiple levels and is shown in Figure 7.2, including:

- 1) Person to person/interpersonal trust;
- 2) Bringing established trust into the relationship and leveraging it;
- 3) Using a platform of trust for developing a mutual understanding and presenting the value proposition;
- 4) Organisational / researcher (reputational) trust; and
- 5) Trust that is associated with sharing and protecting IP.

Levels of trust during initial and early stage relationship development

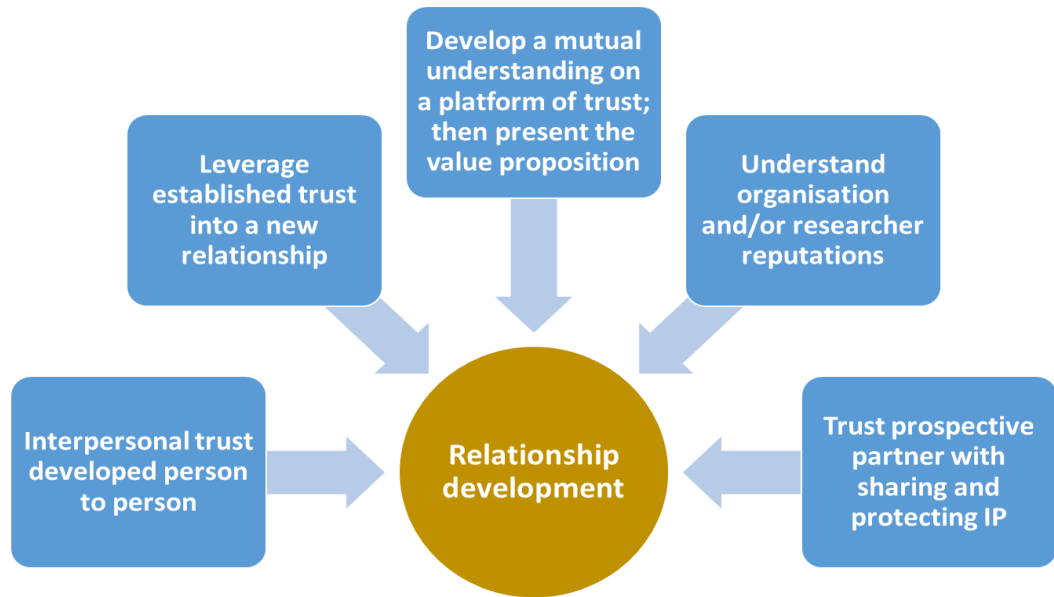


Figure 7.2 A diagram showing the multiple levels of trust that were found in the study to drive relationship development in the initial and early stages of a new working relationship.

Interpersonal trust development between prospective partners

Working relationships have two components, both professional and relationship characteristics. Each of these usages involves a level of trust that is influenced from a cognitive and/or affective mode and rely on communication during interactions between people to facilitate trust development (McAllister, 1995). Face-to-face communication was preferred by all participants during initial meetings as it allowed both verbal and non-verbal communication to take place. Participants found that nuances in behaviour and facial expressions allowed experienced relationship builders to create an opinion of the prospective partners' level of trustworthiness. These opinions were further enhanced if interactions developed trust through meeting partner expectations and a perceived value of the relationship could be communicated.

A test used by some was whether you would invite the prospective partner home for a meal. In some cases, this initial meeting led to the termination of any potential future working relationship. When resourcing or interpersonal issues existed, experienced intermediaries were found to be effective in bridging the development of trust.

Leveraging off established trust for faster relationship development

Trust can take a long time to develop when people do not know each other (Altman et al., 1973). This is a reason that people choose to work with those that they know rather than with new people. Often people will ask those they trust within their professional networks for prospective partners they could recommend so that the risks of working with someone new could be minimised. A positive impact on relationship success by “word of mouth” was also found by Plewa et al. (2013a). Leveraging off the trust that has been established within the professional network was found by some participants to assist in quickly creating an effective new working relationship.

Platform of trust to facilitate communication of the value proposition

When initiating relationships without a platform of trust, the participants found that it was important for to take the lead as the nexus. It was important for the disorientation that occurs during the initial stage to be overcome. Both prospective partners needed to be able to make a personal connection. This trust is a precursor for participants to explore the relationship and for it to develop. It was found that participants needed these interactions to occur face-to-face and for the credibility of the individual and organisation to be confirmed for an effective platform of trust to develop quickly. The development of a platform of trust was not instantaneous and could take many face-to-face interactions which is in agreement with social

penetration theory Altman et al. (1973). It was important for this platform to be established for the nexus and the value proposition to be genuinely considered and the resources required to develop a new working relationship to be arranged. However, any trust could be quickly destroyed by behaviour viewed by the prospective partner as unacceptable. This resulted in the relationship being terminated. The termination was made independent of any potential benefit the project might have delivered. The behaviour that led to this type of termination may also be communicated throughout the community by “word of mouth”.

Reputational trust driving the initiation of new relationships

The reputation that a prospective partner has in a community tends to influence the level of credibility connected to what is communicated. The perception of the values that are experienced when in a relationship may have been communicated through a professional network as “word of mouth” and influence how communication is received (Plewa et al., 2013a).

The use of reputational trust was most effective when a personal introduction was made from someone trusted within a professional network. In some cases, the personal endorsement of the prospective partner resulted in no further intentional actions around developing a platform of trust. Their focus was directed towards developing a mutual understanding of what they wanted to achieve with the project.

It was important that shared values be determined early in the relationship and if any differences exist that some acceptance around these can be accommodated (Morgan et al., 1994). An example of this was observed between some academics and industry around monetary objectives of a project. It was shared by an academic that it is this monetary objective that creates value for the project and that if an academic is

not able to share this value, which they need to accept it and the objectives associated with it for the project to be successful.

Some participants were open to using marketing tools to present the message that they wanted the community to know about them. Through creating a brand and a key message, they were able to tap into the networks of those that they knew and trusted to initiate potential relationships with prospective partners. The communication for these activities was usually in the form printed media distributed personally.

Trust when sharing IP with prospective partners

The ability to conduct exploration of a potential projects between prospective partners is not possible without an element of trust. The fear of the prospective partner taking an opportunity to independently further their own interests is a risk that needs to be overcome. This is best observed in patenting behaviour where protection of investments made in intellectual property is sought (Genet et al., 2012). During the initial stages of a potential project, it is unlikely that patent protections would have been considered. A situation dependent decision on what to communicate and the level of protection necessary will fall to the nexus. One approach that a participant described was based on an incremental project. They felt a handshake was all that was required to being sharing the expected outcomes of a potential project and relied on damage to reputational trust as a deterrent. Most participants were involved in more complex and disruptive type projects and preferred a formal approach such as a non-disclosure agreement before discussing any detail of potential project key innovations and outcomes. In some cases, which were highly complex and/or disruptive, intermediaries with formal IP agreements from each organisation managed the key aspects around intellectual property.

Principled Nexus Behaviour facilitating relationship drivers

The nexus has important communication and behavioural outcomes to manage to establish a successful new working relationship. The communication and behaviour of the nexus should reinforce and not detract from the development of trust. Participants experienced this most when the prospective partner was genuinely interested in their success. Choosing opportunistic outcomes that disadvantage a prospective partner also needed to be avoided. The term Principled Nexus Behaviour (PNB) has been created to describe expected nexus behaviour where personal interactions are based on genuine and principled action. Developing trust during the initial and early stages of a new working relationship is best accomplished by applying the appropriate relationship drivers for the situational environment by utilising a PNB approach.

7.2.1 Can the university be the nexus for innovation projects?

The commercialisation of new products relies upon the functional integration of market, design and manufacturing domains (Gupta et al., 1986). Traditionally, high design and communication costs have supported industry to be the nexus for product development (Baldwin et al., 2011). The marketing manager acting as the nexus within the organisation to bring together the product research and designers, manufacturers and marketers to ascertain the product ideas that can be created, made in a way and at a price that are valued by consumers (Ruekert et al., 1987).

The role of the university has been to provide knowledge to industry who translates the knowledge into new commercial products. Usually this knowledge is science based. However, industry competitiveness has been impacted by

environmental factors such as low communication and design costs which have made it viable for collaborators and individuals to participate in new product development. Industry is theoretically no longer the only nexus candidate for product development (Baldwin et al., 2011). In recent years, examples of people acting as the nexus from organisations other than industry have been published (Juanola-Feliu et al., 2012) and (Raesfeld et al., 2012a). This research discovered four people acting as a nexus for innovation projects outside of industry and two industry people participating in projects where they were not the nexus (Chapter 4).

Examining the themes from the analysed experiences of participants, the major roadblocks facing the university taking the role of nexus are both structural and behavioural (Table 7.1). The structural roadblocks stem from the organisational differences in the values and objectives of academia which are not consistent with those needed of a nexus to commercialise new products. The behavioural roadblocks involved the relationships between university and industry people, who lack the relationship development skills of someone performing the role of a BDM (Chapter 5).

The university academics are strong in research and design knowledge but lack the manufacturing and market knowledge that is required to be integrated. The behavioural roadblocks impede the development of relationships with those who can assist with the required market and manufacturing knowledge. The gap in structure and behaviour is such that the traditional university is not poised to be an effective nexus.

It was interesting that both the university organisations acting as a nexus had a separate identity and branding to the university. The goals and objectives of the nexus entity were aligned closely to the needs of industry. One of the entities had a team of

three guiding the development of a new industry cluster/community. The team included a research expert, manufacturing expert and a commercial expert. The research expert also had great relationship building skills similar to those expected of a BDM. The second entity involved a nexus with industry experience who used marketing and communication resources to develop an environment where academics and industry could come together over a short period of a week to solve complex problems faced by industry. In both these cases, the academics involved had an excellent understanding of the market.

It is therefore considered that a traditional university is not the best choice for a nexus as academia generally lacks the expertise in the commercial markets that innovative new products seek to enter and the business development skills to functionally integrate such information. An exception to this may be with researchers who possess a deep integrated understanding of design and market knowledge such as clinicians. They are experts in understanding the design requirements relating to their area of expertise and have a deep insight into end user requirements through their contact with patients.

7.2.2 The role of social media in the initial stages of relationship development

During the initial stages of initiating and developing a new working relationship, all participants wanted this interaction to occur face-to-face. However, social media and electronic communication was used by prospective partners before and after face-to-face interactions took place.

- Web searching and LinkedIn® were useful for creating a professional profile of someone you wished to meet for the first time,
- Email was useful for co-ordinating meeting times,

- SMS was useful when no response occurred from an attempt to make contact,
- Skype® was useful for interactions after initial contact had been made.

The use of social media, web searching and electronic communications to build profiles of a prospective partner were found by some participants to be invaluable. The use of collaboration and video conferencing solutions such as Skype® was found to be useful when face-to-face communication had occurred, a platform of trust had been developed, and/or the costs associated with travelling between locations were high.

7.3 Theoretical contributions of research

7.3.1 The relationship marketing approach

Plewa et al. (2013b) was the first to provide a relationship marketing framework to explain the development of university-industry relationships. Since then, (Galán-Muros et al., 2016) have presented empirical data to support the importance of interpersonal relationship drivers to gain commitment to university-industry working relationships.

Studies into interpersonal cooperation in organisations have concluded that two types of trust are influential when exploring relationships. Cognitive trust is reasoned, and is based on evidence. It exists when a person has enough evidence to take an action. Affective trust, on the other hand is formed through the emotional bonds that occur through interactions involved in mutual experiences. These emotional ties provide the basis for trust (McAllister, 1995).

The cognitive and affective foundations of trust have been found to play different roles in the development of interpersonal relationships within an organisation. Cognitive trust is influenced by the reliability of peers' performance, cultural similarity and professional credentials. In contrast, affective trust is influenced by cognitive trust, interaction frequency and behaviour (Dirks et al., 2001).

In this study, at the initial and early stages of the engagement process, communication was critical for a mutual understanding is to be established. Face-to-face interactions allowed for non-verbal as well as verbal communication to contribute. Communication was also important for the development of trust, which is the precursor for mutual understanding and a relationship commitment. Both mutual understanding and relationship commitment needed to be established before a decision to cooperate can occur (Figure 7.1).

The content analysis of participant experience from the relationship marketing lens supported the development of cognitive and affective trust during the initial and early stages of new interpersonal working relationships. This is demonstrated in Table 7.1 where roadblock (Chapter 5) and driver (Chapter 6) sub-themes have been grouped by influence on either cognitive or affective trust.

Table 7.1 The roadblock and driver sub-themes are grouped by influencers on cognitive and affective trust. These groupings are independent to the major theme groupings.

Sub-themes	Cognitive Trust	Affective Trust
Roadblocks	Unaware who the appropriate contact is; Inability to explain the value proposition. Barriers at initial interaction stage; IP issues; Industry roadblocks from policy and process failures; Business stakeholder agenda to create wealth; Business risk barriers; Time pressure between organisations.	No timely response to initial contact; Miscommunication caused by different life worlds and jargon; Too formal in the early stages; Poor attitude towards the industry partner; Lack of mutual understanding between people; Roadblocks from ineffective university commercialisation offices.
Drivers	Intermediary driving the development of trust between universities and industry; Leveraging off existing relationships established trust; Reputation of prospective partner; Marketing message to build brand and reputation;	Initial meetings need to occur face-to-face; Making a personal connection; Earning trust by meeting partner expectations; Developing trust through interactions; Interactions between individuals creating relationship value; Genuine interest in partner success; Nexus leadership for building trust in relationships.

The roadblock and driver themes are not discrete concepts with clear boundaries. The development of relationships, in the initial and early stages, operate in an interrelated way and proceed dependent on the situational environment. An example of this is the fragmentation of the sub-theme grouping when the focus was moved from ‘major themes’ to ‘influencers of the type of trust’ in Table 7.2.

Table 7.2 The strengths and weaknesses of potential frameworks that could be used to communicate the themes experienced by participants.

Potential Framework	Dimensions						
	Dynamic	Relationship	Trust	Communication	External Environment	Strategic	Relationship Outcomes
Academic engagement (Perkmann et al., 2013)	No	No	No	No	Yes	Yes	No
University-industry relationship development (Plewa et al., 2013b)	Yes	Yes	Yes	Yes	No	No	Yes
Stakeholder agency (Hill et al., 1992)	No	Yes	No	No	Yes	Yes	No
Interpersonal relationship development (Altman et al., 1973)	Yes	Yes	Yes	No	Yes	No	Yes
Dynamic, dyadic business relationships (Huang et al., 2013)	Yes	Yes	Yes	Yes	No	No	Yes
McKinsey 7S (Dwyer et al., 1991)	No	No	No	No	Yes	Yes	No
Inter-functional interactions involving marketing (Ruekert et al., 1987)	No	No	No	Yes	Yes	Yes	No
Relationship development (Dwyer et al., 1987)	Yes	Yes	No	Yes	No	No	Yes
Chapter 3 proposed model (Figure 3.4)	No	Yes	No	Yes	Yes	Yes	Yes
Chapter 3 proposed model (Figure 3.8)	No	Yes	Yes	Yes	No	Yes	Yes
Adapted Inter-functional interactions involving marketing (Ruekert et al., 1987)	Yes	Yes	Yes	Yes	Yes	Yes	Yes

7.3.2 The nexus framework for driving the development of innovation relationships

The relationship marketing lens draws upon social exchange theory where social judgements in different contexts may occur immediately and/or develop with time. The benefits from these social judgements provide value for a prospective partner to participate in an exchange (Blau, 1964). Social penetration theory builds on social exchange theory through the formation of a deeper and broader understanding of prospective partners through the accumulation of social judgements from many interactions over time.

The model proposed in Chapter 3 captured influencer continuums that were seen as important, but failed to capture the additional aspects discovered in the study of needing to account for the internal and external environment as well as its dynamic nature. The dynamic nature of relationship marketing influencers such as trust, communication, shared values and relationship benefits limit the approaches that may be used to communicate participant interpreted experiences.

A relationship marketing lens was used to interpret the drivers that were experienced by participants. Participant response was explored from the perspective of what drivers would assist a nexus initiate and develop a potential partnership with new people.

The following section describes the drivers that were experienced by participants in this context by relating participant past project experience sub-themes that contribute to the following four major themes which constitute PNB.

- 1) Communication drivers that facilitate interpersonal relationships,
- 2) Drivers that enhance interpersonal trust,

- 3) Drivers for individuals building interpersonal relationships,
- 4) Shared and accepted values.

A search for a suitable framework considered a number of alternatives that had different capacities for capturing and communicating the themes as shown in Table 7.2. The alternate frameworks considered included interpersonal relationship development (Altman et al., 1973), dynamic and dyadic business relationships (Huang et al., 2013), the McKinsey 7S that was developed by Waterman and Peters and researched by Dwyer et al. (1991), relationship development conceptualised by Dwyer et al. (1987), Daniel et al. (2011), Plewa et al. (2013b) as well as Ruekert et al. (1987) who incorporated inter-functional interactions involving marketing frameworks.

The framework developed by Ruekert et al. (1987) explains inter-functional interactions driven by marketing. This framework had the most affinity with the themes experienced by participants. The framework relates the environmental situation, structure and process, as well as the outcomes for different functions within an organisation. The outcomes are driven by a marketing function, who acts as the nexus, to produce new products. The environmental situation in this thesis is different to that developed by Ruekert et al. (1987) in that the internal environment of both the university and industry does not contain all the required key resources.

7.3.3 Explaining the Adapted Ruekert Framework

The existing framework by Ruekert et al. (1987) requires modification to be able to be used as a framework for describing the nexus of university-industry relationships. The assumption is that they are functioning as “silos” with different

thought worlds (Dougherty, 1992). Additionally, the progression of the relationship from initial stages is also not a prime focus of the model with the model encapsulating the formularised work practices and outcomes from work agreed upon. The internal and external environmental conditions, and the communication flow between the stakeholder agent and others providing functional value, are present during the initial interactions of a relationship and need to be considered. These issues have influenced the adapted framework shown in Figure 7.3.

By overlaying the university-industry relationship development stages developed by Plewa et al. (2013b) to the Ruekert et al. (1987) framework we can capture the dimensions that relate to particular stages of the development processes that create the mutual understanding and development of effective working relationships between the people who are key to delivering on innovation projects in a framework which is widely accepted in the functional integration literature.

The benefit of the adapted framework is in providing a lens to interpret the actions of a person in the role of the nexus to deliver on task and relationship outcomes. In their seminal work, the role of the nexus was undertaken by people in the marketing function (Ruekert et al., 1987).

In forming an understanding of the drivers and roadblocks to the initial and early stage development of innovation relationships between university academics and industry it is necessary to discern early stage activities and adaptation of the Ruekert model is required. The stakeholder roles have been included as the nexus was not confined to industry.

The Adapted Ruekert Framework: Initial and early stage relationship development by nexus

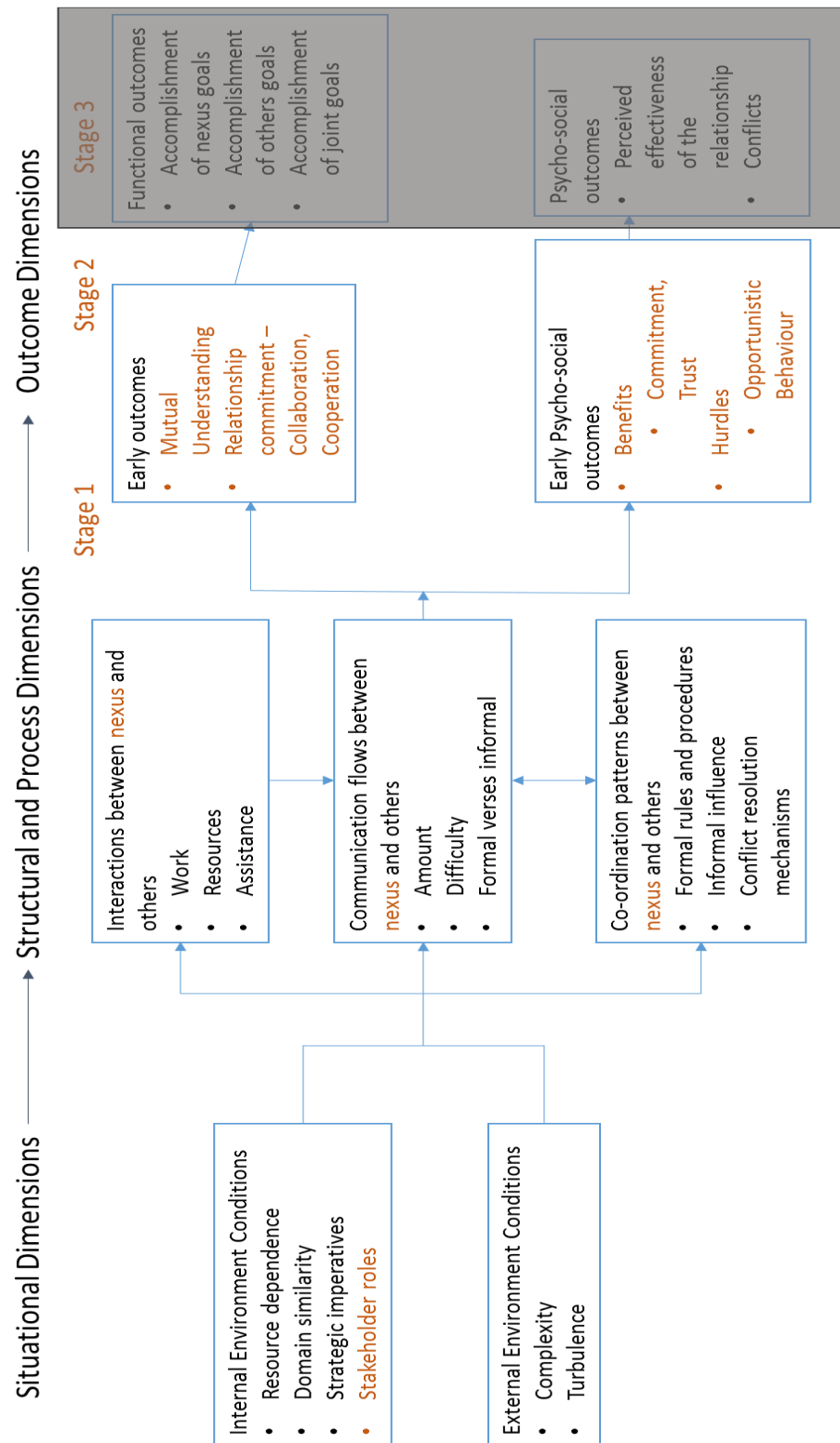


Figure 7.3 The Adapted Ruekert Framework. Stakeholder role included in the situational dimensions. *The early outcomes which are a result of the initial and early stage relationship development have also been included. Marketing manager has been changed to nexus. The text in red are the additions that have been made to the model. The grey box represents the outcomes that occur in the later stages of a*

relationship after a mutual understanding and relationship commitment have been established.

7.4 Managerial implications of research

The implications of the research findings that relationship marketing is a key concept for successful innovation project partnerships apply to both university and industry managers. The supplier/customer aspects of the university-industry relationship alternate depend on the situational environment which influences which organisation is the nexus.

The re-conceptualisation of the Ruekert et al. (1987) model to form the ARF provides nexus managers with a framework to coordinate the communication and interactions between people to maximise the effectiveness of developing a new working relationship with a prospective partner.

The high affinity between successful nexus activities and those of a business development manager during the initial and early stages of a new working relationship provide evidence that nexus managers should place people with business development skills and attributes in face-to-face conversations with prospective partners.

Once the initial contact has been made and prospective partners have become orientated with each other, exploration can occur where goals, objectives and vision are examined. If common values exist and/or accepted, then interactions between prospective partners can be focussed on operational dimensions such as resource levels; types of resources; expectations of the prospective partner.

It should be noted that university commercialisation offices were experienced by some participants as roadblocks in the innovation process. Some research commercialisation offices did a great job for “bread and butter” contract research

where requirements are well defined, however, they lacked the processes and skills to perform nexus type activities that are required to develop break through innovations. The business development manager experience and skill set from individuals with both university and industry experience were found to be more appropriate when attempting translation of disruptive science or an industry community of sufficient size does not exist. This approach was recently adopted by the establishment of intermediary organisations in other international regions such as ‘Interface’ in Scotland, and ‘Catapult’ in England. Some Australian universities have business development manager roles in their innovation offices.

8 CONCLUSION, LIMITATIONS AND FURTHER WORK

8.1 Findings

In this thesis I have provided support for the proposition that trust is a foundational building block for academic engagement. Relationship marketing is theoretically the only way disruptive science translation can effectively work in the rapidly changing technology, risk fraught, and uncertain environmental conditions that were experienced in the study. This was done by determining the roadblocks and drivers experienced by individuals who work on innovation projects through a relationship marketing lens which supported the view that the creation of interpersonal trust through the initial and early developmental stages of new relationships was a central critical theme that was a precursor to the mutual understanding and relationship commitment that is required for people to work cooperatively and collaboratively.

8.1.1 Relationship commitment built on interpersonal trust is an essential factor for academic engagement in effective university-industry relationships

When built on the foundations of informal face-to-face communication and shared and/or accepted values, interpersonal trust was proven to be an essential driver for the nexus overcoming roadblocks to establishing effective university-industry relationships. Interpersonal trust has been shown to be the precursor to mutual understanding and the value proposition. Its development is intertwined with the interpersonal communication that occurs between prospective partners and is the major finding of this thesis. The emergent concept of relationship evolution during university-industry innovation relationships by Daniel et al. (2011) and Plewa et al.

(2013b) is further supported by this finding. The development of interpersonal trust as the focal point for developing a mutual understanding and relationship commitment from a prospective partner is more important than the viability of the potential project. The perception from each prospective partner that they can work with the other/s is required for the effective delivery of innovation projects. This finding is of high importance to university and industry managers responsible for the successful delivery of innovation projects.

It was found that a successful nexus driving the innovation agenda focused on communicating through each interaction to develop trust using the relevant drivers for their situation, but they also needed to ensure that this trust was not destroyed quickly by opportunistic behaviour. The concept that the nexus always needed to behave in a principled way while interacting with prospective partners was considered important and the term Principled Nexus Behaviour (PNB) was created to capture this aspect.

8.1.2 The concept of functional integration for new product development success inside organisations can be applied to resources outside the organisation using relationship marketing concepts (interpersonal trust) as a bridge

The use of relationship trust has been shown to be effective to overcome functional differences across different life worlds within organisations (Massey et al., 2007). This thesis provides support for the view that employing relationship marketing concepts, and in particular interpersonal trust, in an appropriate way for the situation is integral to delivering the effective working relationships required for innovation projects. The major relationship driver themes determined from the content analysis,

and in particular the focal point of interpersonal trust, are critical precursors for the initiation and early stage development of effective working relationships. This finding regarding the importance of relationship development helps to explain some of the complexity that is attributed to university-industry relationships over a simple exchange of knowledge for a monetary benefit. The extended view of the relationship to include social exchanges Blau (1964) that disclose more of each prospective partner each time they interact provides strong support for considering academic engagement to be an example of the application of social penetration theory (Altman et al., 1973). Quantitatively studying this in future would provide empirical evidence that would prove the role of interpersonal trust as an antecedent and social penetration theory explaining academic engagement for which there is a gap in the literature (Perkmann et al., 2012). A recent quantitative study in Europe does provide strong empirical evidence that trust is an important contributor to relationship commitment for innovation relationships (Galán-Muros et al., 2016).

8.1.3 Roadblocks and drivers for initiating and early stage development of relationships

The content analysis targeted the interpretation of driver and roadblock themes of participant interactions during the initial and early stages of new working relationships. When specifically exploring the university-industry relationship drivers and roadblocks for developing effective working relationships, the themes were found to be strongly affiliated to the sharing and acceptance of values, communication and trust as shown in Table 8.1.

Table 8.1 The major themes experienced by participants during the initial and early stages of engagement in new working relationships for innovation projects from Chapters 5 and 6.

Roadblocks	Drivers
<ul style="list-style-type: none"> • Roadblocks to getting relationship started. • Cultural and Language Barriers – research verses profit. • Organisational differences – objectives, goals and values. • Relationship roadblocks between university and industry people. • Barriers to partner decision making. 	<ul style="list-style-type: none"> • Factors that develop interpersonal trust. • Communication factors that facilitate interpersonal relationships. • Shared and accepted values. • Factors for building interpersonal relationships. • A person motivated to drive the project - nexus • Principled Nexus Behaviour (PNB)

Roadblocks that were experienced by participants wanting to get relationships started were mainly related to communication. Actions as simple as not responding to an email or phone message, are examples of a roadblock sub-theme of “no timely response to initial contact”. The culture and language between organisations was also a roadblock that could be overcome with appropriate communication and the development of trust to facilitate forming a mutual understanding. When values were shared and/or accepted between individuals and/or organisations then communication and trust development led to relationship commitment. These roadblocks and drivers have important implications for both university and industry management as they provide important structural, process and behavioural insights of exchanges that occur at the individual level which has received little research attention.

8.1.4 The traditional university is not prioritised and/or resourced to be a nexus for effective innovation commercialisation from research collaborations

Interpretation of the analysis that was conducted on participant experience found that university academics and commercialisation offices often inhibited the processes and relationships required for effective initiation of innovation projects. Some universities had taken an approach to create the commercialisation office as a single point of contact for organisations to explore commercialisation activities. This was generally experienced as an effective way for transactional exchanges to occur where certainty around outcomes existed and when industry was the nexus.

However, the university as an organisation did not have structures in place to be effective at engaging industry as the nexus for innovation projects as the skills, activity and resources necessary to be effective were not evident. Academic engagement with universities acting as a nexus for innovation projects was found to occur in two cases in which they operated with independent structures and branding. In both of these cases, the nexus had market and manufacturing experience and knowledge integrated into their processes through interpersonal relationships containing high levels of trust.

The finding that the traditional university does not have the structures and behaviours in place to be the nexus of the collaboration network for the translation of academic knowledge to new commercial products, at this point in time, provides further evidence supporting the literature about the complex nature of the university-industry relationship (Perkmann et al., 2013).

8.1.5 Informal face-to-face communication preferred by participants over internet communication tools and social media for the initial and early stage development of new relationships

The use of informal face-to-face communication during initial and early stage relationship development was most preferred by participants. Social media and internet tools were not preferred for these interactions. This finding is important as the literature does not provide any evidence about the role of social media and internet tools for initiating and the early stage development of new university-industry working relationships. However, social media and internet tools search tools were used for profiling prospective partners before an initial meeting and for video conferencing after a relationship commitment had been established.

8.1.6 The Adapted Ruekert Framework is theoretically an effective way to describe the important drivers for a nexus to develop relationships for successful innovation projects

The interpretation of the roadblocks and driver themes provided the context for the review of the frameworks to determine which could provide the best theoretical explanation of the required dimensions for initiating and developing the early stages of working relationships for new product development and commercialisation.

The model of marketing driving the functional integration of market, manufacturing and research and design by Ruekert et al. (1987) provided a framework that most aligned with the driver theme findings. The framework was adapted to replace the marketing manager with the nexus as this thesis found that the innovation project nexus is not limited to individuals within industry and manufacturing

organisations. The framework was also adapted to include the expected outcomes from the initial and early stage relationship development. The ARF therefore highlights mutual understanding and relationship commitment as important pre-linkage milestones that are achieved by a nexus on the path to delivering successful innovation outcomes as captured in Figure 7.3.

The nature of university-industry relationships has been proven to be complex. The situational environment is critical to such a framework as it allows for the environment present with each unique university-industry relationship to be evaluated by the nexus. For example, the importance of developing interpersonal trust increasing with higher levels of uncertainty, disruption and complexity involved with a project. The re-conceptualised ADF contributes to the literature a theorised proposal for how working relationships should be best initiated and developed which is a gap in the literature related to the antecedents of academic engagement (Perkmann et al., 2012).

8.2 Limitations

As with any research there are a number of limitations associated with this thesis that need to be acknowledged. Firstly, there is the issue of investigator bias. This was highlighted in the method and the initial investigator thoughts captured at the beginning of the process. Acknowledging the potential influence of this bias has been met with a conscious effort to minimise any impact throughout the analysis and interpretation which in itself may induce bias. Secondly, self-reporting bias of participants was moderated in the research design by selecting participants active in

university-industry innovation projects from different organisations. Participants came from university, industry and the intermediaries that sometimes work between these organisations to provide as balanced experience of the university-industry relationship phenomenon as possible. Thirdly, the qualitative design does not provide the level of certainty and indicate the magnitude of effects that is normally associated with quantitative research. Fourthly, the sample was initially sourced from affiliations with a single Australian research centre and then referrals from those participants were snowballed until saturation. This may have introduced some bias, however, this was likely to be minimal as participants shared their experiences of initial and early stages of relationship development with partners which had occurred in the past and were not associated with the current relationship. Fifthly, the sample of participants was cross-sectional and representative of the situational environment at the time that the data was collected.

To prove the longitudinal aspects of the findings such as the impact of situational environment would require a longitudinal study or a cross section across many locations that contained the different situational environments which is difficult with globalisation. The sixth and last limitation relates to the location of the study in Australia. The current situational environment in Australia of uncompetitive manufacturing and low levels of commercialised disruptive innovation is different to other global locations. There were two participants from UK and Taiwan whose experience about the importance of relationship development in the early stages was in alignment with other participants. The sample size though is too small to make any assertions about their experience.

8.3 Further Work

The topic of academic engagement for innovation and commercialisation of new products has become an important issue with the increase of competition due to globalisation of markets and manufacturing. While the analytical framework for academic engagement is well researched (Perkmann et al., 2013), the understanding of how working relationships between university academics and industrialists are effectively initiated and developed is still an under researched area.

This research provides strong evidence that academic engagement relies on the development of interpersonal trust between prospective university and industry innovation partners. The complex nature of the relationships was not able to establish the relative magnitude or the interdependency of factors that would be needed for empirical evidence to support the inclusion of relationship marketing concepts and factors as antecedents to academic engagement. Further investigations similar to that recently published by (Galán-Muros et al., 2016) would be required. This type of research has been found to be of value in the banking, insurance and health care sectors (Agariya et al., 2011).

Further work should also focus on the types of environmental situations that exist in different sectors and locations and the impact on the structural and process dimensions. The development of clusters has been shown to be an effective way to leverage localised strengths to develop competitive advantage for new commercialised products (OECD, 2009). Becoming more effective and efficient in the structures and processes that initiate and develop relationships and new commercialised products leads to increased participation and successful innovation. A special group of individuals was noticed throughout the study as they had key attributes that were

different to general manufacturing. Clinicians involved in new product development had design knowledge from their training and practice, inherent cognitive trust associated with their medical credentials, an in-depth understanding of the needs of the market through contact with patients and a market wanting their product to be customised to them. The functional integration by clinicians acting as a nexus for innovation projects is very different to that experienced by the manufacturing industry and is worthy of further exploration for structural and relational roadblocks and drivers to enhance innovation management and processes.

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APPENDIX A: A review of the conceptual and theoretical research related to academic engagement of University-Industry Relationships (UIR's). Adapted from Perkmann et al. (2013).

Author (s)	Research Question (s)	Data / Sample	Method	Dependent Variables	Key Findings
Bird and Allen (1989)	How does faculty perceive and respond to entrepreneurial and commercialisation opportunities?	Mail survey to 767 faculty members at University of North Carolina and North Carolina State University who received an external grant or contract in the previous three years. Response rate 25%.	Descriptive	(1) Past contacts with clients or parties arising from research and consulting activities; (2) academics' future research, consulting and commercialisation plans	(1) 71.3% of faculty are involved in consulting while 7.6% are involved in commercialisation. Most faculty do not expect to alter their relationship with the university as a result of the commercialisation potential of their research.
Louis et al. (1989)	What are the factors that explain different form of academic entrepreneurship?	Two surveys, one to 1594 life scientists in major universities, one to 40 university administrators in the same universities. Response rate 69%.	Regression	Forms of academic entrepreneurship: (1) large-scale science; (2) supplemental income; (3) additional research funds; (4) patenting results of academic research; (5) forming companies	(1) Life scientists in research-intensive universities are modestly entrepreneurial; (2) Scientifically productive researchers are more entrepreneurial, this relationship is weaker for more commercial forms of engagement; (3) scientists concerned about protecting science from pressures to commercialise are less likely to be entrepreneurial

Van Dierdonck et al. (1990)	What explains the attitudes of academics towards university-industry technology transfer?	Questionnaire to 300 heads of laboratories at 13 Belgian universities in four disciplines: sciences, medicine, engineering and agriculture. 77% response rate. Structured interviews with 8 Technology transfer office members. Questionnaire to 137 companies in university science parks. Response rate 50%.	Descriptive	Collaboration activities	(1) Experience with industrial collaborations positively affects the attitude of the academic researcher towards industry; (2) Personal efforts of the academic researcher in creating collaboration opportunities for his laboratory are more important than institutionalised transfer mechanisms.
(Mansfield, 1995)	What are the characteristics of the universities and academic researchers that seem to have contributed most to industrial innovation? How is such academic research funded?	Data obtained from 66 firms in seven major manufacturing industries and from over 200 academic researchers.	Descriptive	(1) Faculty quality; (2) Scale of research effort; (3) Geographical proximity; (4) Perceived university contribution	(1) Industry partners want universities in close proximity for complex projects. Proximity less important for simple projects. (2) Government funding preceded industry research funding.
Blumenthal et al. (1996)	What are the effects of university-industry relationships on academics?	Questionnaire mailed to 3169 academics in the life sciences at the 50 US universities receiving the most research funding from the NIH. Response rate 65%.	Regression	(1) Academic activities; (2) Commercial activities; (3) Restriction of communication; (4) Choice of research	(1) Faculty members with industrial research support are at least as productive academically as those without such support and are more productive commercially; (2) Faculty members with relationships with industry are more likely to restrict their

					communication with colleagues.
Lee (1996)	What does faculty think about university involvement with industry?	Mailed survey questionnaire and field interviews with university officials responsible for university-industry relations. The survey data is supplemented by two other sources: the National Science Foundation's 1994 Academic Science and Engineering R&D expenditure data; and Feller and Geiger's university ranking. Questionnaire sent to 2292 academic researchers in various disciplines at 194 US research universities. Response rate 43%.	Regression	Faculty transfer attitudes towards technology transfer	(1) US academics in the 1990s are much more favourably disposed than in the 1980s towards policies supporting knowledge transfer from universities (2) Faculty members are reluctant to support policy designed to 'privatise' academic research; (3) The fear of possible negative consequences hinder the collaboration between academia and industry; (4) Faculty in applied disciplines is more supportive of knowledge transfer
Lee (1998)	(1) What role do academics believe that they and their university should play in university collaboration? (2) What are the factors that influence their attitudes and perceptions?	Equivalent to Lee (1996)	Regression (structural equations)	Faculty transfer attitudes towards technology transfer	(1) Academics are generally in favour of close UI collaboration on TT, especially if this is tied to regional economic development rather than firms' profits; (2) Faculty perceive a tension between the need of industry finding

					for academic research and the need to preserve academic freedom; (3) Policy-makers should take into consideration the pressure arising when the marginal opportunity cost associated with firm-specific research exceeds the marginal benefits of the collaboration.
Campbell and Slaughter (1999)	(1) Do faculty and university administrators hold different views on IP and related topics? (2) Are the views of academics not collaborating with industry different?	Survey of representatives of 12 largest public universities in each of the Carnegie classifications. Included individuals from science and engineering, social sciences, fine arts, and business. Response rate 34%.	Descriptive	(1) Conflict of interest (IP, entrepreneurship; (2) Conflict of commitment; (3) Conflict over internal equity	(1) Faculty and administrators hold different views, particularly on issues related to control over relationships with industry. Faculty favours ways to retain autonomy, while administrators seek ways to control faculty's participations in UIRs; (2) Involved faculty are more enthusiastic about engaging in revenue-generating opportunities than non-involved faculty; (3) Non-involved faculty support collaboration with industry but are less supportive of the specific repercussions that might arise from these relationships

Klofsten and Jones-Evans (2000)	How do academics engage with industry?	Questionnaire mailed to 5020 academics in the faculties of science, engineering and medicine in five Irish universities four Swedish universities. Response rate 37%.	Descriptive	Activities including contract research, consulting, large scale science projects, external teaching, testing, patenting/licensing, spin-off, sales	(1) Low engagement activities of female and junior faculty; (2) High degrees of involvement in 'soft' activities such as consultancy and contract research, but not in creation of technology spin-offs; (3) Irish and Swedish present comparable level of entrepreneurship even if Swedish policies are more sophisticated.
(Godin et al., 2000)	To what extent is collaborative research in Canada influencing the nature of scientific production and the level of international scientific collaboration.	The data used in this paper were compiled from the Canadian bibliometric database produced by the Observatoire des sciences et des technologies (OST). They comprise publications by Canadian researchers indexed in the Science Citation Index (SCI). The period covered by the database runs from 1980 to 1997.	Descriptive	Collaborative research; academic research	Data suggests that university research done in collaboration with industry, hospitals or government laboratories, is not incompatible with quality
Lee (2000)	(1) What are the motivations of academic scientists for collaborating with industry? (2) What are the benefits academics get from collaboration?	Questionnaire mailed to 671 university faculty members from 40 US research-intensive universities in the departments of biological science, chemistry, chemical engineering, computer science, mechanical engineering, and material science; 64% response rate. Questionnaire to 306 affiliate members of the University Technology Managers Association. Response rate 50%.	Descriptive	(1) Motivations for collaboration (academics and industry); (2) Benefits derived from collaboration (academics and industry)	(1) Academics seek collaboration with industry to secure funds for their graduate students and lab equipment, supplement their own research, field-test the application of their own research, and gain new insights; (2) Faculty members benefit from collaboration with industry by acquiring funds, gaining

					valuable insight and field-testing the practical application of their research.
Louis et al. (2001)	Are there any differences in entrepreneurial behaviour between clinical and non-clinical faculty?	Questionnaire to 4000 clinical and non-clinical faculties in life-science departments in the US. Response rate 64%. 847 questionnaires used.	Regression	(1) Secrecy (being denied access to research results, had denied access to research results); (2) Productivity (research, teaching, service); (3) Research budget	(1) Clinical faculty is more dependent on industry funding; (2) Non-clinical faculty is personally involved in the commercialisation of their research and more likely to experience data withholding.
Gulbrandsen and Smeby (2005)	What does industry funding affect research performance?	Questionnaire sent to all faculty members of the rank of assistant professor or higher at Norway's four universities. Response rate 60%.	Regression	(1) Patents; (2) Commercial products; (3) Establishment of firms; (4) Consulting contracts	Professors with industrial funding: (1) perform more applied research; (2) collaborate more with other researchers both in academia and in industry; (3) report more scientific publications and entrepreneurial outputs

Azagra-Caro et al. (2006)	(1) What determines individual support for university-industry interactions? (2) Are there differences between technology-leading countries and in regions with low absorptive capacity?	Questionnaires sent to random sample (10%) of faculty at five public universities in the Valencian Community (Spain). Response rate 44%.	Regression	(1) Support for different objectives of university-industry relations (orientation, development, commercialisation, firms, funds, teaching); (2) Perceived degree of R&D cooperation with firms	(1) University's age is negatively related to faculty's support of UIR objectives; (2) Disciplinary effects and university support are not significant in shaping faculty's support of UIR objectives; (3) Faculty's support to UIR activities is hindered by the fear of losing academic freedom; (4) The results are obtained in a region with low absorptive capability
Lin and Bozeman (2006)	What is the impact of researchers' previous industry experience on their academic productivity?	Curriculum Vitae (CV) database containing demographic information, educational background, employment record, publication data, patent data, professional affiliations, and grant/funding information. Survey of Careers of Scientists and Engineers sent to the 997 fulltime academic faculty and postdoctoral researchers in the CV database. Response rate 44%.	Regression	(1) Publication productivity; (2) Number of students supported	(1) Academics with prior industry exposure produce fewer total career publications, but they support more students; (2) Previous industry experience raises the annual publication productivity of junior faculty members and women researchers.
Renault (2006)	Why do professors seek intellectual property protection for the results of their research?	Survey of 420 faculty members in 12 research-intensive US universities (14% response rate). 39 face-to-face interviews with faculty. Interviews with TTO and incubators administrators. Additional data from AUTM and NSF.	Regression	(1) Collaboration (dummy); (2) Patent filed (or intention to file); (3) Spin-off involvement (or intention to spin-off)	(1) The norm of academic capitalism is not universally embraced; (2) A positive individual attitude towards academic capitalism increases the likelihood of participation in collaboration with industry and commercialisation of

					research; (3) Technology transfer participation is positively affected by academic quality and technology transfer policies
Azagra-Caro (2007)	What type of faculty member interacts with what type of firm?	Survey to 380 academic researchers in the five universities of the Valencian Community. Response rate 44%.	Regression	(1) Contracts with firms; (2) size of collaborating firms; (3) geographical location of the firms; (4) technological level of collaborators; (5) educational qualification of collaborators	Only selected types of faculty members interact with specific types of firms: some faculty members will show higher propensity to engage into UII (those in specific scientific areas, who have more resources for R&D activities, with a senior status, male and holding an administrative position) and at least some of them (those who have more resources for R&D activities, male and holding an administrative position) will find it easier to interact with some firms (those of larger size, in science-based sectors).

Bozeman and Gaughan (2007)	What is the impact of research grants on academics' involvement with industry?	Survey of 4916 US academic researchers, conducted by Research Value Mapping Program at Georgia Tech. Tenured and tenure-track university researchers employed in doctorate granting research extensive institutions. Sample stratified by academic discipline, academic rank and gender. Response rate 38%.	Regression	Industrial activity, measured via industrial involvement scale (synthetic index)	(1) Academic researchers who have research grants and contracts work more extensively with industry; (2) Scientists with industry contracts interact with industry more than those who are exclusively government funded.
D'Este and Patel (2007)	(1) What are the channels through which academic researchers interact with industry? (2) What explains the variety of interaction?	Survey of 4337 university researchers in the UK (principal investigators with EPSRC grants in the period 1995-2003). Response rate 35%.	Regression	(1) Interaction channels used by individual researcher; (2) Number of interaction channels through which a researcher has engaged more frequently than the average	(1) University researchers interact with industry using a variety of channels; (2) Individual characteristics (previous experience, academic status) have a stronger impact than the departmental or university characteristics in explaining the variety of interaction between academics and industry
Link et al. (2007)	What determines informal technology transfer activities by university faculty?	Survey of 4916 US academic researchers, conducted by Research Value Mapping Program at Georgia Tech. Tenured and tenure-track university researchers employed in doctorate granting research extensive institutions. Sample stratified by academic discipline, academic rank and gender. Response rate 38%.	Regression	Informal technology transfer (involvement in activity to transfer or commercialise technology, involvement in joint publications, consulting)	(1) Male faculty members are more likely than female faculty members to engage in informal commercial knowledge transfer and consulting; (2) Tenured faculty members are more likely to engage in informal technology transfer; (3) Faculty members who allocate a higher percentage of their time to grants-related

					research are more likely to engage in informal technology transfer.
Rothaermel et al. (2007)	Can the current university entrepreneurship knowledge, which is fairly fragmented, be synthesised to provide directions for future research and guideposts for policy makers	Comprehensive and detailed literature analysis of the stream of research on university entrepreneurship, encompassing 173 articles published in a variety of academic journals.	Descriptive	(1) entrepreneurial research university, (2) productivity of technology transfer offices, (3) new firm creation, and (4) environmental context including networks of innovation.	An inductively derived framework describing the dynamic process of university entrepreneurship based on a synthesis of the literature was proposed.
Bekkers and Bodas Freitas (2008)	What explains the importance of different knowledge transfer channels used by academics?	Two related questionnaires, one aimed at 2082 university researchers and one at 2088 industry researchers. For universities: All research staff of five Dutch universities in the faculties of pharmaceuticals and biotech, chemistry, mechanical engineering and electrical engineering. 575 completed questionnaires, 27.6% response rate. For industry: Similar procedure (they are all inventors). Response rate 26%.	Regression	Six groups of channels for knowledge transfer: (1) scientific output, informal contacts and students; (2) labour mobility); (3) collaborative and contract research; (4) contacts via alumni or professional organisation; (5) specific organised activities; (6) patents and licensing.	Differences in importance of various channels of KT can be explained by: (1) Basic characteristics of the knowledge in question (tacitness, systemicness, expected breakthroughs); (2) The disciplinary origin of the knowledge involved (as opposed to the sectoral activities of the partner firms); (3) To a lesser degree individual and organisational characteristics (seniority, publication record, patent record, entrepreneurship, research environment).

Boardman (2008)	What is the impact of affiliation with university biotechnology centres on the industrial involvement of university scientists?	National survey of 4916 academic researchers, conducted by Research Value Mapping Program at Georgia Tech. Tenured and tenure-track university researchers employed in doctorate granting research extensive institutions. Sample stratified by academic discipline, academic rank and gender. Response rate 38%.	Regression	Mode of engagement with industry during the 12 months preceding survey (consultancy, student placements, worked in a company, patent/copyright with industrial partner, commercialisation of research, co-authored paper with industrial researchers)-binary variables combined into an indicator of industrial involvement	University biotech centre affiliation correlates positively with industry involvement in terms of informal interactions, but not with economic and bibliometric outputs.
Boardman and Corley (2008)	What is the impact of affiliation with a university research centre on university scientists' collaborative behaviours?	Survey of 4916 US academic researchers, conducted by Research Value Mapping Program at Georgia Tech. Tenured and tenure-track university researchers employed in doctorate granting research extensive institutions. Response rate 38%.	Regression	Percentages of research work time spent in seven collaboration settings (alone, immediate group, home university, other nations, other universities, industry, government labs)	(1) Centre affiliation is negatively correlated with time spent working alone in research; (2) Centre affiliation is positively correlated with collaboration outside the immediate work group but within the university; (3) Centre affiliation is negatively correlated with collaboration with other US universities; (4) Industry collaboration is positively correlated with industry-linked centre affiliation.

Martinelli et al. (2008)	Map Sussex University's external relations and to uncover its knowledge exchanges and its UITT network	Questionnaire to 710 Sussex University faculty members (asking names of partner organisations and type of collaboration). Response 24%.	Descriptive	(1) Types of knowledge exchange (transmission, presentation, effort, consultation, use, business activities, commercialisation); (2) Types of external links (patents, consultancy, collaborative research, research contract, research grant, research students, KTS); (3) nature of partners (biomed, traditional, ITSSIS, technology, media, telecom, government); (4) entrepreneurial culture; (5) IP awareness	In spite of a comparatively late start, a considerable number of researchers engage in knowledge exchange processes with industry and other non-academic partners. Faculty in the social sciences and humanities as well as natural sciences and engineering maintain links to industrial partners, including multinational corporations. Schools differ in the way their faculty engage in university-industry collaborations. Further differences can be observed with respect to faculty attitudes towards technology transfer and awareness of the university's respective codes of practice
Ponomariov (2008)	Which university characteristics influence the propensity of individual scientists to interact with industry?	Survey of 4916 US academics in doctorate granting, research extensive institutions researchers, conducted by Research Value Mapping Program at Georgia Tech. Response rate 38%.	Regression	(1) Industrial involvement scale (Bozeman and Gaughan, 2007); (2) additive scale of different types of interaction; (3) engagement with industry (binary); (4) quintile of distribution of industrial involvement scale for each individual (ordinal)	(1) The propensity of scientists to interact with the private sector is positively affected by income from industrial R&D; (2) The propensity of scientists to interact with private sector is negatively affected by the average academic quality.

Ponomariov and Boardman (2008)	Do informal interactions between university and industry scientists result in collaborative research?	Survey of 4916 US academic researchers, conducted by Research Value Mapping Program at Georgia Tech. Tenured and tenure-track university researchers employed in doctorate granting research extensive institutions. Sample stratified by academic discipline, academic rank and gender. Response rate 37%.	Regression	Percentage of research time devoted to working with researchers in industry	University scientists involved in informal interactions with industry are more likely to engage in collaborative research and are more likely to spend larger proportion of their research time working with researchers in private firms.
van Rijnsoever et al., 2008	What influences the intensity of the interactions between university researchers and their academic and industrial partners?	Questionnaire to all the scientific employees of Utrecht University. 17% response rate.	Network analysis	(1) Network activity (degree to which the researchers use their contacts for research purposes); (2) Academic rank	(1) Networking with academic researchers stimulates careers, while interactions with industry does not; (2) The researcher's scientific network activity declines after about 20 years while industry collaboration continuously increases; (3) Global innovativeness (the degree to which an individual is receptive to new ideas and makes innovation decisions independent of the communicated experience of others) positively influences science-science interactions.

Walsh et al. (2008)	(1) How have university-industry interactions changed in Japan since the mid-1990s?; (2) Is Japan different from the US regarding these interactions?	Questionnaire mailed to 2557 Japanese academics. The first wave included University of Tokyo engineering faculty (2003-2004); the second wave (2004-2005) included engineering faculty at the other universities and biomedical faculty at all 15 universities. 57% response rate.	Descriptive	(1) Ties to other sectors; (2) Changes in the research environment, types of ties with firms, channels of access, patenting and reasons for patenting; (3) Research results, including publications, patents and licenses	(1) They find a significant increase in commercial activity since the mid-1990s, especially with small- and medium-sized enterprises; (2) Scientists are increasingly considering business potential when choosing projects; (3) No increased barriers to access research tools; (4) University-industry interactions are mainly represented by informal ties and gift-exchange.
Welsh et al. (2008)	What are the views of academic researchers on university-industry relationships?	In-depth interviews with 84 university scientists at 9 US universities with research programmes related to agricultural biotechnology	Descriptive	(1) Researchers' views of characteristics of industry relationships; (2) Researchers' views of purpose of university IP policies	(1) Academics believe that working with industry can restrict communication among scientists (problems for scientific networks, publications); (2) They believe university IP policies should shield their work from opportunistic behaviour and at the same time attract industry (3) Researchers believe universities use their IP policies primarily as revenue raising vehicles and second, to address public good issues

Barbolla and Corredera (2009)	What underpins success in research contracts from the standpoint of individual academics?	Interviews with 30 academics at the Technical University of Madrid	Qualitative	(1) Project features; (2) company involvement; (3) core competency and motivation of the university; (4) relationship among players	Creation of a model for technology transfer. Three characteristics of a partner company influence the result of a particular collaboration with the university: (1) the corporate perception of usefulness of the project; (2) the capacity of the company to integrate the results in its value chain; and (3) the company's confidence in the university team.
Boardman (2009)	How different types of university research centres affect individual level U-I interactions?	National survey of 4916 academic researchers, conducted by the Research Value Mapping Program at Georgia Tech. Tenured and tenure-track university researchers employed in doctorate granting research extensive institutions. Sample stratified by academic discipline, academic rank and gender. Response rate 38%.	Regression	Industry involvement	Affiliation with an industry-related centre correlates positively with the likelihood of an academic researcher having had any research-related interactions with private companies, while affiliation with centres sponsored by government centres programmes correlates positively with the level of industry involvement, no matter whether these centres additionally have ties to private companies.

Boardman and Ponomariov (2009)	Which individual characteristics explain academics' involvement with industry?	Survey of 4916 US academics at research universities, conducted by Research Value Mapping Program at Georgia Tech. Response rate 38%.	Regression	(1) Respondents' interactions with the private sector during the previous 12 months; (2) Modes of interaction (formal contact, informal contact, consulting, placing students, owner/employee of a private firm, patenting and/or copyrighting, transferring and commercialising technology, co-authoring papers).	(1) Positive relationship between conducting government-funded research and supporting graduate students and interactions with the private sector; (2) Subscription to traditional scientific norms is not necessarily at odds with pursuing commercially relevant activities; (3) Scientists affiliated with university research centres are more likely to interact with the private sector
(Boardman et al., 2009)	Do tenure-track scientists in the US have personal and professional characteristics that affect whether university scientists interact with private companies and, if so, the ways in which they interact?	This study uses a national survey of tenured and tenure track scientists in the US (2003-2004). The final N for this data set included 1643 university researchers. The scientific disciplines in the sample included biology, computer science, mathematics, physics, earth and atmospheric science, chemistry, and agriculture, as well as five sub-disciplines of engineering including chemical, civil, electrical, mechanical and materials. Sociology was also included in the sample, but it is not considered in the analyses.	Regression	(1) funding sources; (2) institutional affiliations; (3) tenure status; (4) support of students; (5) scientific values, and (6) demographic attributes.	Results suggest a synergy between a wide range of traditional academic activities and roles and Interactions with the private sector.

Thursby et al. (2009)	What is the role of university faculty in university-industry technology transfer? Do patents and/or consulting provide insights	A sample of 5811 patents with US faculty as inventors, 26% are assigned solely to firms rather than universities as dictated by US university employment policies and Bayh-Dole.	Regression	(1) patent characteristics; (2) university policy; and (3) inventor field.	Patents assigned to firms (whether established or start-ups with inventor as principal) are less basic than those assigned to universities suggesting firm assigned patents result from faculty consulting. Assignment to inventor-related start-ups is less likely the higher the share of revenue inventors receive from university-licensed patents. Firm assignment also varies by inventor field and whether the university is public or private.
Giuliani et al. (2010)	(1) What is the role of researchers' individual characteristics in explaining their propensity to engage with industry? (2) What is the role of researchers' institutional environments in explaining their propensity to engage with industry?	Survey to 135 academic and PRO's researchers in the wine field in Chile, South Africa and Italy.	Regression/ Network analysis	(1) Normalised degree of centrality of each researcher's U-I network	The centrality of researchers in the national research system is highly significant. Researchers' demographic characteristics, such as age and sex, are related to the propensity for researchers to form U-I linkages, whereas educational background, academic status and publication performance do not seem to influence this relationship. Working in a university vis-à-vis another type of public research organisation produces a

					higher propensity to engage with industry but the characteristics of the research organisations where researchers work appear to influence U-I linkages to a lesser extent.
Grimpe and Fier (2010)	What are the effects of institutional differences on the choice of scientists to transfer technology informally?	Survey to 16,296 German university scientists (17.2% response rate). Same questions as the Research Value Mapping Program.	Regression	(1) Commercialisation; (2) joint publication; (3) consultancy	(1) Confirmation of Link et al. (2007) results; (2) Being a research group leader increases commercialisation and consulting; (3) Almost no effect of scientific productivity on informal TT; (4) Positive impact of previous patents on all forms of TT
Lam (2010)	How is the shifting boundary between university and industry experienced by academic scientists?	36 in-depth individual interviews and a survey to 734 academic scientists from 5 UK research universities	Qualitative	Type of academic	There are four possible orientations: two polar types ('traditional' and 'entrepreneurial') and two mixed types ('traditional hybrid' and 'entrepreneurial hybrid'). The hybrids are the dominant category and are particularly adept at exploiting the ambiguities of

					boundary work between academia and industry.
Nilsson et al. (2010)	(1) Why do researchers engage in commercialisation at all? (2) If researchers do transfer research, how do they choose to perform that transfer?	Seven longitudinal case studies in three Swedish research centres performing research on stem cells	Qualitative	(1) Determinants of choice (perceived role of the univ., supportive infrastructure, industrial actor set-up, networks); (2) mechanisms of transfer (pubs and conferences, patents and licenses, spin-offs, sponsored research, informal discussion, shared personnel, labour movement)	(1) The organisational, regulatory and working environment encourages engagement in TT; (2) Researchers engage in TT because they want to secure funding for their research, put their research into practical use, gain private financial benefits; (3) Researchers use the TTO if they believe it is competent or if they do not have enough social capital themselves, otherwise they interact directly with firms
D'Este and Perkmann (2011)	What are the motivations for academics to engage with industry?	Survey of 4337 university researchers in the UK (principal investigators with EPSRC grants). Response rate 35%.	Regression	Frequency of interaction with industry using different modes of interaction	Most academics engage with industry to further their research rather than to commercialise their knowledge. Joint research, contract research and consulting are strongly informed by research-related motives.

Haeussler and Colyvas (2011)	Does engagement in academic entrepreneurship reproduce the existing social structure of science?	Questionnaire (2007) to 2294 German and UK university life scientists who either published or patented between 2002 and 2005 (between 17% and 26% response rate).	Regression	(1) Consulting with companies; (2) applied for at least one patent; (3) have founded a company; (4) commercial activity index (combination of the previous three).	Characteristics reflecting professional security, advantage and productivity are strong predictors for a greater breadth of participation in academic entrepreneurship, but not for all forms of technology transfer. Scientists perceive the value of patenting differently, and the level of reputational importance placed on scientific achievements matters in shaping commercial involvement.
Raesfeld et al. (2012b)	Does of partner diversity influence collaborative public R&D project outcomes?	Enriched a database on the commercial outcomes of technology research projects from the Dutch Technology Foundation STW. Selected 169 nanotechnology research projects from the database, which started in a five-year period from 1998 until 2003.	Regression	(1) companies; (2) governmental parties; (3) research institutes; (4) (academic) hospitals/medical institutions; (5) universities/schools; and (6) special interest groups.	(1) Technological diversity has a U-shaped effect on the projects' commercial performance. Findings show a strong positive impact of value chain complementarity of partners on both application development and commercial performance of the projects. (2) The framework introduced in this study allows an evaluation of the effects of technological diversity and value chain complementarity on application development and

					the commercial performance of public R&D projects.
Perkmann et al. (2013)	How is academic engagement different from commercialisation, defined as intellectual property creation and academic entrepreneurship?	Identified all the relevant research published on this topic from 1980 to 2011. Extensive search in the titles and abstracts of published, peer-reviewed articles held by the bibliographical database service EBSCO. Subsequently, performed a manual search of the journals with the highest article counts over the past 22 years (1989–2011). Quality rules used to filter to the final list of 36 articles.	Descriptive	Academic engagement leading to commercialisation influenced by: (1) Individual factors; (2) Organisational factors; (3) Institutional factors.	Apart from being more widely practiced, academic engagement is distinct from commercialisation in that it is closely aligned with traditional academic research activities, and pursued by academics to access resources supporting their research agendas.
Tartari et al. (2014)	Are academic scientists' industry engagement influenced significantly by the behaviour of their peers, that is, the behaviour of colleagues of similar seniority?	Analysis of data from multiple sources for 1370 UK academic scientists and engineers	Regression	(1) Peers engagement; (2) Academic age; (3) *Star scientist.	Peer effects are stronger for early career individuals and weaker for star scientists, suggesting the incidence of social comparison.

APPENDIX B: CHRONOLOGICAL VIEW OF UNIVERSITY-INDUSTRY RELATIONSHIP MOTIVATION LITERATURE.
ADAPTED FROM ANKRAH ET AL. (2013). *THE ASTERISKS IN THE MOTIVES COLUMN INDICATE THAT THE INDIVIDUAL AND/OR ORGANISATION WERE MEASURED FOR ACTOR GROUPS INCLUDED IN THE STUDY.*

Author	Actors	Approach	Data/method	Unit of analysis	Motives	Country
Oliver (1990)	Generic	Qualitative	Integration of inter-organisational literature to propose 6 types of relationships.	–	*	–
van Dierdonck et al. (1990)	Academia	Quantitative	Survey of 300 university laboratories at 13 Belgian universities. (sciences, medicine, engineering, and agriculture)	Individual	*	Belgium
Geisler (1995)	Academia, industry	Qualitative	Theoretical framework derived from data from university co-operative research centres	Organisation		USA
Klevatorick et al. (1995)	Industry	Quantitative	Survey of 650 managers across 130 lines of business	Organisation		USA
Lee (1998)	Academia	Quantitative	Survey of 1000 academics across 9 departments and 115 universities. (science and engineering)	Individual	*	USA
Peters et al. (1998)	Industry, academia	Quantitative	Social network analysis of 2 EU R&D funding programmes supporting multiple projects	Project		EU
Jones-Evans et al. (1999)	Intermediaries	Qualitative	Interviews with intermediaries (Industrial liaison offices—ILOS) at 9 universities	Organisation		Sweden and Ireland
Rappert et al. (1999)	Industry	Qualitative	Interviewees from 59 University spin out firms and SMEs. (IT, science and new materials)	Organisation		UK
Jacob et al. (2000)	Academia, industry	Qualitative	Critical analysis of literature and single case. Fenix (multiple research organisations & industry partners)	Organisation/individual		Sweden

Klofsten and Jones-Evans (2000)	Academia	Qualitative	Large scale survey of 1,194 (Swedish) 663 (Irish). Science and engineering academics.	Individual		Sweden and Ireland
Lee (2000)	Industry, academia	Quantitative	Non-simultaneous cross-sector survey 427 researchers and technology managers from 140 firms	Individual/ organisation	*	USA
Santoro (2000)	Industry, academia	Quantitative	Multi-method field study. Analysis of 21 research centres and linked industrial partners. Further interviews with 31 firms (cross sector)	Organisation		USA
Caloghirou et al. (2001)	Academia, industry	Quantitative	STEP-TO (RJVS databank) 5,932 Research Joint Ventures (RJV) Over 14 years (probit regression)	Organisation		15 EU countries predominate
Mowery et al. (2001)	Academia	Qualitative	Descriptive assessment of patent and licensing data. Columbia, Uni. Of California and Stanford	Time series		USA
Santoro and Chakrabarti (2001)	Industry, academia	Qualitative	Multi-method exploratory field study, Focus on research centres (NSF, IUCRC). As Santoro (2000)	Organisation		USA
Cohen et al. (2002)	Industry	Quantitative	Carnegie Mellon survey data. 1,267 manufacturing firms. (factor analysis)	Firm		USA
George et al. (2002)	Industry	Quantitative	Survey of 2,457 alliances by 147 Biotech firms (non-incubator/research-park based) (multivariate)	Organisation		USA
Harman and Sherwell (2002)	Academia, industry	Qualitative	5 case studies of U/I relationships in medicine and health sciences.	Project/ organisation		USA, Canada, UK
Santoro and Chakrabarti (2002)	Industry, academia	Qualitative/ Quantitative	Multi-method field study. Evaluation of 12 surveys, 15 interviews with firms and research centre directors, survey of 21 RCs & 31 firms	Organisation		USA
Beath et al. (2003)	Academia, industry	Quantitative	Economic framework	Individual	*	—

Caloghirou et al. (2003)	Industry	Quantitative	STEP-TO (RJVS databank) 504 firms (R&D managers) over 636 partnerships. (probit model)	Firm		7 EU countries
Siegel et al. (2003)	Industry, academia	Qualitative	98 interviews of university–industry technology transfer stakeholders at 5 universities Inc industrial partners) in 2 regions of the US	Organisation/ project		USA
Lee and Win (2004)	Academia	Qualitative	Comparative case study of 3 research centres	Organisation		Singapore
Siegel et al. (2004)	Academia	Qualitative	55 structured interviews of 98 UITT stakeholders linked to five US universities	Individual		USA
Dietz and Bozeman (2005)	Academia	Quantitative	1,200 researcher CVs compared with patent data. (tobit & poisson mods)	Individual		USA
Fontana et al. (2006)	Industry	Quantitative	Survey of 558 SMEs across 5 sectors & 7 countries	Firm		EU
Langford et al. (2006)	Academia	Qualitative/ Quantitative	Single case. Calgary University (240 researchers)	Individual	*	USA
Tijssen (2006)	Industry, academia	Quantitative	Large-scale review of Academia articles (research and industrial), case study of European universities (immunology research)	Organisation		–
Allen et al. (2007)	Academia	Quantitative	Analysis of 1,335 faculty members extracted from Academia Value Mapping Program (RVMP) survey	Individual	*	USA
Azagra-Caro (2007)	Academia	Quantitative	Survey of 380 researchers across 5 universities in Valencia. (regression analysis)	Individual	*	Spain
Bozeman and Gaughan (2007)	Academia	Quantitative	Survey of 1564 academics. Georgia Tech's Research Value Mapping program	Individual	*	USA

D'Este and Patel (2007)	Academia	Quantitative	Survey of 4,337 UK university researchers. Records of research grant holders (ESPRC)	Individual	*	UK
Lam (2007)	Industry, academia	Qualitative	3 company case studies. Interviews with 30 company managers and scientists (ICT & pharma) & 27 academics.	Individual	*	UK
Thursby et al. (2007)	Academia	Quantitative	Development and presentation of economic life cycle models (research outputs at the university level)	Individual		–
Ambos et al. (2008)	Academia	Quantitative	207 research council-funded projects (bi-variate correlation)	Project/ individual/firm		UK
Arvanitis et al. (2008)	Academia	Quantitative	Large scale survey of KTT activity of 241 research institutes	Organisation	*	Switzerland
Azagra-Caro et al. (2008)	Academia	Quantitative	Economic model created and tested with data from large scale survey. 380 researchers across 5 universities in Valencia	Individual	*	Spain
Bekkers and Freitas (2008)	Industry, academia	Quantitative	Two related surveys (1) 575 researchers (pharmaceutical, biotech, chemistry, mech-eng and elec-eng) and (2) 454 industrial inventors	Individual/ organisation		Netherlands
Bramwell and Wolfe (2008)	Industry	Qualitative	96 in-depth interviews with firms, associations and knowledge institutions in ICT cluster. Waterloo University (single case)	Organisation		Canada
Jong (2008)	Industry, academia	Qualitative	Case study of two US universities with different institutional environments. Historical account constructed on archival research, interviews and citation counts from the Web of Science SCI database.	Individual		US
Martinelli et al. (2008)	Academia	Qualitative	Survey of 173 academics from departments across Sussex University	Individual	*	UK

Ponomariov and Boardman (2008)	Academia	Quantitative	Survey of 1,643 academics extracted from the Research Value Mapping Survey Program.	Individual	*	USA
Tether and Tajar (2008)	Industry	Quantitative	UK CIS survey of 3,996 respondents across 12 industries	Organisation		UK
van Rijnsoever et al. (2008)	Academia	Quantitative	Survey of 304 scientific employees at Utrecht university	Individual		Netherlands
Welsh et al. (2008)	Academia	Qualitative	Interviews with 84 biological scientists across 9 universities	Individual		USA
Wright et al. (2008)	Academia	Qualitative	Case studies, archival, survey and interviews in 6 universities across 4 EU countries	Organisation		EU
Youtiea and Shapira (2008)	Academia	Qualitative	Single case. Georgia Tech.	Organisation		USA
Baba et al. (2009)	Industry	Quantitative	445 firms from life science industry (negative binomial regression model)	Firm		Japan
Boardman and Ponomariov (2009)	Academia	Quantitative	Survey of 4916 tenured & tenure track scientists and engineers in 13 disciplines	Individual	*	USA
Foss et al. (2009)	Academia	Qualitative	Literature review of knowledge sharing research in 13 top academic/practice journals	–		–
Giuliania and Arza (2009)	Industry	Quantitative	Face-to-face interviews with skilled workers from 73 firms in wine industry. (Probit & OLS models)	Organisation		Italy and Chile
Jain et al. (2009)	Academia	Qualitative	Interviews with 20 scientists. (sensemaking)	Individual		
Lacetera (2009)	Industry, academia	Quantitative	Theoretical model tested with 550 research contracts downloaded from rDNA website (bio-tech/ university contracts). (probit-panel data)	Project		USA

Fini et al. (2010)	Academia	Quantitative	Survey of 11,572 professors (Carnegie I & II universities in national research council tracked disciplines)	Individual		USA
Wen-Hsiang Lai and Chang (2010)	Industry	Qualitative	Survey of 58 respondents from machinery manufacturers	Organisation		Taiwan
D'Este and Perkmann (2011)	Academia	Quantitative	Survey of 4,337 UK university researchers. Records of research grant holders (ESPRC)	Individual	*	UK
Lai (2011)	Industry, Academia and intermediary	Quantitative	Survey of three groups, 112 respondents, 27 researchers, 64 industry managers, 21 TT staff. (regression analysis)	Organisation	*	Taiwan
Lam (2011)	Academia	Quantitative	Study based on 36 interviews and consequent survey sample of 734 academic scientists from five research universities.	Individual	*	UK
Ankrah et al. (2013)	Industry, academia	Qualitative	Study based on 37 semi-structured interviews with respondents from 5 Faraday partnerships.	Individual	*	UK
Tartari et al. (2014)	Academia	Quantitative	analysis of data from multiple sources for 1370 UK academic scientists and engineers	Individual		UK

APPENDIX C: PILOT STUDY INTERVIEW PROTOCOL USED FOR DATA COLLECTION

Preamble: The purpose of this research is to describe the collaboration experiences of adopters of new innovative technology. What I am interested in is the experiences that you have had adopting technology in the local manufacturing industry and in particular barriers that you have come across.

Your answers are strictly confidential – no one else is privy to this discussion

1. What did you think of the additive manufacturing conference?
 - a. What were you thinking before the conference?
 - b. What were your thoughts following the conference?
 - c. How do you think you may use what you learnt?
2. Can you tell me about your general experience with new technologies?
3. What is your view on 3D printing and additive manufacture?
 - a. What do you see as its benefits?
 - b. What do you think needs to be overcome?
 - c. What do you think is going to be needed for local industry adoption?
 - d. Who do you think will contribute to successful adoption?
4. Have any other new technology come along for you to consider?
 - a. What was your experience?
 - b. Have you adopted any other new technologies?

APPENDIX D: INTERIM INTERVIEW PROTOCOL USED FOR DATA COLLECTION

Preamble: The purpose of this research is to describe the collaboration experiences of adopters of new innovative technology. What I am interested in is the experiences that you have had innovating products in the local manufacturing industry and in particular barriers that you have come across.

Your answers are strictly confidential – no one else being privy to this discussion

1. Can you please explain what have your experiences have been in terms of innovation adoption?
2. Can you please describe your business strategy regarding innovation?
3. Please describe the behaviour you observe within your organisation between the groups bringing a product to market?
4. What situations have typically influenced or affected your experiences of innovation collaboration?
5. What do you see as the outlook for your business? The next 3/5/10 years?

APPENDIX E: FINAL/MAIN INTERVIEW PROTOCOL USED FOR DATA COLLECTION

The protocols were the same for industry, university and intermediaries. The use of the word university/industry was used dependent on the situation. University participants had a different list of motivators. Intermediaries had both sets of motivators.

Protocol for Industry Participants

<i>General:</i> <i>Information about the interviewee (Plewa, 2013)</i>	<i>What kind of linkages with industry/university are you involved in? (Plewa, 2013)</i>
	<i>How many projects/relationships are you involved in? (Plewa, 2013)</i>
	<i>When did those partnerships commence? (Plewa, 2013)</i>
	<i>Have you been employed in industry/at university previously? (Plewa, 2013)</i>
<i>Industry/</i>	

University:	What was your motivation to get involved with university (Ankrah,	
	Necessity	<input type="checkbox"/> Responsiveness to government policy <input type="checkbox"/> Strategic institutional policy
	Asymmetry	<input type="checkbox"/> Maintain control over proprietary technology
	Reciprocity	<input type="checkbox"/> Access to students for internship or hiring <input type="checkbox"/> Hiring of faculty members by industry <input type="checkbox"/> Attract specific collaborative funded projects with universities to participate in <input type="checkbox"/> Provide feedback/contribute to policy
	Efficiency	<input type="checkbox"/> Commercialise university-based technologies for financial gain <input type="checkbox"/> Benefit financially from serendipitous research results <input type="checkbox"/> Cost savings (easier and cheaper than to obtain a license to exploit foreign technology) or cost effectiveness <input type="checkbox"/> National incentives for developing such relationships such as tax exemptions <input type="checkbox"/> Enhance the technological capacity and economic competitiveness of firms <input type="checkbox"/> Shortening product life cycle <input type="checkbox"/> Human capital development <input type="checkbox"/> Reduce barriers to technology take up
	Stability	<input type="checkbox"/> Shift in knowledge based economy (or growth in new knowledge) <input type="checkbox"/> Business growth <input type="checkbox"/> Access new knowledge, cutting-edge technology, state-of-the-art expertise/research facilities and complementary know how <input type="checkbox"/> Multidisciplinary character of leading edge technologies <input type="checkbox"/> Access to research networks or pre-cursor to other collaborations <input type="checkbox"/> Solutions to specific problems <input type="checkbox"/> Subcontract R&D (e.g. lack in house)/Consultancy <input type="checkbox"/> Risk reduction or sharing <input type="checkbox"/> Gain understanding of technology <input type="checkbox"/> Link to correct academic partners and industry partners to suit and meet the need <input type="checkbox"/> Fun
	Legitimacy	<input type="checkbox"/> Enhancement of corporate image
2013)?		
<i>How did you first get involved with universities/industry? (Plewa, 2013)</i>		

	<div data-bbox="501 338 1069 376" data-label="Text"> <p><i>How was first contact made? (Plewa, 2013)</i></p> </div> <div data-bbox="549 414 801 604" data-label="List-Group"> <ul style="list-style-type: none"> <input type="checkbox"/> Radio <input type="checkbox"/> Newspaper <input type="checkbox"/> Personal invite <input type="checkbox"/> Conference <input type="checkbox"/> I approached them <input type="checkbox"/> Other </div> <div data-bbox="501 607 572 633" data-label="Text"> <p>Notes:</p> </div> <div data-bbox="501 878 912 916" data-label="Text"> <p><i>What happened? (Plewa, 2013)</i></p> </div> <div data-bbox="501 1245 1008 1283" data-label="Text"> <p><i>Good vs Bad experience (Plewa, 2013)</i></p> </div>
<p><i>Individual relationships:</i></p>	<p>Would you call your interactions with the university to date a relationship?</p>

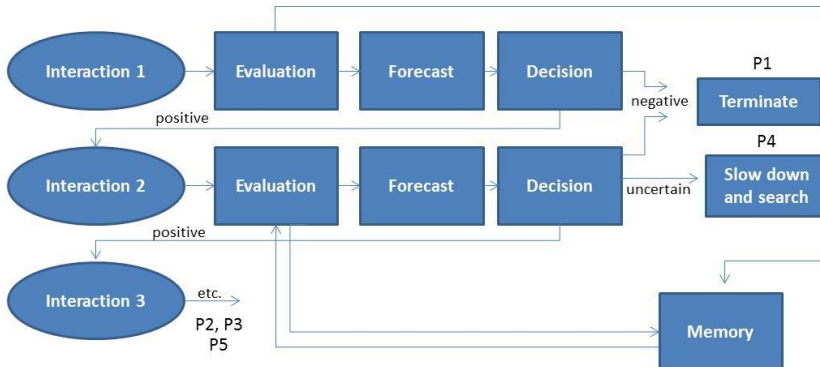
	<i>Relationship (various relationships; focus on individual relationship when answering questions) (Plewa, 2013)</i>
	<i>1. Briefly describe what kind of relationship you are engaged in (Plewa, 2013)</i>
	<i>2. How long has it been running (e.g., several projects or one project, length of time) (Plewa, 2013)</i>
	<i>3. How many people are involved on both sides? (Plewa, 2013)</i>

	<p>4. <i>How much is involved (how important for you)? (Plewa, 2013)</i></p>
	<p>Would you consider the project/s you are most interested in as incremental or disruptive or radical in nature?</p>
	<p>What would your ideal relationship with Universities/industry look like?</p> <ul style="list-style-type: none"> <input type="checkbox"/> Informal or formal arrangements <input type="checkbox"/> The university communicating opportunities that may be of interest to your industry (What is engagement?) <input type="checkbox"/> The university providing access to someone to discuss how to advance your business (What is interaction?) <input type="checkbox"/> Communication in a way that suits you? <input type="checkbox"/> Other
<p>Relationship development:</p>	<p><i>Can you identify different stages/phases of the relationship; did the relationship change over time) [if yes, use those phases to discuss the following questions] (Plewa, 2013)</i></p>

	<i>Please explain the change. (Plewa, 2013)</i>
	<i>How do the phases differ? (Plewa, 2013)</i>
	<i>Phase 1</i>
	<i>How did the relationship come about? (Plewa, 2013)</i>
	<i>What was important for the relationship success at this stage? (Plewa, 2013) Have you come across any relationship road blocks?</i>

	(relationship, process/technical, administrative) What would have helped speed up the process?
	<i>What would you say is success at this stage? How would you define it? (Plewa, 2013)</i>
	<i>What agreement did you have (written or tacit); please comments on agreement development. (Plewa, 2013)</i>
<i>Relationship Investment:</i>	If involved in a relationship with the university/industry, which of the following do you agree with?

(Kyriazis, 2005)	<div> <input type="checkbox"/> The Uni contact and I have devoted a lot of time and energy into making our relationship work </div> <div> <input type="checkbox"/> We made an effort to increase the amount of time we spent together </div> <div> <input type="checkbox"/> There is a lot of equity in our relationship which would be lost if it ended </div> <div> <input type="checkbox"/> I've made an effort to demonstrate an interest in our relationship </div> <div> <input type="checkbox"/> The University contact has invested heavily in our relationship </div>										
	Did you experience any roadblocks in developing the relationship in terms of resourcing or time? Would a business development manager or some other resources help?										
Communication:	What are your preferred types of communication for university/industry relationships (tick)? [Elias thesis in black, new added in blue]. Do you dislike any communication types (cross)? <table border="1" data-bbox="501 1451 1390 1904"> <thead> <tr> <th></th> <th>Why?</th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/> by email</td> <td></td> </tr> <tr> <td><input type="checkbox"/> by voice mail</td> <td></td> </tr> <tr> <td><input type="checkbox"/> in scheduled one-to-one meetings (face-to-face)</td> <td></td> </tr> <tr> <td><input type="checkbox"/> in impromptu face-to-face conversations (e.g., in the hall)</td> <td></td> </tr> </tbody> </table>		Why?	<input type="checkbox"/> by email		<input type="checkbox"/> by voice mail		<input type="checkbox"/> in scheduled one-to-one meetings (face-to-face)		<input type="checkbox"/> in impromptu face-to-face conversations (e.g., in the hall)	
	Why?										
<input type="checkbox"/> by email											
<input type="checkbox"/> by voice mail											
<input type="checkbox"/> in scheduled one-to-one meetings (face-to-face)											
<input type="checkbox"/> in impromptu face-to-face conversations (e.g., in the hall)											

		<input type="checkbox"/> by online professional networks (linked in)	
		<input type="checkbox"/> by video call (skype, google hangout)	
		<input type="checkbox"/> Other	
	<p>Can you describe the pattern of communication that occurred with a good university/industry relationship that you have been involved in? (<i>Diagram Bruhn, 2003</i>)</p>  <p>The diagram illustrates a process flow for university/industry interactions. It starts with three interaction nodes: Interaction 1, Interaction 2, and Interaction 3. Each interaction leads to an 'Evaluation' stage. From 'Evaluation', the process can go to 'Forecast' and then 'Decision'. From 'Decision', there are three possible outcomes: 'negative' leading to 'Terminate' (labeled P1), 'uncertain' leading to 'Slow down and search' (labeled P4), and 'positive' leading to 'Memory'. 'Memory' then feeds back into the 'Evaluation' stage of the next interaction. Interaction 1 leads to 'positive' and then 'Memory'. Interaction 2 leads to 'positive' and then 'Memory'. Interaction 3 leads to 'etc.' and then 'Memory' (labeled P2, P3, P5).</p> <p><u>Participant Outcomes</u></p> <p>P1 – Terminated interaction 1 P2 – Continuing interactions for information, have own equipment, no common project P3 – Uncertain, slowed down interactions while focussed on other projects P4 – Continuing interactions for information, no common project P5 – Stopped terminating project by aligning goals and setting context, continuing interac</p> <p>Notes:</p>		
	<p>What is your preferred communication method for knowledge transfer?</p>		

	Which relationship structures have you found to be effective for successful innovation projects?	
	Relationship Type	Effectiveness of Communication
	Personal Informal Relationships	
	Personal Formal Relationships	
	Third Parties	
	Formal Targeted Agreements	
	Formal Non-Targeted Agreements	
	Creation of Focused Structures	
	<i>Cluster managers?</i>	
	<i>Independent professional translators</i>	
What is the communication like, what could be improved?		

Bi-Directional Communication <i>(Kyriazis, 2005)</i>	<p>What has been your experience with communication from the university/industry?</p> <ul style="list-style-type: none"> <input type="checkbox"/> The University <i>always</i> responded to my communication <input type="checkbox"/> The University provided me with a lot of feedback <input type="checkbox"/> There was a lot of <i>two-way</i> communication between the university and myself <input type="checkbox"/> We exchanged <i>e-mail</i> frequently
<i>Other</i> <i>Backgroun</i> <i>d–</i> <i>institution</i> <i>specific</i> <i>(Plewa, 2013)</i>	<p><i>Industry: How does the organization manage outside research?</i></p> <p><i>(Plewa, 2013)</i></p>

b) The alternate motivation table that was used for university and added for intermediary actors.

Necessity	<input type="checkbox"/> Responsiveness to government policy <input type="checkbox"/> Strategic institutional policy
Asymmetry	<input type="checkbox"/> Not expected
Reciprocity	<input type="checkbox"/> Access to complementary expertise, state-of-the-art equipment and facilities <input type="checkbox"/> Employment opportunities for university graduates <input type="checkbox"/> Provide feedback/contribute to policy
Efficiency	<input type="checkbox"/> Access funding for research <input type="checkbox"/> Business opportunity, e.g. exploitation of research capabilities and results or deployment of IPR to obtain patents <input type="checkbox"/> Reduce barriers to technology take-up
Stability	<input type="checkbox"/> Discover new knowledge <input type="checkbox"/> Test application of ideas/theory or explain/sell ideas to industry <input type="checkbox"/> Expose students and faculty to practical problems/applied technologies which enhances business relevance <input type="checkbox"/> Publication of papers (for RAE) <input type="checkbox"/> To ensure that research within the university is at a cutting edge that is more useful/relevant
Legitimacy	<input type="checkbox"/> Societal pressure <input type="checkbox"/> Service to the industrial community/society <input type="checkbox"/> Promote innovation through knowledge/technology transfer <input type="checkbox"/> Contribute to regional or national economy <input type="checkbox"/> Academics' quest for recognition or achieve eminence/university prestige

APPENDIX F: PARTICIPANT INFORMATION AND CONSENT

TITLE: DEVELOPING A BEST PRACTICE MODEL FOR EARLY STAGE UNIVERSITY- INDUSTRY RELATIONSHIPS

PURPOSE OF THE RESEARCH

This is an invitation to participate in a study conducted by researchers at the University of Wollongong. The purpose of the research is to investigate the experience of knowledge providers and adopters undertaking new product development associated with universities.

STUDENT INVESTIGATOR	SUPERVISORS		
Adrian Tootell (Researcher)	Dr Elias Kyriazis	A/PR Samuel Garrett-Jones	PR Gordon Wallace
Faculty of Commerce	Faculty of Commerce	Faculty of Commerce	AIIM Research Facility
04-97861371	02-42214871	02-42214359	02-42214419
at231@uowmail.edu.au	keliass@uow.edu.au	sam_garrett-jones@uow.edu.au	gordon_wallace@uow.edu.au

METHOD AND DEMANDS ON PARTICIPANTS

If you choose to be included, you will be asked to participate in a semi-structured interview that will last between 45 and 60 minutes, and will be digitally recorded to ascertain your experience relating to initiation of university-industry relationships. A typical semi-structured interview question is: *What kind of linkages with industry/university are you involved in?*

POSSIBLE RISKS, INCONVENIENCES AND DISCOMFORTS

Apart from the 45 to 60 minutes of your time for the interview, we can foresee no risks for you. Your involvement in the study is voluntary and you may withdraw your participation from the study at any time and withdraw any data that you have provided to that point. Refusal to participate in the study will not affect your relationship with the University of Wollongong.

FUNDING AND BENEFITS OF THE RESEARCH

This study is funded by HDR funding for Doctor of Philosophy. This research will provide a basis for describing the experience of innovators in progressing new product development associated with new technologies such as additive manufacturing. Findings from the study will be published in a Doctor of Philosophy thesis and possibly published in marketing journals. Confidentiality is assured, and you will not be identified in any part of the research.

ETHICS REVIEW AND COMPLAINTS

This study has been reviewed by the Human Research Ethics Committee (Social Science, Humanities and Behavioural Science) of the University of Wollongong. If you have any concerns or complaints regarding the way this research has been conducted, you can contact the UoW Ethics Officer on (02) 4221 3386 or email rosoethics@uow.edu.au.

Thank you for your interest in this study.

CONSENT FORM FOR

**RESEARCH TITLE: DEVELOPING A BEST PRACTICE MODEL FOR EARLY STAGE
UNIVERSITY- INDUSTRY RELATIONSHIPS**

RESEARCHER: Adrian Tootell

I have been given information '*Developing a Best Practice Model for Early Stage University-Industry Relationships*' and discussed the research project with *Adrian Tootell* who is conducting this research as part of a *Doctor of Philosophy - Research* supervised by *Dr Elias Kyriazis* in the faculty of *Commerce* at the University of Wollongong.

I have been advised that there are no potential risks and burdens associated with this research, and have had an opportunity to ask *Adrian Tootell* any questions I may have about the research and my participation.

I understand that my participation in this research is voluntary, I am free to refuse to participate and I am free to withdraw from the research at any time. My refusal to participate or withdrawal of consent will not affect *my treatment in any way /my relationship with the Faculty of Commerce or my relationship with the University of Wollongong*.

If I have any enquiries about the research, I can contact *Adrian Tootell* (phone: 04 9786 1371) and *Dr Elias Kyriazis* (phone: 02 4221 4871) or if I have any concerns or complaints regarding the way the research is or has been conducted, I can contact the Ethics Officer, Human Research Ethics Committee, Office of Research, University of Wollongong on 4221 3386 or email rso-ethics@uow.edu.au.

By signing below I am indicating my consent to (please tick):

- ☐ *a digitally recorded in depth interview lasting between 30 and 40 minutes,*
- ☐ *the interview transcript being used for the research analysis,*

I understand that the data collected from my participation will be used for *purpose (eg thesis, journal publication, etc)*, and I consent for it to be used in that manner.

☐ Signed

Date

.....

...../...../.....

Name (please print)

.....

APPENDIX G: RESEARCHER EXPERIENCE WITH THE TOPIC

Section (source)	Question
General: Information about the interviewee (Plewa et al., 2013b)	What kind of linkages with industry/university are you involved in? I have been involved in: Two welding projects where I was the industry partner for the project; I have been involved in one IT project as an industry partner.
	How many projects/relationships are you involved in? 3
	When did those partnerships commence? 15 years ago
	Have you been employed in industry/at university previously? Industry; I have worked in manufacturing in operations and technical roles including process improvement, operations management, customer technical service and then managing the technical sections. Have been the person doing B2B product innovation projects and then the manager of the industry supplier which had in-house R&D.
Motivation: (Ankrah et al., 2013)	What was your motivation to get involved with the university? Improve performance of process line; build a prototype software system to test logic before purchasing complex system. Stability: Gain understanding of technology, access new knowledge.
	How did you first get involved with the university? A friend made contact
	How was first contact made? On phone
	What happened? After friend making initial contact on behalf of academic had arranged time to meet at



	<p>my site of work, the academic became too busy and rescheduled by email before deciding to make an introduction by phone. I worked with his students and did not meet academic until I visited the university.</p>
<p>Individual relationships: (Plewa et al., 2013b)</p>	<p>Would you call your interactions with the university to date a relationship? Yes</p>
	<p>Briefly describe the kind of relationship you are engaged in. I was supplying the academic work for his students, he was providing expertise to the students to create the proof of concept prototype. It was more transactional.</p>
	<p>How long has it been running (e.g. several projects or one project, length of time) The welding project was linked with other projects and ran over 5 years that I was involved. The IT proof of concept project ran for a year.</p>
	<p>How many people are involved on both sides? 2 on the industry side, 4 on the university side.</p>
	<p>How much is involved (how important for you)? In the welding trial I was managing the process that the weld monitoring was being done so I had to manage all the interactions to conduct the trials of the demonstrator. For the IT process I had to meet with the students to provide details of the project and assess progress.</p>
	<p>Would you consider the project/s you are most interested in as incremental or disruptive or radical in nature? The IT one is a disruptive proof of concept. The welding projects were disruptive for the monitoring control system.</p>

Relationship development: (Plewa et al., 2013b)	What would your ideal relationship with university look like? When having issues that require incremental or disruptive innovation where the resources are not available, being able to “phone a friend” to have a confidential chat about what might be possible. Informal; university communicate opportunities to me; communicate in a way that suits me.
	How did the initial relationship come about? Contact with a third party with whom I had a strong relationship.
	What was important for the relationship success at this initial stage? Making contact, and then being able to discuss what was intent and come to some sort of agreement.
	Have you come across any relationship road blocks? (relationship, process/technical, administrative) What would have helped speed up the process? Welding: I was not part of the initial stages; IT Prototype: The academic keeping commitment to meet.
	What would you say is success at this stage? How would you define it? Agreeing to meet and then having an honest discussion about what is possible.
	What agreement/s did you have (written or tacit); please comments on agreement development. The welding project was a written agreement that I was not a part of initiating or forming; the IT prototype was a tacit agreement.
Relationship Investment: (Kyriazis, 2005)	If involved in a relationship with the university/industry, which of the following do you agree with? We made an effort to increase the

	amount of time we spent together; I've made an effort to demonstrate an interest in our relationship.
	Did you experience any roadblocks in developing the relationship in terms of resourcing or time? No
<p>Communication:</p> <p>(Bruhn, 2003)</p> <p>(e-collaboration) →</p>	What are your preferred types of communication for university-industry relationships? Face-to-face is my preferred communication style for understanding, planning and organising; written reports for finding with a one-page summary of important points on top.
	Can you describe ways you have communicated when developing and maintaining a good business relationship? I have found that I have communicated in a way that the other person feels comfortable. Open and honest in what I am saying taking some care to only talk about the topics in hand. Take an interest in what interests the other party. Active listening where appropriate. Try to leave with a clear next step/expectation. A poor one? Spoke to what I wanted to achieve. Closed questions and formal in driving through an agenda.
	Do you find new communication and collaboration methods useful? Yes: Email as able to communicate out of hours; LinkedIn® used to keep business network contact details and to message if contact details lost; Web searching for quickly finding out general information to get orientated on something/someone. and No: Skype® (use a lot for family conversations, not business); Facebook® not used at all (tried but not liked); Do not use online collaboration – have tried some but not liked them.

	Can you describe the pattern of communication that occurred with a good university-industry relationship that you have been involved in? There was quick answering of email and phone messages. Regular meetings to ensure all on track and make amendments where necessary.
	What is your preferred communication method for knowledge transfer? Communicating with the person directly, written document for later reference.
	Which relationship structures have you found to be effective for successful innovation projects? Personal informal relationships; intermediaries. What is the communication like, what could be improved? I find it is OK.
Bi-Directional Communication (Kyriazis, 2005)	What has been your experience with communication from university? It is generally what I would expect in the general community, sometimes do not get responses and wonder what may have happened or if I am a priority. We exchange email frequently.
Other: (Plewa et al., 2013b)	How does your organization manage/plan to manage university relationships? In very a controlled way, with a focus on owning all IP and through a central point of contact – the innovation team.

APPENDIX H: UNIVERSITY ADVERTISEMENT FOR BUSINESS DEVELOPMENT ROLE



Business Development Manager - Academic Services Team

- Emphasis on Engineering or Sciences
- Identification, development and closing licensing deals
- Innovation at it's best

Business Development Manager - Academic Services Team

There is a position available to join UNSW Innovations as a Business Development Manager (BDM). UNSW Innovations is wholly owned subsidiary of the University of New South Wales.

UNSW Innovation's mission is to drive the outputs of UNSW's research into use in the economy and society, ensuring its inventions and technologies achieve their maximum potential by being put into use by innovation partners including industry and government. UNSW has various products including Easy Access IP with the intention to ease industry partners for accessing UNSW inventions.

Business Development Managers within the Academic Services Team of UNSW Innovations are responsible for systematically identifying and protecting University created technologies and inventions as well as marketing these for the benefit use of society and the economy. Closing these deals will enhance the relationship UNSW has with industry, various Government sectors and international partners. The BDM will also be involved in introducing valuable research partners to UNSW. The BDM may develop strategies to target new invention, determining the level of IP protection needed, marketing/selling/licensing of UNSW intellectual properties to potential industry partners. The BDM helps inventors, researchers and entrepreneurs to increase the uptake and impact of their research outcomes and works closely with the patent manager, the legal and finance teams as well as regular meetings with researchers and industry.

This position requires excellent communication skills and the capacity to understand various research and grant agreements. It also involves marketing technologies and inventions, licensing and negotiation skills. Expertise in the field of Engineering or Science (tertiary qualification) as well as business development experience will be ideal for this position. Those with MBA/PhD are particularly encouraged to apply. Candidates should also demonstrate highly developed stakeholder, project management and interpersonal skills.

All applications and enquiries should be directed in the first instance to Callaways Executive Selection.

Please call Philip O'Sullivan on 02 8005 3456 to discuss further or submit your CV to apply@callaways.com.au ref BDM03/02

Callaways is an equal opportunity employer, actively working with our clients in achieving their diversity targets. We encourage all experienced applicants to apply for this role.

www.callaways.com.au

APPENDIX I: SOME CHARACTERISTICS OF ADDITIVE MANUFACTURING (3D PRINTING)

Additive manufacturing has been in development for about 25 years and encompasses a number of technologies that can be described as bonding layers of particulate material one at a time to form a solid object (Wohlers, 2011). An example of additive manufacturing is 3D printing where polymeric materials are used similar to the functionality of an inkjet printer. An example of a 3D printer can be seen in Photo I1.



Photo I1: A picture of a typical 3D printer taken from Mashable (2011).

The 3D printing process technology is continuing to improve producing finer finishes, faster printing in larger sizes. An example of printed objects can be seen in

Photos I2 (end user design), Photo I3 (collaborator design) and Photo I4 (producer design). The additive manufacture technology is not limited to polymers; processes also exist for metals and ceramics.



Photo I2: An example of a 3D printed polymer aircraft created by an end user with design provided (on commission) for other consumers to purchase final product (Shapeways, 2012).



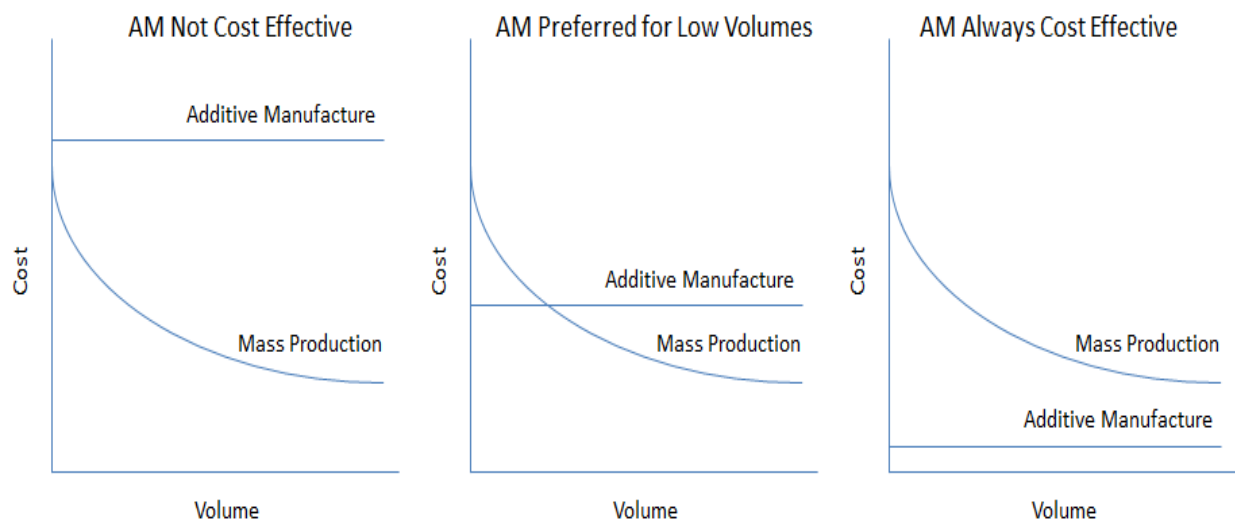
Photo I3: (Designs created by the collaboration Particle14. 3D Printed and presented at 'France Design' during Milan Design Week (Mathilde, 2012).



Photo I4: An example of 3D printed prosthetics produced commercially by Bespoke who have been acquired by 3D systems (Murray, 2012).

The developments in technology are improving the properties of the produced objects and reducing design costs through the use of rapid prototyping and also reducing production costs in some cases. Production costs for additive manufacture can be placed into three groupings when compared to traditional mass production for the fabrication of products as seen in Figure I5.

Figure I5: Technological advances have improved the competitiveness of additive manufacture (AM) in terms of production costs. Wohlers Associates (2011) illustrated the centre diagram to show that in some situations that additive manufacturing is cost effective.



Until recently the costs of producing products with additive manufacturing technology were much higher than the costs associated with traditional production routes. The development of improved input materials and in bonding technology has led to additive manufacturing becoming a manufacturing route of choice for some low volume customised small products e.g. dental moulds.

It should be noted that additive manufacturing still has a lot of development to undergo before it may be considered an alternative to mass production as it is not

currently effective for many manufacturing situations. However, it is experiencing exponential growth in machines being produced, the development of wider ranges of raw materials, more affordable raw materials and its use in rapid prototyping.

The rate of additive manufacturing technology advancement is dependent on the material and the technology being used. Polymer solutions are beginning to be preferred for low volume complex or unusual shapes with a growing market. Metal solutions are advocated for experimentation for producing small complex shapes that are expensive to fabricate using other methods. Ceramic solutions are generally not cost effective and slow to progress (Wohlers Associates, 2011).

References:

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Note: This summary was also attached to the HDR proposal.

Science-industry relationships

When examining industry-university relationships the focus is on science and technology knowledge transfers as the reason for the relationship. This can be seen in

early books, one of which is Crane (1972) that examines how scientific communities affect the growth of knowledge. She argues that institutional factors are considered with two contextual aspects: firstly, their affiliation to a scientific discipline, and secondly, whether there are specific national regulations and public policies. Both of these aspects are important as they are either: governance that must be followed from government regulatory bodies or the rules of conduct prevailing in the societies that academics choose to operate.

Although Crane's research is limited to scientific faculty, the factors that increase the growth of new knowledge have an impact on the volume of new ideas that are available to be transferred for innovation projects. This research while measuring the output of individuals, examines the organisational factors rather than the individual factors that impact knowledge growth.

Another early text in the area by Merton (1973) examines the sociology of science where he argues the concepts of knowledge and how it is evaluated in the scientific community. The traditional mind-set of scientists and their culture are analysed. Although this research is limited in its focus on the scientific community, it provides some insight into how individuals may behave in their respective communities and the cultures that have formed. Merton (1973) argues that it is important to differentiate researchers who can provide value and engage with external organisations, with those who have a traditional mind-set and provide individualised structures and rewards pertaining to their situation. It is worth noting that the focus of most research on this topic is on university actors which are further explored in Section 2.4.

Where Crane (1972) focussed attention on the technical knowledge transfer and Merton (1973) on the relationships that exist within collegial networks, Bonaccorsi

et al. (1994) seminal work takes a wider view and brings together all the different types of relationships that exist across a university. The characterisation of different types of formal and informal relationships provides researchers with common groupings and language to use when researching in this area. This research is important as it provides a common framework to view university-industry relationships that is independent of the culture of a particular university faculty. It also introduces the concept of third party involvement in relationships to act as facilitators or technology translators. Another concept that is considered by Bonaccorsi et al. (1994) is how to measure the performance of university-industry relationships. They argue that both objective and subjective measures need to be used due to the level of uncertainty that can occur with relationships. They provide three areas for measurement to focus on: knowledge generation, transmission and propagation.

Local manufacturing challenge

Traditional manufacturing in Australia has been contracting, and at the same time, the mining industry is stagnant with low commodity prices, and the currency is weakening from historical highs. The innovation cycle is now very important for manufacturing businesses to regain competitive advantage to re-establish margins for financial viability (Commonwealth of Australia, 2012).

Government initiatives such as Enterprise Connect (Commonwealth of Australia, 2012) have been set up by government agencies to address commercialisation barriers (Gascoigne, 1999) and to help the contracting manufacturing industry. These agencies are concerned that government incentives developed to support manufacturing transformation are not being subscribed to by the targeted manufacturers, but instead by other businesses under less threat (Masterson, 2012). Understanding why this is the case is important for regional economic development and the future of manufacturing.

The Australian Research Council Centre of Excellence for Electromaterials Science (ACES) at the University of Wollongong Innovation Campus has been successful in progressing timely, successful innovation programs with collaborators. However, they have had less success in attracting manufacturers under financial pressure, even with government incentives being offered. It is within this context that this thesis research has been undertaken.

University-industry relationships

To understand the nature of traditional university-industry relationships, Bonaccorsi et al. (1994) categorised them as shown in Table I.1. The relationships can

be seen as generally task-focussed in nature including: cooperatives, research centres, innovation/incubation centres, start-ups, research science and technology parks, associations, collaborators and spin offs.

The relationships are not always solely between universities and industry. They may involve third parties. Traditionally the third party relationships have been with liaison offices, industrial associations, applied research institutes, general assistance units and institutional consultancies.

Table I.1 A summary of University-industry inter-organisational relationships taken from Bonaccorsi et al. (1994).

Relationship Type	Examples
Personal Informal Relationships	<ul style="list-style-type: none"> • individual consultancy (paid for or free); • informal exchange forums and workshops; • academic spin-offs; • research publications and 'grey literature'.
Personal Formal Relationships	<ul style="list-style-type: none"> • scholarships and postgraduate linkages • student interns and sandwich courses; • sabbatical periods for professors; • exchange of personnel (secondment).
Third Parties	<ul style="list-style-type: none"> • liaison offices; • industrial associations (functioning as brokers); • applied research institutes; • general assistance units; • Institutional consultancy (university companies).
Formal Targeted Agreements	<ul style="list-style-type: none"> • contract research; • training of employees; • cooperative research projects and joint research programmes"
Formal Non-Targeted Agreements	<ul style="list-style-type: none"> • broad agreements; • industrially sponsored R&D in university departments; • research grants and donations, general or directed to specific departments.

<p>Creation of Focused Structures</p>	<ul style="list-style-type: none"> • association contracts; • university-industry research consortia; • university-industry cooperative research centres; • innovation/incubation centres; • research, science and technology parks; • mergers.
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However, with the rapid convergence and development of new technologies, the emergence of translators or facilitators independent of the university, such as Small-Medium Enterprises (SMEs) in the biotech field in Europe, have been found to be more effective and seen as the nexus for that particular regional technology transfer (Genet et al., 2012).

Financial and technology impact on relationships

With recent changes to the global economy and technology, industry has had to adapt. Higher production and transactional costs in the western world are retarding new commercialisation viability for mass producers (Baldwin et al., 2011). The reduction in communication costs provided by the IT industry and design costs through the development of technologies such as rapid prototyping with 3D printing (Appendix I), are assisting individuals and collaborators the opportunity to commercialise products that have until now been the sole domain of mass producers (Baldwin et al., 2011).

These changes are likely to lead to the emergence of new entrants wanting to engage in university-industry relationships prompting a new interest in highly responsive relationships and the motivation behind them. Oliver (1990) reviews the formation of inter-organisational relationships and provides a framework for examining inter-organisational relationship motivators. A recent case study analysed

the motives for using this framework with individual actors in university-industry relationships. The individual actors from both the university and industry indicated that stability through seeking control over their environment and future as the key motivator for engagement (Ankrah et al., 2013).

A key aspect of this stability is the creation of stable interpersonal working relationships which occur with the establishment of trust when turf wars, interpretive and communication barriers are overcome as relationships progress through orientation, exploration and testing (Hutt, 1995). Positive actions by actors, such as facilitating managers being perceived as a political ally, have also been shown to be antecedents to the development of the interpersonal trust necessary for successful relationships (Kyriazis et al., 2012).

Recent university-industry relationship literature has provided some further insight into academic engagement and commercialisation (Perkmann et al., 2013). Academic engagement occurs when a relationship is formed with non-academic organisations for knowledge-related collaboration, in contrast to commercialisation, where the primary motivation is to secure resources for a research agenda. These relationships were seen to be more effective when they involved individual academics rather than formal commercialisation mechanisms such as technology offices. This lends food for thought as how to best address university-industry relationships.

Studies examining internal company innovation have found that success and functional integration are often affected by barriers to the integration of required knowledge (Souder, 1981). It is believed that barriers to successful innovation adoption currently being experienced can be overcome by actors coming to a mutual understanding. Such mutual understanding is also necessary in “external” relationships where two parties from differing worlds come together. With the increase in

competition from globalisation, and accelerating technology development, the innovation environment has become an ever-changing landscape. The paradigms that have worked in the past are being challenged. Manufacturers are competing with collaborators and single users (Baldwin et al., 2011). Regional stakeholders are sharing innovation resources to access external markets even though they may compete locally (Tam et al., 2011). Technology transfer modes that work for one technology, such as biotechnology, are not working for others such as nanotechnology (Maine et al., 2012). Businesses need to be more agile and allow relationships to be formed quickly and well.

Relationship marketing theory

Bruhn (2003) highlights the interdisciplinary nature of marketing and captures theoretical foundations and frameworks from different research fields (Table 3.3). These theories can be related to three marketing paradigms: neoclassical, neo-institutional, and neo behavioural. The neoclassical and neo-institutional are based upon micro-economics while the neo-behavioural paradigm is interdisciplinary. To understand how these paradigms relate to the foundational theories for relational marketing.

There are six requirements that have been developed to indicate if a theory contributes to the understanding of relationship marketing (Bruhn, 2003).

1. *“Theory must be able to clarify the forms and types of customer relationships*
2. *Able to explain different phases of relationship development*
3. *Describe the processes for how customer relationships emerge*

4. *Highlight the dynamic aspects of customer relationship through relationship phases*
5. *Indicate the conditions for customer relationship emergence and maintenance*
6. *Possible to express the view of both buyer and seller”*

Table I.2 The theoretical foundation for relationship marketing as developed by Bruhn (2003).

	Theory	Authors	Focus
Neoclassic	Value Theory	Implicit application based on a series of marketing publications	Significance of quality, customer satisfaction, perceived value, and relationship quality within relationship marketing
	Profit Theory	Blattberg and Deighton 1996	Evaluation of customer relationships from a corporate perspective
Neo-institutional paradigm	Information economics	Klee 2000	Explanation of interaction uncertainties and derivation of strategies to reduce uncertainty
		Ahlert, Kenning and Petermann 2001	Trust as success factor for service-based corporations
	Transaction cost theory	Klee 2000	Pre-conditions for an advantageous initiation of customer relationships
		Grönroos 1994	Profitability of long-term business relationships
	Principal-agent theory	Jensen and Meckling 1976; Bergen et al. 1992	Elucidation of customer and employee behaviour within customer relationships
Neo-behavioural paradigm	Psychological theories		
	Learning theory	Sheth and Parvatiyar 1995	Clarification and influencing factors for the emergence of customer relationships
	Risk theory	Sheth and Parvatiyar 1995	Clarification and influencing factors for the emergence of customer relationships
		Fischer and Tewes 2001	Trust and commitment as intermediary variables for service processes
	Cognitive dissonance theory	Sheth and Parvatiyar 1995	Clarification and influencing factors for the emergence of customer relationships
	Socio-psychological theories		
	Interaction/Network approaches	IMP Group 1982; Gronroos 1994	Structuring of interaction processes
	Social exchange theory	Houston and Gassenheimer 1987	Emergence and maintenance of customer relationships; evaluation, long-duration, and stability of customer relationships
	Social penetration theory	Altman and Taylor 1973	Emergence and development of customer relationships

Bruhn (2003) conducted a critical evaluation of these requirements was undertaken to ascertain which theory contributes the most to understanding the concept of relationship marketing as shown in Table I.2. As can be seen, social penetration theory provides the best explanation of the concept whereas the other theories only partly describe the theoretical foundation.

Table I.3 Summary of the critical evaluations of theories against requirements as performed by Bruhn (2003).

Theories	Requirements					
	Theory must be able to clarify the forms and types of customer relationships	Able to explain different phases of relationship development	Describe the processes for how customer relationships emerge	Highlight the dynamic aspects of customer relationship through relationship phases	Indicate the conditions for customer relationship emergence and maintenance	Possible to express the view of both buyer and seller
Social penetration theory	+	+	+	+	+	+
Neoclassical theory	-	-	-	-	o	+
Information economics	+	-	+	O	-	+
Principal agent theory	+	-	-	-	+	+
Transaction cost theory	+	-	-	O	+	+
Psychological theories	-	-	-	-	+	o
Interaction/Network theories	+	-	-	-	+	+
Social exchange theory	o	-	-	O	+	+

Note: a '+' denotes a positive contribution, a 'o' some contribution and a '-' for no contribution.

Relationship marketing paradigms

The relationship marketing theories fit into three groups of paradigms: neoclassical, neo-institutional and neo-behavioural (Table I.3). The neoclassical and neo-institutional paradigms which include: information economics, principle agent theory and transactional cost theory have an economics foundation. In comparison, the neo-behavioural paradigm character has an interdisciplinary foundation to explain marketing-relevant circumstances. The neo-behavioural theories were further grouped into psychological and socio-psychological theories based on the work of Backhaus and Buschken. (c.f. Bruhn, 2013). The critical evaluation of theories against requirements in Table I.3, show the socio-psychological group of theories most fully represent the concept of relationship marketing.

8.3.1.1 Interaction/Network theories

The interaction/network approach is founded on the structure and interaction of processes (Håkansson, 1982; Grönroos, 1994). The theory is unable to explain the dynamic nature of relationships, their emergence and development.

8.3.1.2 Social exchange theory

If university-industry knowledge transfer was always conducted as a simple exchange of knowledge for a benefit, then exchange theory would best describe the situation between the supplier (university) and consumer of knowledge (industry). In the case of university-industry relationships, the benefits are not always monetary and collaborations between individuals are often based on or seeking social benefits (Blau, 1964; Ankrah et al., 2013). For this reason, understanding social exchange theory is

better than other theories as a starting point to explain individual university-industry relationships.

Social exchange theory (Blau, 1964) explains the emergence and continuance of social relationships, where benefits are an incentive to the other party to provide value for continued association. Different types of benefits that people value are grouped in Table I.4.

Table I.4 The different types of benefits that may be valued by people to continue a social relationship (Blau, 1964)

	Internal	External	Society
Spontaneous Evaluations	Personal attraction	Social approval	Respect/prestige
Calculated Actions	Social acceptance	Instrumental services	Compliance/power

Social exchange theory captures the role of non-monetary benefits, however it doesn't explain how relationships emerge and the different stages of relationship development.

Social penetration theory

Social penetration theory has been derived from social exchange theory (Altman et al., 1973). The theory is an empirical positivist approach and is application based in nature (Bruhn, 2003). The theory has been criticised for its linear approach to the relationship development process resulting in research through the relationship lifecycle (Allensworth, 1996; Jap et al., 2007). However, the effects of interactions on developing the breadth and depth of interpersonal relationships and communication have continued to be researched (Kodish et al., 2008; Harmeling et al., 2015). When comparing social penetration theory to social exchange theory, the former has the

benefit of being able to explain how relationships emerge and develop through different stages. The theory provides a micro-view of the emergence and continuance of social relationships. The theory explains that with increasing interactions an individual discovers additional elements of the other party's personality with either a positive or negative outcome. These elements add to the understanding of the other party's personality depth and/or breadth. Reviewing the available theories, the theory that most supports examining university-industry relationships that are emerging or developing in the early stages from a relationship marketing lens is social penetration theory. Whether this remains the case will be re-visited once the data has been collected and content analysed.

Relationship marketing influencers

The application of theory in the form of models helps form a practical understanding of the relevant theoretical concepts for the study of university-industry relationships. Relationship marketing models have mainly been developed from the foundation of social exchange theory (Blau, 1964). A key concept of this theory that helps explain emergence and development of relationships is that an individual will interact until they gain enough social data to determine whether or not the relationship with another party is worth pursuing or not (Blau, 1964). This concept has been further broken down into the major factors that impact the relationship and have been argued to be a set of key mediating variables that are interrelated (Morgan et al., 1994).

A limitation of social exchange theory is that it does not capture the dynamic nature of the multiple interactions that occur when developing a relationship. Social penetration theory builds on social exchange theory by: acknowledging that a decision occurs after each interaction to continue, slow or terminate the relationship. It is able

to explain the processes for how customer relationships emerge and the different phases of relationship development (Bruhn, 2003).