Research Report

Success Factors Powering University – Industry Collaboration in Australia

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1 Introduction

In the current financial climate, private organisations are in demand of new technologies, new processes and new developments to accelerated them to the next level. In the midst of increasing international competition and rapid technological advancement, organisations are looking further than their Industry partners for greater opportunities and more efficient innovation (Barnes et al, 2002). It is collaboration between University and Industry partners that is being seen as increasingly essential, (Bammer, 2008) and Santoro (2008) re-iterates this expressing that as organisations face a constantly evolving competitive landscape, relationships with universities are more attractive and imperative.

From the Australian perspective, the Government is actively encouraging both interdisciplinary and transdisciplinary collaborations through funding arrangements such as Linkage Grants through the Australian Research Council Research Networks and CRC grants through Australian Cooperative Research Centres. University and Industry relations stretch further than these grants and have been increasingly recognised as being multiplex in nature, (Perkmann & Walsh, 2008). University and Industry collaborations, frequently diverse, require a considerable management effort in order to be successful, (Dodgson, 1991). It is the correct management of these collaborative efforts that leads to their success.

Since the early 1980s there has been substantial scholarly and policy interest in University-Industry interactions, and this interest has generated a body of work that varies greatly with respect to perspective, structure and effect, (Boardman & Branco, 2009). This study aims to explore the Australian experience of University and Industry collaboration and identify the key factors which lead to a successful partnership. Qualitative and quantitative data has been collected, to depict a comprehensive image of what success factors are perceived as most important and the differences between academic and organisation employee perspectives. Furthermore, this piece of research endeavours to capture the experience and knowledge from past and present collaborative ventures and use this to improve these encounters going forward.

This report begins by outlining the objective of this research in section 2 followed by a review of the current literature in section 3 which covers the importance of University Industry collaboration; collaboration specific to Australia and collaboration specific to the IT Industry. This is followed by section 4 where the research method defines the research questions, describes the chosen methodology and follows the research process. The results from the research are then provided in both a graphical and text form in section 5. Section 6 is a discussion of the results, leading into section 7 that provides recommendations driven from this study. Finally, section 8 concludes the report and section 9 provides some extra documentation in the appendix.

2 Research Objective

A growing body of research on University and Industry collaboration exists. Research has covered a range of areas such as examinations of the increase in collaborations and team sizes, patterns of collaboration networks, motives, choices and strategies for collaboration, the measurement of collaboration, how collaborations are organised and collaboration success, (Bammer, 2008). The aim of this research is to take an exploratory view and examine both the Industry and the academic perception of the Australian ICT University and Industry collaboration. The findings from this study intend to offer new insights into University and Industry collaborative ventures and to aid both parties in improving their future relations.

If Organisations or their University partners were to discontinue their collaboration, Industry would be deprived of the creativity of academic innovations and universities would lose critical relationships that provide opportunities of education and future research, (Burnside & Witkin, 2008). Hence, the importance of collaboration between Universities and Industry is clear, and this is furthermore iterated in the Australian context. On the world stage, the European Union actively encourages collaboration between corporate organisations and universities, with the aim to promote cross-national, cross-disciplinary and cross-sectoral collaborations (Bammer, 2008). The USA also has a large network of collaboration that is encouraged from both the Industry and University side, for example IBM research centres. Similarly in Australia, the Government can be seen to be actively encouraging collaboration between Industry and Academic Institutions through three key areas: Australian Research Council (ARC), Cooperative Research Centres (CRC) and national centres of excellence.

ARC is a body that is part of the Government which advises on research matters and manages the overall investment of the Australian Government in research and development. Through Linkage Projects, the ARC is seen to encourage collaborations that are interdisciplinary and transdisciplinary and that also hold national priorities (Bammer, 2008). Linkage grants encourage strategic research alliances between universities and organisations and the application process requires the identification and assessment of the national benefit for Australia.

CRC's are more specific funding programs, which are set up to enhance Industry and science partnerships (Bammer, 2008). The aim of CRCs is to link researchers from public and private sectors with users of research from appropriate Industry sectors, to participate in actively planning and operating research activities (Garret-Jones et al, 2005). ARC focuses more on the national priority or benefit of the research; alternatively CRCs are assessed on the quality of the science, the research, the partners and the strategy for application (Garret-Jones et al, 2005).

Garrett-Jones et al (2005) expresses that CRCs have changed the culture of research, promoting increased and more effective cross-sectoral, multidisciplinary and multi-organisational research leading into the creation of national centres of excellence. Australia's Information and

Communications Technology national centre of excellence was created and branded with the name NICTA. This is an independent company that focuses on research and is the largest organisation in Australia dedicated to ICT research. NICTAs research primarily focuses on addressing technology challenges facing Industry, our communities and national interest.

In the Australian Information Technology field, there are clearly a number of paths that Universities and Organisations can take to effectively collaborate. In order for this collaboration to be most successful and effective, it is important to understand the factors that contribute to this. Academics need to understand the needs and expectations from Industry, and organisations need to further understand how academic institutions manage and achieve goals through collaboration. By effectively summarising the perceptions of both Industry and universities on the factors leading to the success of collaboration, both parties can learn from these research outcomes and improve their future dealings.

3. Review of the Literature

Academic literature has seen the development of a strong body of work surrounding collaboration between University and Industry partners and this has varied greatly from perspective, structure, level of analysis and effect (Boardman & Ponomariov, 2009). The following outlines a review of this literature, to high light the current state of the art theory and identify the noticeable gaps. This review follows with section 3.1 assessing the importance of University Industry collaboration and why it is needed in today's society. Following this is section 3.2 providing a review of Australian specific literature on University Industry collaboration. This leads into section 3.3 that provides the current theory which has been developed specific to the IT Industry and their collaboration with universities particularly through R&D type pieces of work.

3.1 What is the Importance of University Industry Collaboration?

"Global competition, shortened product life cycles, and the increased pressure on corporate profits make it increasingly more difficult for firms to advance knowledge and new technologies through the sole use of in-house resources and capabilities", (Santoro, 2000). Collaboration is the key solution to the quoted issue and Bozeman and Corley (2004) provide the following benefits that successful collaboration with University will attain: access to expertise or unique skills, access to equipment or resources, improved access to funding, learning tacit knowledge about a technique, obtaining prestige, visibility or recognition and enhancing student education.

Majority of research in this domain has focused on the outcomes for private firms that collaboration intends to facilitate and produce, such as a firm's R&D investment rates, patenting rates and new technology and process development (Boardman & Branco, 2009). Another area of focus has existed in the stimulus and barriers for academics engaging in the University and Industry collaboration, (Van Dierdonck et al, 1990). Abramo et al (2009) addresses the greater country and high lights that the:

"Capacity of a nation to produce wealth depends increasingly on the investment it undertakes in strengthening the so-called "triangle of knowledge" which is composed of research, education and innovation". This high lights the importance of collaboration between University and Industry partners to excel our country on the whole.

The key to collaboration between University and Industry is building a strong relationship in which each entity benefits considerably. For the organisation, collaboration provides the means by which to advance technologically, at a lower cost and with less inherent risk (Barnes, 2002). Barnes further elaborates that collaboration gives the organisation access to a greater breadth and depth of knowledge and technologies than would normally be unavailable through internal development. Santoro (2000) expresses that for an organisation, advancing new technologies is crucial for long-

term prosperity and survival and that collaboration gives access to highly trained students and professors as well as University labs and facilities. From the Universities perspective, benefits from the collaboration fall under both public and private funding opportunities and increase income through licensing and patenting, (Barnes, 2002). Through these relationships, students and researchers also gain exposure to practical problems and potential employment opportunities, (Santoro, 2000).

Davies (1996) depicts that failure to develop academic inventions results from poor communication between Industry and academia as well as inadequate understanding of the marketplace by academics and the death of strategic alliances between these two groups. Davies stresses the importance of the alignment of Industry and University in order to best meet each other's needs and excel not only the organisation but the University as well.

3.2 University-Industry Collaborations in Australia

In Australia, Forsyth et al (2009), notes that there is a serious skill shortage in the technology sector and the country faces real competition as a result of substantial investment in Asia and elsewhere in research and higher education. Australian Universities rely on Industry partners heavily, and risk losing these to offshore Asian competitors. With this as the current situation, there is still minimal literature on the Australian experience of University and Industry collaboration in the IT field.

Bammer (2008) recognises the many forms of collaboration that are currently available, such as Linkage Grants, Corporate Research Centres and other more informal streams in Australia. Bammer, then moves into the research to look at the key management challenges of collaboration which is not as relevant to this study of success factors. Further University Industry collaboration research in an Australian setting has focused on: postgraduate coursework (Forsyth et al, 2009), corporate University business education partnerships (Ryan, 2006) and on humanities (Cassity & Ang, 2001). Garrett-Jones (2005) completed extensive research into CRCs but this still sits as both the IT side and the scientific side as well and looks very specifically at the challenges and success with CRCs. Hence, there is minimal research on University and Industry collaboration in Australia, and when it is clearly important; this creates a gap which needs to be explored.

3.3 University-Industry Collaborations and IT

University and Industry collaboration is not a straight path, and a lot of research has been done on the barriers to collaboration and the negative experiences which have taken place. Santoro (2000) tells that as powerful as Industry University collaboration is, there is considerable evidence to indicate that industrial managers choose inter-organisational partnerships when pursuing technological initiatives.

Guan et al (2005) completed a study on industrial innovation that looks at Western countries and the barriers that face in University Industry collaboration. Guan focused the findings on China and found the following obstacles to collaboration: lack of an efficient communication channel, immature technology and difficulties in commercializing academic products. China is an immensely different country to Australia, so this encourages the need for an Australian perspective on collaboration in the IT field. Collaboration between organizations and universities require a considerable management effort to be successful (Barnes et al, 2002).

Outlined above are some barriers that could potentially lead to the down fall of University Industry collaboration. Just as important are the success factors that make up the successful University Industry partnerships, which are vital in the current global marketplace. Barnes et al (2002) states that: "Success of a collaborative project is governed by a complex interaction of factors, and the *cumulative result of negative and positive impacts from those factors.*" This further iterates the complexity of success factors that drive Industry collaboration achievement. Entrepreneurial University was identified in exploratory studies as demonstrating that a number of factors can impact on its ultimate achievement including: histories, traditions, organisational structures, University approaches, knowledge exchanges and technology transfers (Boardmand & Ponomariov, 2009).

Previous research has looked into success factors of collaboration between University and Industry partnerships in technology transfer projects. Barbolla & Corredare (2009) completed a study interviewing 30 researchers in different areas of knowledge, with the majority of them involved with information and communications technologies. Analysis was taken of the projects themselves, the experiences, and a determination of what made it successful or unsuccessful, leading to the following success factors:

- High real project usefulness
- High company confidence in the University team
- Evident corporate team interest in assimilating project result
- High corporate capacity to put the results into use
- Good understanding between working teams use of mature technologies or knowledge
- Corporate team composed of sufficient qualified professionals
- Company confidence in project results
- Good coordination between working teams

Barnes et al (2002) completed a large research project that involved six case studies touching a number of industrial partners. The key aim, through a number of extensive interviews was to identify

factors that would increase the probability of a collaborative effort between University and Industry being perceived as critical. The result was a "Good Practice Model" for effective management of collaborative R&D projects that covers the following key areas:

- Partner evaluation
- High quality project management
- Trust, commitment and continuity
- Management processes need to be flexible to react to changes in interest and commitment of the industrial partners
- Importance of achieving mutual benefit

Other research focused on identifying indicators of successful University Industry interactions that were related to interpersonal exchanges (Boardmand & Ponomariov, 2009). Indicators that were found to be most prominent in relation to interpersonal exchanges were: University representative's behaviors, productivity, funding sources, industrial relations, personal attributes and scientific values.

Siegel et al (2003) completed a study in the United States of America that extended past the Barriers to Successful University and Industry relations and qualitatively collected recommendations for future relations. Improvements were identified for both the University and Industry side. University, to improve their understanding of their true "customers", more flexibility in negotiating technology transfer agreements, licensing officers and recognize value of social networks. For Industry, it was recommended that they are proactive in their efforts to bridge the cultural gap with academia and hire technology managers who have University experience.

The above review of the current literature, shows that particularly from an Australian perspective, there has been little to no research on the success factors that make University and Industry collaboration a success. Wohlin (2009), has produced a piece of research recently that uses success factors to explore both academic and Industry opinions on collaboration with each other in the IT field in Sweden. The research further explores what both Industry and University collaborators identify as most important or detrimental to the success of the project. Wohlin (2009) found this research to be particularly useful in providing feedback to both University and Industry collaborators to improve their relationships. This type of research would also be helpful, to gather an understanding of collaboration in the IT field of Australia, and the success factors that are key to the success or failure of University Industry collaboration.

4 Research Method

This research intends to explore that nature of collaboration in Australia between University groups and their associated Industry partners, in the field of Information Technology. Similar to Barnes et al (2002), the research brings together a thorough review of the published literature in the field and combines this with collected empirical evidence. The aim is to identify the success factors that make University and Industry collaboration successful in the Australian context. This section firstly outlines the research questions for this study in 4.1 derived from the previously outlined objectives. Next, section 4.2 looks at the methodology chosen for the data collection of this project. This is followed by section 4.3, a depiction of the research process and an explanation detailing the development of instruments and collection of data.

4.1 Research Questions

Wohlin (2009) completed a piece of research that was designed to collect the experience and lessons learnt from a large collaborative research project that was run between a Swedish University and its Industry partners. The completed research, investigated both the industrial and academic perspective on factors that were perceived as most important in leading to the success of University and Industry collaboration (success factors). As University and Industry collaboration is prevalent in the Australian research community, it was decided to replicate this piece of study within the Australian context. The Australian study aims to cover a variety of areas in University and Industry collaboration, instead of sticking to a singular project. A number of changes were made to the research method and this is outlined below in the Research Process section.

From the research objective perspective, the aims of this research are closely linked to that of Wohlin (2009). The following research questions were investigated, from an Australian perspective:

RQ1: What makes collaboration between Industry and academia successful or unsuccessful?

RQ2: Which success factors are considered most important in collaboration between Industry and academia?

RQ2a: What are the differences between academic and industrial perceptions of success factors in collaboration between Industry and academia?

RQ2b: What are the differences between different roles of academics and Industry professionals in their perceptions of success factors in collaboration between Industry and academia?

RQ2c: What are the differences between the Swedish perceptions of success factors in collaboration between Industry and academia when compared to the Australian results?

4.2 Research Methodology

The original study by Wohlin (2009) was a purely quantitative piece of work, taking 14 success factors previously identified in the literature and designing a survey where respondents prioritised these. This research by Wohlin (2009) was valuable, and it did provide the academic and industrial perception of their collaborative experiences. To further broaden this piece of research, to gather more conclusive evidence and gain a better understanding, it was chosen to incorporate a mixed methodology of both quantitative and qualitative data collection.

To best investigate the current Australian perspective and experience in University and Industry collaborative ventures, it was important to complete the survey that looked quantitatively at success factors, but to also gather data through interviews that gave a broader view of what leads to success or failure of collaborative projects. Therefore a mixed methodology was introduced as this provides a more reliable understanding of a topic, gained by exploiting the strengths of different methods, (Mingers, 2001). Yin (2009) is also in favour of the mixed methodology as it permits investigators to address more complicated research questions and collect a richer and stronger array of evidence than be accomplished by any single method alone.

Quantitative data will be useful as it provides an objective measurement of the success factors, and the qualitative data will generate understanding to support and interpret the qualitative results. Additionally, this combines both the benefits from the quantitative and qualitative methods and generates data that is much richer and holds more explanatory power. By using the combination of methods, it was possible to triangulate the resulting data to generate a stronger and more detailed results analysis. The findings from both the quantitative and qualitative gathering can be analysed individually and then the findings can be cross-validated for better interpretation.

Replication of the Swedish study is advantageous, as it is possible to compare the results from the Swedish survey with that of the Australian survey, with the qualitative data contributing to better understand the differences. Additionally, the survey instrument has been already tested to add to the validity and reliability of the tool.

4.3 Research Process

Figure 1 below depicts the research process implemented for this study. Quantitative data was collected through a survey, simultaneously to the qualitative data that was collected through semistructured interviews. This section outlines the activities that are displayed in Figure 1.



Figure 1. Research Process for this study

4.3.1 Develop Interview Instrument

The introduction of a qualitative aspect to this research resulted in the inclusion of interviews as a data collection instrument. The interviews were designed as semi-structured to enable exploratory discussion between the researcher and interviewee. Barbolla & Corredera (2009) took a similar method to this, as they recognised interviews would provide more exhaustive and live information on the collaborative experiences.

The interview instrument was not particularly long, with the interviews spanning between 30 and 60 minutes. The instrument was designed to first collect some basic information on the participant and then focused on their experiences in collaboration between universities and their Industry partners. The nature of the interviews allowed for the gathering of more comprehensive examples of both successful and unsuccessful collaboration and factors that were identified on these paths.

Additionally, it is important to note that the interview questions were replicated and customized to suit each party (University and Industry) best. A copy of the interview questions can be found in Appendix A & B in section 9.

4.3.2 Interview Data Collection

The interviews branched from the University of New South Wales, where academics were interviewed for their opinions on collaboration and perception of experiences. University of New South Wales also made contact with their Industry partners, allowing for interviews to be made with Industry professional with experience in working collaborative with universities.

In total, 10 interviews were completed: six from UNSW academic staff, 1 Lund University PhD student and 4 from industry partners. Table 1 and Table 2 provide demographic information on the interviewees in relations to their positions and experience levels. Five of the six academic respondents had a large amount of experience in collaboration with industry and three of these had extensive experience in overseas locations as well. From the industry respondents, three of the four had expansive experience in University collaboration, and the fourth had small exposure to

collaboration with university. In total the academic interviewees had an average of 16.5 years of experience in academic positions and 5 of the 6 interviewees had extensive experience in collaboration with industry. The Industry interviewees came from 4 different industries and had an average of 11.5 years employed with their organisation.

University	School	Position	Years in
			Academia
UNSW	School of Information Systems,	Associate Professor	17
	Technology and Management		
	(SISTM)		
UNSW	SISTM	Professor	17
UNSW	SISTM	Lecturer	18
UNSW	Computer Science &	Professor	20
	Engineering		
Lund University	Software Engineering Research	PhD Student	9
	Group		
UNSW	SISTM	Associate Professor	18

Table 1. Distribution and demographic of Academic Participants in Interview

Table 2. Distribution and demographic of Industry Participants in Interview

Industry	Position	Years employed
		at Organisation
Banking, Finance & Insurance	Project Manager	6
Professional & Personal Services	Project Manager	7
Pharmaceutical Industry (R&D,	Associate Director, Information	27
Manufacturing, Marketing and Clinical	Services	
Support for chronic disease medicines)		
Bottler and Distributor	Solutions Delivery Manager	6

The semi structured interviews allowed for the ability to gather more comprehensive examples of both successful and unsuccessful collaboration and the factors that were prevalent in these situations. Additionally, there was the ability to cover lessons learnt by academics and Industry professionals who have been previously involved.

Analysis of the interview data was completed through a content analysis. The interview notes were firstly typed and created into transcripts which were reviewed to ensure all information was captured. Secondly, a spreadsheet was used to draw out common themes and analyse these across all interviewee respondents.

See the Appendix A and B for copies of the two interview instruments.

4.3.3 Develop Survey Instrument

Wohlin (2009)'s study consisted of a short survey, in excel format that allowed those involved in the collaboration (both from Industry and University) to prioritize the importance of different factors in the collaboration. Each participant was given 1000 points to separate between 14 different success factors, these being:

Table 3. Wohlin (2009) Success Factors

Success Factor	Explanation	Source
Champion at company	Person with a dedication and commitment to help at the company	Wohlin (2009)
Champion's network within the company	Size and strength of the champion's network	Wohlin (2009)
Buy in and support from company management	Collaboration is supported by appropriate management levels	Wohlin (2009)
Short term results and impact on Industry	Early result from the collaboration – something of value for both Industry and academia	Wohlin (2009)
Organisational stability	Stability of the industrial organisation in terms of organisational units and the sample people being around during the collaboration	Wohlin (2009)
Researcher has a visible presence in Industry	Extent to which the research is visible in the Industry environment	Wohlin (2009)
Regular meetings	Regular meetings with the involved parties, for example, a steering group for a specific collaborative project	Wohlin (2009)
Relevant expertise of researcher	Competence and knowledge of the researcher	Wohlin (2009)
Attitude and social skills of researcher	Social abilities of the researcher	Wohlin (2009)
Researcher's commitment to contribute to Industry needs	Researcher's attitude towards helping in addressing the industrial challenges and not being too focused only on the research	Wohlin (2009)
Well-organised collaborative research project	Collaborative project's organisation and management	Wohlin (2009)
Research environment at the University	Importance of research excellence in the research environment at the University that the researcher is coming from	Wohlin (2009)
Prior experience of Industry-academia collaboration	Importance of prior experience in conducting Industry-academia collaboration	Wohlin (2009)

This survey design, allows for the relative importance of the success factors to be obtained and there was also the opportunity for respondents to add any factors that they did not believe were covered. Wohlin (2009) used these results to identify both the Industry and academic opinion on the factors governing the success of their collaborative initiative.

Through the review of literature, it became clear that Australian Universities interacted with organisations in a number of different forms such as: Linkage Grants and ARC (Cassity & Ang, 2006), CRC's (Bammer, 2008) and co-operative education programmes, (Ryan, 2007). Additionally, international experience shows that research is increasingly being carried out in organisational forms, such as University-Industry collaborative research centres, (Garrett-Jones et al, 2005). With this in mind, it was decided to replicate the survey and modify it so that it captured not only the

breadth of collaborative University Industry experience, but the type of experience involvement and the positions held in relation to the collaboration. This meant that the target population was far greater, and a more overall picture could be created of the Australian University Industry collaboration experience instead of focusing on a singular project.

Originally, Wohlin's (2009) survey was an Excel spreadsheet that allowed for the participant to record their weighting on the 14 success factors. The survey also identified what "role" the respondent had in relation to the collaboration. Wohlin's (2009) survey was completed by 16 University staff and students and 23 Industry representatives from four different companies.

To reach a larger audience and have a more user friendly interface, for this research piece, the survey was re-created to an online survey site: questionpro: (<u>www.questionpro.com</u>). The link used for the survey was: <u>http://universityindustrycollaboration.questionpro.com</u>. From review of the literature, it was noted that a number of other success factors had been identified in previous research. The majority of these were covered by the 14 chosen factors by Wohlin (2009), but following two, had not been included:

Table 4. Additional Success Factors

Success Factor	Explanation	Source
Trust	Trust among partners, maintaining the flow of	Barnes et al
	information, building rapport	(2002)
Short Term Results and Impact on University	The University people participating in the collaboration find it useful and helpful, and hence they are willing to participate.	Barnes et al (2002)

These two factors were therefore added, to make a total of 16 success factors that the respondents could spread their 1000 points across. Additionally, the survey was generated so that it split between both Industry and University representatives, to gather the correct data. For Industry representatives it requested the organisation name, Industry, length of time in collaboration, universities involved and Industry role taken. For the University representatives it requested the University name, length of time with this University, years of experience in collaboration and the academic position towards this collaboration. For both Industry and University it also requested the type of collaboration involvement and extent of experience in collaboration. These added variables, were attained to gather a clearer understanding of those who were rating the success factors and to analyse how different experiences could possibly create impact on the different success factors identified.

4.3.4 Survey Data Collection

The survey targeted both academia and Industry professionals. The survey itself was reviewed by University staff and piloted, before it was sent out. The pilot study was small, and consisted of four data points. This was to cover the changes that had been made from Wohlin's (2009) survey, as the

instrument had been sufficiently tested previously. It was sent to University representatives around Australia that worked in IT / Information Systems schools. For the Industry perspective, the survey was sent to UNSW partner organisations, for their opinions on collaborative ventures with universities. Table 5 outlines the number of respondents:

Table 5. Survey Response rates

	TOTAL	Academia	Industry	Unknown
Started	107	47	24	36
Completed	51	34	17	0

Some additional information was collected about the participants, and this is covered in the following three tables. Table 6 shows the different positions that academic respondents had held in relation to University Industry collaboration, table 7 shows the type of experience that academic participants had been involved in and table 8 shows the extent or amount of collaboration that academic participants had been involved in.

 Table 6. Distribution of positions of Academic participants in Survey

Position at University	Percentage of
	Respondents
Researcher (e.g. Post Doctorate, Associate Lecturer or Lecturer)	17.65%
Senior Researcher (e.g. A/Professor, Professor or Research Fellow)	41.18%
Student (Honours student or Postgraduate student)	44.18%
New Graduate	8.82%

 Table 7. Distribution of type of experience of Academic participants in Survey

Type of Collaborative Experience	Percentage of
	Respondents
Development Project	20.5%
Joint Research Project	47.1%
Students Undertaking Industrial Training	47.1%
University Consulting	26.47%
PhD, Masters or Honours research	64.7%
Grant - ARC, Linkage or Other	32.35%

 Table 8. Distribution of amount of experience of Academic participants in Survey

Amount of Collaborative Experience	Percentage of
	Respondents
Extensive	26.4%
Regularly	17.65%
Some	50%
None	5.88%

The same information was derived for the Industry participants of the survey. Table 9 shows the different industries that the respondents were employed in, table 10 shows the positions in organisations of the Industry participants and table 11 shows the type of experience that Industry participants had been involved in and table 12 shows the extent or amount of collaboration that Industry participants had been involved in.

Table 9. Distribution of industries that respondents worked for

Industry that Organisation Belongs	Percentage of
	Respondents
Professional & Personal Services	23.53%
Banking, Finance & Insurance	47.1%
IT & Telecommunications	11.76%
Health & Aged Care (Incl. Retirement Developments)	5.88%
Pharmaceutical Industry (R&D, Manufacturing, Marketing and Clinical	5.88%
Support for chronic disease medicines)	
Bottler and Distributor	5.88%

Table 10. Distribution of position within the organisation that the participants in Survey held

Position in Organisation	Percentage of
	Respondents
Industry Sponsor	47.1%
Project owner / Manager in Industry	35.2%
Collaborator in Industry	47.1%
Developer	5.88%

Table 11. Distribution of type of experience of Industry participants in Survey

Type of Collaborative Experience	Percentage of
	Respondents
Development Project	17.65
Joint Research Project	17.65
Students Undertaking Industrial Training	82.35%
University Consulting	5.88%
PhD, Masters or Honours research	17.65%
Grant - ARC, Linkage or Other	11.76%

 Table 12. Distribution of amount of experience of Industry participants in Survey

Amount of Collaborative Experience	Percentage of
	Respondents
Extensive	23.53%
Regularly	17.65%
Some	41.18%
None	17.65%

See Appendix C for a copy of the survey instrument.

5 Results

This section provides the results that were gathered during this study of University and Industry collaboration in Australia. The results have been split into two main divisions, the first being that of the survey results in section 5.1 and secondly that of the interview results in section 5.2.

5.1 Survey Results

The survey results were analysed to establish the complete set of rankings across the 16 success factors. Three data sets were drawn from the survey including overall results, University specific results and Industry specific results. Industry and University were broken down, so it was possible to compare the different perspectives, as well as the overall results were analysed.

Each success factor is measured by a rank percentage on the left hand side of the graph. This calculation is the percentage of the value of points that the success factor received out of the total points that were available. This was used, to take into account the differences in number of responses from Industry and University.

5.1.1 Overall Survey Results

The survey results, when analysed as a single data set, combining that of the Industry and University perspectives, provided an overall rank of each success factor of importance to the success of University and Industry collaboration. Figure 2 depicts that final ranking for each success factor in this overall set of results.



Overall Rankings

Figure 2. Overall Rankings of the Success Factors

Overall, the three top ranking success factors for this study completed were:



Overall Top Rankings

Figure 3. Overall Top Rankings of Success Factors

These results shown in Figure 3 are interesting, as they are all related to the Industry side of the collaboration. They show that there is a strong focus on the industry involvement in leading to the success of the collaborative venture. This shows that the success ways more heavily on the organisational side of the collaboration. The third factor though, can be seen as both academic and Industry, as it requires for the academics to provide value and short term results, visible to the Industry.

Overall, the three bottom ranking success factors for this study completed were:



Success Factor

Figure 4. Overall Bottom Rankings of Success Factors

These results are quite different to the top three factors, as these are all based on the University. Looking at these results side-by-side, it has clearly been identified that the success factors lie with the Industry and not as much with the University. This displays that the Industry has more power over the collaboration and their handling of this collaboration will ultimately lead to its success or failure. As there were uneven response rates from Industry and the University – this could be the reasons for these rankings. Hence it is important to look at each perspective. Additionally, the short term results and impact on University is the lowest rated factor, showing that it is more important that Industry gets value and results from the collaboration than the University.

Just over 4% of the overall rankings lay with the "other" category. Participants had the opportunity to select a success factor that they believed was missing from the list. The following are the success factors that make up that other:

- Commitment from University management
- Clearly defined problem, with a common vision and approach (i.e. everyone is on the same page)
- Focus on the balance of needs genuinely meeting both the industry's needs (practical outcomes) and academia's needs (students must achieve a PhD)
- For industrial training the organisation must foster an environment that engages the student
- Existing contacts between people in the research team and people in the organisation before the project begins
- A real industry problem that exists, is important and of interest to both industry and academia

5.1.2 University Survey Results

The survey results, when analysed as looking just at the University perspective, provided an overall rank of each success factor of importance to the success of University and Industry collaboration. Figure 5 depicts that final ranking for each success factor in the University perspective set of results.



University Rankings

Focusing on just the academic responses, the following were the overall three top ranking success factors identified:



University Top Rankings

Figure 6. Top 3 Ranking Success Factors from University Perspective

Two of these three are the same as the overall three factors that were identified. The third factor came in at overall rate of 5, so it must not have been seen as that important by Industry. Again, the top three results are Industry focused, even the third factor as it is about the researcher committing and delivering to the Industry.

Focusing on just the academic responses, the following were the overall three bottom ranking success factors identified:



Figure 7. Bottom 3 Ranking Success Factors from University Perspective

Two of these factors are the same as the overall results, but in different positions. The third bottom rank has been selected as having prior experience in collaboration, which is clearly not seen as particularly important to the University representatives.

5.1.3 Industry Survey Results

The survey results, when analysed as looking just at the Industry perspective, provided an overall rank of each success factor of importance to the success of University and Industry collaboration. Figure 8 depicts that final ranking for each success factor in the Industry perspective data set.



Industry Rankings

Success Factor

Figure8. Top Ranking Success Factors from Industry Perspective

University Industry Collaboration

Focusing on just the Industry responses, the following were the overall three top ranking success factors identified:



Industry Top Rankings

Figure 9. Top 3 Ranking Success Factors from Industry Perspective

Compared to the overall results identified, these are exactly the same, which shows that the Industry opinion is aligned with that of the combined University and Industry results. In comparison to the academic results, the first two are once again the same (ordered differently). The third "Short term results and impact on Industry" was ranked as the 7th most important from the academic perspective. This shows that the Industry prioritises what it gets out of the collaboration, but University do not rate this as highly at all.

Focusing on just the Industry responses, the following were the overall three bottom ranking success factors identified:



Industry Bottom Rankings

Figure 10. Bottom 3 Ranking Success Factors from Industry Perspective

Two of these factors were also identified in the overall results, showing that Industry once again is aligned to the overall results. These results reinforce that it is not as important to the collaboration if those involved have had previous experience, compared to the other factors identified.

5.1.4 Comparison

Table 13 draws together the top three success factors, identified in the survey results for some more clarity on the different ranks for each category: overall, University and Industry.

Rank	Overall	University	Industry
1	Buy in and Support from	Champion at company	Buy in and Support from
	company management		company management
2	Champion at company	Buy in and Support from	Champion at company
		company management	
3	Short term results and	Researchers commitment to	Short term results and
	impact on Industry	contribute to Industry needs	impact on Industry

Table 13. Overal	l results co	mparison (of top	3success	factors
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These results show that the overall rankings and the Industry rankings are identical. The University results, are very similar with two of the fields the same, just in a different order. Researcher's commitment to contribute to Industry needs - is only seen as important by the University staff themselves. Whereas Industry, focus on all factors that affect or are affected by themselves. It is important to note in reviewing these results that there were double University respondents compared to those from industry, and this affects the overall collated results.

The following table draws together the bottom three success factors, identified in the survey results for some more clarity on the different ranks for each category: overall, University and Industry.

Table 14. Overall results comparison of bottom 3 success factors

Rank	Overall	University	Industry
	Short term results and	Short term results and impact on	Research environment at the
1	impact on the University	the University	university
	Research environment at	Researcher has a visible presence	Researcher has a visible
2	the university	in Industry	presence in Industry
	Researcher has a visible	Prior experience of Industry-	Prior experience of Industry-
3	presence in Industry	academic collaboration	academia collaboration

For the bottom three factors, there are four different factors that are being rotated around, the one with the lowest ranking being: the prior experience of Industry-academic collaboration. It is clearly seen that no prior experience is needed to complete a successful collaboration, and this can be equated to the survey demographics. Only 26.4% of academic survey respondents had extensive experience in collaboration and only 17.65% had regular experience. On the industry side, 23.5% had extensive experience and 17.65 had regular experience. This shows that the respondents themselves do not have a huge amount of experience in their collaborations, for the academics 55.95% had some or less experience and for industry, this figure was 58.7%.

5.1.5 Comparison: Sweden vs Australia

These results are able to be compared to those from Wohlin's (2009) previous study on University and Industry success factors. Starting with the overall top ranking success factors, the following were identified in Wohlin's (2009) research:

Table 15. Overall results comparison of top ranking success factors in Sweden and Australia

Rank	Australian Result	Swedish Result (Wohlin, 2009)
1	Buy in and Support from company	Buy in and Support from company
	management	management
2	Champion at company	Champion at company
3	Short term results and impact on Industry	Attitude and social skills of researcher

These results show that the top two identified success factors are identical in both the Australian and Swedish study. The third factor identified by Wohlin (2009) was not found on any of the Australian top three ranking factors, from either Industry, academia or combined. The Australian top ranking factors are all Industry focused, but the Swedish study brings in a University focused factor, that looks at the skills and attitude of the academic.

Looking at the overall bottom ranking success factors, the following were identified in Wohlin's(2009) research:

Table 16. Overall results comparison of bottom ranking success factors in Sweden and Australia	

Rank	Australian Result	Rank	Swedish Result (Wohlin, 2009)
1	Short term results and impact on	1	Prior experience of Industry academia
	University		collaboration
2	Research environment at the University	2	Research environment at the University
3	Researcher has a visible presence in	3	Well-organized collaborative research
	Industry		project

The only common factor in these results, is that of the "research environment at the University", once again steering towards this idea that it is the University that is less influential over the collaboration success. All three Australian results focus on the University and its research environment, researcher presence and short term results. The Swedish study high lights that the least important factor is previous experience to the collaboration; this indicates that it is not necessary to have previous experience in collaboration to make it successful. The third Swedish factor was not raised in either the Australian top three or bottom three factors, sitting more in the middle of the success factors.

Wohlin (2009) provided results for their different roles identified, the three roles being: PhD students, Senior Researchers and Industry.

Firstly comparing the top ranking Industry results, shows:

Table 17. Overall results comparison of top ranking success factors for Industry perspective in Sweden and Australia

Rank	Australian Result	Swedish Result (Wohlin, 2009)
1	Buy in and Support from company	Buy in and Support from company
	management	management
2	Champion at company	Champion at company
3	Short term results and impact on Industry	Researcher's commitment to contribute to
		Industry needs

From the Industry perspective, the Swedish and the Australian results are almost identical. The only difference exists with the third top ranking success factor, being quite different. Here the Australian opinion once again focuses on the Industry perspective, but the Swedish has moved towards the researcher, their contribution, and commitment as key research agent.

Secondly, are the success factors, prioritised by the researchers, Wohlin (2009) restricted this role to senior researchers, but this research allowed for the inclusion of all levels of research. This could result in a possible difference of results.

Table 18. Overall results comparison of top ranking success factors for researchers perspective in Sweden and Australia

Rank	Australian Result	Swedish Result (Wohlin, 2009)
1	Champion at company	Champion at company
2	Buy in and support from company management	Attitude and social skills of researcher
3	Researcher's commitment to contribute to Industry needs	Buy in and support from company management

Once again, the Australian and Swedish results are very similar, with both identifying champion at company as the number one success factor. Each research has also included the buy in and support from company management, but it is the third values that are different, but similar in that they both focus on the researcher and their commitment and attitude.

Thirdly, here are the success factors, prioritised by the students. Wohlin (2009) restricted this role to PhD students, but this piece of work looked at all levels. This could result in a possible difference of results.

Table 19 Overall results comparison of top ranking success factors for student perspective in Sweden and Australia

Rank	Australian Result	Swedish Result (Wohlin, 2009)
1	Short term results and impact on Industry	Champion at company
2	Well-organized collaborative research project	Buy in and support from company management
3	Relevant expertise of researcher (main person in the collaboration)	Attitude and social skills of researcher

This is the first top ranking set that has been completely different, with not a single factor in common. This could be because of the different levels of students, who perhaps have a lot less clarity and experience in University and Industry collaboration.

5.2 Interview Results

To better explore the collaborative experience between Australian Universities ICT Schools and their partnering organisations, interviews were completed that delved into collaborative experiences, touching on both successful and unsuccessful University Industry collaborative projects and identifying factors that lead to or inhibited the project success.

Each interviewee made it clear, that there was no singular factor that caused the break down or success of a collaborative project and that it is the sum of all parts and individual factors. Some factors, depending on the type of collaboration and the environment will be more effective than others, but it is primarily the interaction of these factors.

The interviews identified a number of factors that the experienced University and organisation staff believes to be the most impacting on collaborative success between both parties. These are the findings:

Mutually beneficial for both the University and Industry

This factor, was raised in every interview, for the collaboration to be successful it must have mutually beneficial outcomes. Often this leads to a balancing act, as each party may need to work to meet each other's needs. UNSW Co-Operative programme is the perfect example of successful collaboration, and this is due to the fact that all involved parties get benefits from this: students get the experience, University gets the money and partnership with the organisation and the organisation gets access to high calibre students for recruitment and work experience at a low cost.

Organisations can throw money at a University but this does not always work, there needs to be guidelines, discussions or planning around what the organisation wants out of the collaboration. In these collaborative ventures, there is no such thing as a free lunch, hence when the organisation is funding, they need to be clear on the outcomes they will receive from this. From the University perspective, partnerships with Industry can lead to Government grants, such as: CRCs and Linkage

grants.

Academics to best engage with University need to attempt to turn something theoretical into something tangible, that Industry will be seen as valuable. Mutual benefit is what ultimately drives the relationship between the two parties, and this relationship is an important factor in the network of parts establishing a successful collaboration.

Interesting to Academics

This point comes back to the differences between academic and organisational career structures. In the academic world, promotions are driven by the number of papers published in journals and the standard of the journals. When it comes to a collaborative piece of work, the academic needs to be able to get papers published out of the relationship.

Unsuccessful experiences have been identified, when the academic loses interest in the research and it comes to a standstill. Further, as the research progresses academics might realise that there is nothing to be gained theoretically through this piece of work. Consequently, this same factor can impact negatively on the Industry experience, as they see the academic getting bogged down in all the detail and losing sight of the overall goals of the collaboration.

In some collaborative forms, the academic is seen to take on a consulting type of role, and this can be seen as unsuccessful from the academic perspective as they do not achieve anything from this. Financially, consulting will provide some extra income, but usually the type of work and problems presented are not enough to make theoretical advances. As an interviewee put it: "We have consulting firms for a reason". Similarly, academics can struggle when organisations place non disclosure agreements (NDA) on the collaborative pieces of work, making it very difficult for academics to collect, use and publish data.

Building a Personal & Sustainable Relationship

Collaboration has been identified as relying primarily on the relationship between the two involved parties. Both parties need to work to build that relationship, to ensure that it is sustained during and past the collaborative effort, to reach full potential value. The relationship requires people with two things: firstly the skill to keep it going and secondly the passion/motivation to put in the effort required. People are an important part of the University Industry collaboration and this is demonstrated through the relationship.

For the relationship to remain strong, it needs to be based on trust and honesty, another factor that has been identified. Additionally, it was raised that the relationship needs to involve open and clear communication. University staff identified that collaborative ventures depended on the people involved, and the relationship between these people being effective and positive. In the collaboration, there needs to be the right people managing the account, and they need to understand "give and take" – sometimes you need to lose a small part to gain more overall. This is prevalent in University and Industry collaboration.

Trust

When choosing to collaborate with universities, the organisation needs to be prepared to take a chance on the University and trust them. Academics therefore need to build a relationship with Industry based on trust and honesty. Trust from Industry that academia will do things well, will lead to future loyalty from the organisation. Successful collaboration can be demonstrated by the amount of trust existing between the parties, especially because Industry employees are more willing to make time when they appreciate the academics and trust them. Transparency, where both the University and Industry are clear on the expected outcomes and goals of the collaboration and clear as to how it is progressing, helps to build the trust.

Champion in Organisation

A champion in the organisation is seen to those experienced in this field, as a key Industry sponsor that actively supports the piece of collaborative work. Unsuccessful projects have occurred with this individual has moved on, and the whole project has collapsed when there has been no one to fulfil their place. Academics see the management as effective, as it provides direction for the piece of work, as the Industry leader usually has a long term vision for the piece of work. Academics can get caught up in the detail, and possible lose sight of the overall picture and what Industry expects, hence the academics benefit from this direction.

Additionally, the University needs to provide encouragement and support towards the research as well. Collaboration has been particularly successful where the Industry professional has provided the final outcome of the project and then given the University staff space to complete the project and best achieve the outcomes.

University and Industry Time Frames

Issues have been identified as arising due to the fact that Industry and academia work on fairly different time frames. University tends to work slowly, because it is in a much lower level of detail. Whereas Industry is fast paced, and managers are continually under pressure to meet tight time frames. Therefore not only do University and Industry need to align their objectives, but they need to bring into line their time frames.

Staff Turnovers

A breakdown in collaboration has been experienced when the main Industry sponsor has left, when research students have moved on, when academics have moved countries and so on. Staff turnover is seen to be far greater in Industry, and this can lead to a breakdown in collaboration. Due to this constraint, the relationship between the University and organisation should be built so that it relies on multiple players. The relationship needs to extend past, just two individuals and into both the organisational team and the University school or faculty. This ensures that when staff is moved, the collaboration can continue, as there are other individuals who are able to fill the gaps.

Relying on Students

University and Industry collaboration, often involves students, and it has been identified that these students can be a key risk in the success of a collaborative venture. The primary limitation with students is that they do move on, like staff turnovers. Collaborative ventures like the UNSW Co-Op program, relies on the students to make it successful. Experiences where this program has not been successful has been due to the students not being motivated to work, slacking off and managers in Industry that do not provide the students with a worthwhile experience.

In situations of Masters, PhD and Honours projects, the University is relying on the students to complete the work to a high standard, but they cannot do much more than monitor their progress if they are ineffective or underachieving. Therefore University needs to aid the students and engage them in collaboration and try to keep them motivated.

Noticeable Country Difference

A number of University staff that were interviewed, had some additional collaborative experience overseas. From a Swedish perspective, access to Australian information is very difficult, starting with the ethics approval process and numerous consent forms such as NDA's. From an American perspective, they believe that senior academics are more Industry aligned than those in Australia, and to be successful in the US academic world, they need to be in some sort of Industry partnership.

From a European perspective, the European Union differs from the Australian equivalent ARC (Australian Research Council) in that they only focuses on pieces of work that are at least a couple of million Euros and have to involve different states and different industries. European Union supports primarily applied science research and these usually span across countries, and universities.

Other Interesting Points Made

Two more interesting points were raised during the interviews, these were both from Industry representatives and they are not success factors, but they are worth a consideration.

- 1 Clear strategic engagement is missing between Industry and University parties. Industry is able to help the University in making the right type of graduates that they are after. CEO level engagement is perhaps required, to really value academic partners. Currently organisations often value their clients and Industry partner's way above their University partners - and this could be a large mistake. It is clear, that University and Industry are again living in Silos - not interacting to be aware of these things.
- 2 Idea of using Portfolio theory, and applying this to collaboration from the University side. To elaborate, this is to target where the collaboration should take place, with whom and where. As collaboration thrives on being advantageous to the University and Industry, it would be even more successful if pieces of work were chosen where Australia has a natural advantage. Advice is to use a filter and specific criteria, and rank and evaluate all opportunities for Industry collaboration research in general.

6 Discussion

By returning to the original, research questions that were derived in the Research Method section of this report, it is possible to take all collected data and draw out the key results identified through the combination of the qualitative and quantitative data.

RQ1: What makes collaboration between Industry and academia successful or unsuccessful?

Barnes et al (2002) states that: "The success of a collaborative project is governed by a complex interaction of factors and cumulative result of negative and positive impacts from those factors". This clearly supports the findings that results from this piece of research. The interview data showed that there is no singular factor, but a network of factors that interrelate to lead to a successful piece of University and Industry collaboration. The survey results sustain this further, as there was support across all the factors of ratings of importance. The factors were rated with different values, to show that not all factors are necessary and not all factors are equal as well. Through this rating, it was possible to pick out those that were considered the least important and those that were considered the most important in developing a successful collaborative venture between University and Industry.

From the qualitative data, every interviewee highlighted that for collaboration to be successful, it was required to be mutually beneficial to both parties involved. Mutually beneficial, is defined as both parties getting something out of the relationship. The number one, bottom ranking factor was: "Short term results and impact on University", this shows in the survey results that it is not important, the value that the University receives from the collaboration. This could be explained, in that in University and Industry collaboration, in a lot of cases (depending on the form of collaboration) it is more so the researcher or academic that benefits from the collaboration and not the University on the whole (not directly). If the project is around funding, then the University are impacted, but when an academic standing, but the University as a whole is not directly impacted by this.

The survey results high-lighted that it was primarily the Industry partners that made a piece of collaborative research successful or unsuccessful. The top rankings focused on the champions in the company, short term results and impacts on Industry and support from company management. The interview results aligned with this, but brought in more of the academic side as well, high lighting that collaboration is all about the relationship. And for the relationship to survive and furthermore generate success it must first meet each parties needs and work towards a goal that has been clearly defined and agreed upon. It is possible that the survey results swayed towards the industry side factors, because there were uneven response rates between University and Industry respondents. Hence both Industry and University results were analysed individually to rule out this bias.

RQ2: Which success factors are considered most important in collaboration between Industry and academia?

From the Australian perspective, overall the most important success factor in collaboration was the buy in and support from company management. The interview results did not really touch on this area, but more focused on the need for a champion in the company. This corresponded to the second most important overall success factor, that of a champion in the organisation. The interview results described this to be the key Industry sponsor who is actively supporting the collaborative work. From the academic perspective, this is effective as it provides strong direction and continued support from the organisation. This ties in the first factor, of buy in and support from company management, as it is the champion who powers this support and ensures that the organisation continue to buy in on the collaboration.

Furthermore; the third important success factor is that of short term results and impact on Industry. This fits nicely into the interview feedback, where it was identified that the collaboration needs to be mutually beneficial, ensuring that the Industry receives results from the collaboration. Also, it was identified that universities and their Industry partners work on diverse time scales, where things move much faster in Industry, and there are demands for deadlines and value producing activities. Hence, it is vital that Industry receive short term results and noticeable changes so they continue to champion the research and ultimately continue to provide the buy in and support from company management.

These top ranked factors fit in with the previous research of Barbolla et al (2009) identifying four factors of importance and these were: project features, company involvement, core competency and motivation of the University and relationship among players. Company involvement is imperative, as all three top factors found in this study focus on the Industry involvement. It should also be noted that the majority of survey respondents had experience that was varied in collaboration, and different types of collaboration can lead to different success factors identified. From the University respondents their experience lay mainly within PhD, Masters and Honours Research, Joint research with industry, followed by Students on Industrial Training and Grants such as Linkage or CRCs. On the industry side, experience was mainly in the form of students on Industrial Training, Development projects, Joint research project s and PhD and Masters Students completing research.

On the lower ranked end of the scale, those factors which were seen as least important are those to do with: researcher's presence in Industry, research environment at the University and short term results and impact on University. The interview data was more limited in this area as well, but it was noted that the University needs to encourage its staff to be involved in collaborative ventures. It was seen that Industry perceived University staff to focus on their time and efforts on research that does not mean much to the real world, an example raised was "over-innovating". This was described as innovation moving faster than people could handle and were willing to accept. The danger exists, that the University invests money in these projects, and then they are just disbanded or disregarded

in the real world. University and Industry collaboration is advantageous as it brings in the real world partners and the real world experience, to solve a number of these issues.

The interviews also picked up on factors around the people involved in the collaboration and how often collaborative relations would collapse when individuals moved on to different projects, lost interest in the work, or students were involved that did not perform as desired. On the overall rankings, the fourth important factor is that of the attitude and social skills of the researcher, so this has also been highly rated in the research piece. It is not just the attitude and skill, but it is about building the relationship between the two parties that is stable and dependant.

RQ2a: What are the differences between academic and industrial perceptions of success factors in collaboration between Industry and academia?

From the University perspective the top success factors identified were the champion at the company, buy in and support from company management and the researchers commitment to contribute to the needs of Industry. This third factor was not in the overall results, and this ties into the information collected during the interviews. For researches to exceed and be promoted, emphasis exists on their performance in relation to the number of papers they have published. This is dangerous in collaboration, as academics can loose sight of the business issue and go deep into the theoretical side of the research. This can lead to failure of the project and the Industry not getting what it originally expected from the research. Therefore it is important that the researcher maintains a commitment to the organisation or Industry.

From the Industry perspective the top success factors identified were the buy in and support from the company management, champion at the company and short term results and impact on Industry. These results are very similar to that of the University, with the first two factors identical and just ranked in a different order. As this is the Industry perception, it makes sense for them to see it as important to receive short term results from the collaboration. In the survey results, 6 different industries were represented, so this spreads the results over different fields, making it more valid.

Looking at the bottom factors, University perspective ranked the bottom three factors as short term results and impact on University; researcher has visible presence in Industry and prior experience of Industry academic collaboration. Industry identified the following three bottom factors being research environment at the University; researcher has visible presence in Industry and prior experience of Industry academic collaboration. The only difference is between the very bottom factors and this is interesting, as the University perceive the short term results and impact on University to be the very least important factor. The interview data did not really touch on these factors, except for that of the mutually beneficial need of collaboration.

RQ2b: What are the differences between different roles of academics and Industry professionals in their perceptions of success factors in collaboration between Industry and academia?

During cross analysis with the Swedish results, the University perspective was broken down into two

key roles to find the differences in the perception of students and researchers. From Australian University research perspective the top three factors identified were: champion at the company, buy in and support from the company management and researcher's commitment to contribute to Industry needs. These results are exactly the same as the overall University opinions expressed.

From the student perspective though, the results are quite different: The top three factors from Australian University student perspective were: short term results and impact on Industry, wellorganised collaborative research project and relevant expertise of researcher. The difference in these results to all of the other results could be the fact that students have not yet acquired enough experience in these collaborative ventures, to properly understand what the success relies upon. This is backed by the data that 62.5% of students had only "some" experience in University collaboration. The interviews depicted students as a key area of concern in collaborative ventures between Industry and universities because they can be ineffective, turn over rapidly and lose motivation and interest in the piece of work they are responsible for. This paints students, as perhaps a failure factor and not a success factor, and this can be seen in the very different results drawn from their perception.

RQ2c: What are the differences between the Swedish perceptions of success factors in collaboration between Industry and academia when compared to the Australian results?

The Swedish study conducted by Wohlin (2009), identified exactly the same first two ranked success factors: buy in and support from company management and champion at company. The third factor identified was that of the attitude and social skills of researcher which was identified as the fourth most important factor in the Australian results. This shows that the overall perception is very similar between Sweden and Australia. The interviews also showed that the researcher was the key player in building the strong relationship that the collaboration relies on. It was identified that sustainable collaboration was created through sustainable relationship, which would require a positive and hard work attitude of the researcher and strong social and communicative skills. Furthermore Boardman & Branco (2009) support this by relaying that one of the most prominent indicators of successful University Industry interactions are related to interpersonal exchanges.

Looking at the bottom ranked factors there are a number of differences. Wohlin (2009) noted the bottom three factors to be: prior experience of Industry academia collaboration, research environment at the University and a well-organised collaborative research project. The only corresponding factor here to the Australian results is that of the research environment at the University. During the interviews, prior experience was not touched on as being essential to collaboration success and this is mirrored in the Australian factor results. A well-organised collaborative research project was alluded to in the interview transcripts, but not picked up as a common theme that was vital to the overall success.

Limitations of this Study

The main limitation of this study was the lack of interest from Industry sponsors. It would have been beneficial to have more interviews with Industry partners, as only 4 in total were made available. For the survey, there were unequal response rates as only 17 Industry representatives filled in the survey compared to the 34 from academia. There was also a fairly high non-response rate of approximately 53% of respondents starting the survey and not completing it. This could be due to the nature of the question involving the ranking of success factors. As this was the original format used by Wohlin (2009) it was unable to be changed.

A second limitation of the study was that many academics and Industry professionals are not involved in collaboration. Due to past failed experiences, or lack of interest by academics, both academics and Industry professionals avoid involvement with the collaboration. Hence, a number of respondents would not have completed the survey, as they do not see it relevant to their experience.

A third limitation of the study was that the majority of the data points have come from the University of New South Wales. All interviews were completed, by UNSW staff or UNSW Industry partners. The survey data points were much further spread touching 13 universities around Australia.

7 Recommendations

From this study, a number of recommendations can be drawn to help both Universities and Industry Organisations improve their collaborative ventures. Through analysis of both the survey and interview data, the following recommendations can be supported and made:

University

These results provide University representatives with a reflection of Industry opinion on current University and Industry collaboration success and failure. It is recommended that academics could improve collaboration with their University partners through:

- Providing results on a regular basis to the partner organisation. Companies need to understand what value they are getting for their money, where there money is being used and how the collaboration is improving their organisation. The key to this is completing all activities in the collaboration with transparency.
- Help the Industry to also manage the collaboration from their side of the fence. If an organisation has not been previously involved, use these success factor results to identify the key elements which must be implemented to ensure that the collaboration is a success, for example a champion in the organisation.
- Do not get lost in the theory, and try to drive the changes. Academics can lose sight of the goal of the collaboration so it is important to make sure this does not happen. Provide the organisation with feasible and tangible results that they understand and see the value in.
- Communicate with Industry partners regularly and be present in the organisation. The Industry needs to build trust in the academics and this leads to a sustained relationship that moves past staff turnovers.
- Understand Industry issues, so that the University can focus on this from an academic perspective. Issues have arisen, where academics over innovate and take their research and practices far beyond anything that industry is interested in achieving. Industry is a primary audience for Information Systems and Information Technology research, as this is where it is applied.
- Academics highlighted that applied research was recommended when working collaboratively with Industry. Applied research is more beneficial to industry as it involves tackling a problem and producing data that resolves or explains this.
- Academics need to also be aware of their attitude towards the collaborative venture. Industry standards must be met for professional behaviour. Additionally, social skills will help to develop a strong industry network that will aid future industry collaborations.
- Industry showed in this research that they saw commitment to the research from the

University collaborators to be important. Therefore, academics need to ensure they show their dedication to the research and demonstrate to the organisation that it is of high priority to them.

• Regular meetings are important to industry, as it is a way of staying on top of the collaboration and making sure that the results are being achieved. This will also lead to a collaborative foundation built on trust, which is also vital.

Industry Partners

These results provide Industry professionals with a reflection of University opinion on current University and Industry collaboration success and failure. It is recommended that Industry could improve collaboration with their University partners through:

- Ensuring a champion is established within the organisation to lead the collaboration from the organisation perspective. This gives guidance, and a responsible person for the University to deal with.
- Involve management levels in the collaboration, through sponsoring the research and even just being aware and across it. This adds to the profile of the research within the organisation and Industry, and continues the buy in. Once the funding is lost by Industry, it usually leads to the end of the collaboration.
- Develop relationships with the University that are not based on single individuals. Industry have high staff turn over's, so it is essential that the relationship with the University can survive key players in the collaboration moving on.
- Value your University partnerships; firstly start by assessing the relationships you have with University. Consider how these relationships could be more effective and help your organisation to a greater extent. University's provide your future workforce; consider ways that your organisation can be involved in making the work force that industry will value.
- Understand the nature of academic work and how this will not always perfectly align with Industry. This can be handled, by providing academics with more space so they can meet their own needs as well as those of their Industry partners.
- Demonstrate commitment to the collaboration, as this is important for the University to have the direction and support. If the collaboration is not cared about or not shown any sort of commitment, it will eventually lead to both parties losing interest. Sometimes, it is unknown whether the collaboration will be successful or not, it is possible to give it as much opportunity to be successful as possible.
- Realise that when it comes to collaboration, it might be necessary to lose something small in
 order to gain something far greater. Collaboration involves the balancing act of meeting each
 parties needs and in this situation often the university and industry partners will have
 conflicting needs and goals. Hence it is important to focus on the overall goal of the
 collaboration and not all the individual and less imperative factors.

- In reference to coordinating industrial training for students placed within the organisation, it is important to follow each of these guides:
 - Give the students a real world experience
 - Assign the students to a chunky piece of work, so they are busy and achieving something large, that they can take away from the experience
 - Provide guidance, but do not spoon feed them
 - Make them feel a part of the team
- Make sure that they collaboration addresses a clearly defined problem or aims towards a distinct goal. A common vision and approach between the two parties is fundamental and will impact on the overall success of the collaborative effort. As industry is usually funding the collaboration, they are in the best position to define this goal or problem.

8 Conclusion

University Industry collaboration is effective as it is working with another team or organisation that have a perspective, skills, resources or some other attribute that contributes something relevant to addressing the research problem, (Bammer, 2008). It is this contribution by the two parties that makes a piece of collaboration effective. There is a current perception by Industry that academics are not in tune with their needs since many academics tend to focus their research on issues centred around their own interests or on previous research rather than issues that are important to Industry, (Santoro, 2000).

To date, there are no studies in an Australian context that succinctly explores that nature of collaboration in the IT field between Industry and organisations. Research high lights the importance of collaboration and how collaboration draws together diverse partners with aligned goals, (Bammer, 2008). This piece of research identifies the key factors that makes collaboration in Australia successful and explains this through exploratory research into a number of different projects conducted, spanning the borders of organisations and their University partners.

The results have shown that University and Industry in the Australian context have very similar perceptions of the importance of factors in the success of collaborative projects. Industry partners can take these results and recommendations to further improve their dealings with universities by learning what they value and also better understanding the University perspective as well. Academics can use these results, to understand what the Industry needs to see a collaborative venture as successful and recognising areas such as strategy where Industry and organisations have the potential to be better aligned. By better understanding each other's perspectives, collaboration between University and Industry can be improved in the future to be more effective and successful.

Future research in this field is highly encouraged, as it is seen in the literature the importance of combined University and Industry collaboration. The limitations of this research show that there is possibility to extend this research further with more data points and to be able to make strong generalisations in this area. The recommendations in this research are useful to both Australian academics and industry professionals, but are narrow in that they have come from a limited data set. Hence future research could be driven to further explore these research questions and gather data that is more conclusive and perhaps further spanning multiple countries, universities and industries.

9 Appendix

Appendix A - Industry Interview Instrument

Bac	ackground Information					
1	a)	How long have you been employed / involved with this Organisation?				
	b)	Briefly explain the position that you hold within this Organisation:				
2	a) Ai	re you currently involved in collaborative work with University?				
	b)	How long have you been involved in this for?				
	c)	What University is this with?				
	d)	Can you please describe the form of collaboration this is?				
	e)	What benefits result for the organisation from this collaboration?				
	f)	What benefits result for the University from this collaboration?				
3	Hov	v long have you been working with Industry partners in collaborative pieces of work? (In years)				
	Wha deso	at other types of collaborative projects have you been involved in with Industry? Can you please cribe other types of projects you have been involved with?				
		Development Project				
		Joint Research Project				
		Student undertaking Industrial Training				
		University Consulting				
	PhD, Masters or Honours Research					
5	a) Ir	n thinking about the experience that you have in University Industry collaboration? What do you believe makes a project successful?				
	b)	Can you think of any specific examples – where there was a particular factor / factors that have made this relationship successful?				
	c)	In thinking about the experience that you have in University Industry collaboration? What do you believe makes a project unsuccessful?				

	d)	Can you think of any specific examples – where there was a particular factor / factors that have made this relationship unsuccessful?
6	a) I	n your University Industry collaboration experience – are there any lessons that you have learnt?
7	a) 1	The aim of this study – is to improve the collaboration between University and Industry entities. From your experience – are these any improvements that you can identify? Or comment on?
8	a)	Do you have any closing comments that you wish to share on this topic?

Appendix B - University Interview Instrument

Background Information					
1	a) How long have you been employed / involved with this University?				
b) Briefly explain the position tha		Briefly explain the position that you hold within this University:	you hold within this University:		
2	a) Are you currently involved in collaborative work within Industry?				
		How long have you been involved in this for?			
	b)	What organisation is this with?			
	c)	Can you please describe the form of collaboration this is?			
	d)	What benefits result for the organisation from this collaboration?			
	e)	What benefits result for the University from this collaboration?			
3	How long have you been working with Industry partners in collaborative pieces of work? (In years)				
	What types of collaborative projects have you been involved in with Industry? Can you please describe the types of projects you have been involved with?				
		Development Project			
		Joint Research Project			
		Student undertaking Industrial Training			
			l		

			University Consulting		
			PhD, Masters or Honours Research		
5	a) I	a) In thinking about the experience that you have in University Industry collaboration? What do you believe makes a project successful?			
	b)	Can you think of any specific examples – where there was a particular factor / factors that have made this relationship successful?			
	c)	 In thinking about the experience that you have in University Industry collaboration? What do you believe makes a project unsuccessful? 			
	d)	Can you think of any specific examples – where there was a particular factor / factors that have made this relationship unsuccessful?			
6	a) I) In your University Industry collaboration experience – are there any lessons that you have learnt?			
7	a) 1	a) The aim of this study – is to improve the collaboration between University and Industry entities. From your experience – are these any improvements that you can identify? Or comment on?			
8	a)	a) Do you have any closing comments that you wish to share on this topic?			

Appendix C - Survey Instrument

1. In University - Industry collaboration, which of the following do you best represent?

- 1. University (jump to question further below)
- 2. Industry
- 2. What is the name of the Organisation that you represent?

3. How long have you been employed by / involved with this organisation for? (In years)

4. Which of the following, best describes the Industry that this organisation operates in?

- 1. Banking, Finance & Insurance
- 2. Clubs, Leisure, Hospitality & Tourism
- 3. Construction, Building & Property
- 4. Franchising
- 5. Government, Education & Utilities
- 6. Health & Aged Care (Incl. Retirement Developments)
- 7. IT & Telecommunications
- 8. Manufacturing
- 9. Mining & Resources
- 10. Not-For-Profit, Charities, Cultural & Recreation
- 11. Primary: Agriculture, Forestry & Fishing
- 12. Professional & Personal Services
- 13. Retail
- 14. Transport, Wholesale & Storage
- 15. Other

5. Which of the following Australian Universities have you been involved in collaboration with? You may select more than one answer.

- 1. Adelaide Graduate School of Business
- 2. Australian Catholic University
- 3. Australian Defence Force Academy (ADFA)
- 4. Australian Maritime College
- 5. Australian National University
- 6. Avondale
- 7. Bond University
- 8. Box Hill Institute

- 9. Central Queensland University
- 10. Charles Darwin University
- 11. Charles Sturt University Curtin University
- 12. Deakin University
- 13. Edith Cowan University
- 14. Flinders University
- 15. Griffith University
- 16. PGA International Golf Institute
- 17. James Cook University
- 18. La Trobe University
- 19. Macquarie University
- 20. Institute of Early Childhood
- 21. Melbourne University Private
- 22. Monash University
- 23. Monash College
- 24. Mt Eliza Business School
- 25. Murdoch University
- 26. New Directions Institute of Natural Therapies (NDI)
- 27. Northern Territory University
- 28. Queensland University of Technology
- 29. RMIT University
- 30. Southern Cross University
- 31. Swinburne University of Technology
- 32. University of Adelaide
- 33. University of Ballarat
- 34. University of Melbourne
- 35. University of New England
- 36. University of New South Wales
- 37. University of Newcastle
- 38. University of Notre Dame Australia
- 39. University of Queensland
- 40. University of South Australia
- 41. University of Southern Queensland
- 42. University of the Sunshine Coast
- 43. University of Sydney
- 44. University of Tasmania
- 45. University of Technology, Sydney
- 46. University of Western Australia
- 47. University of Western Sydney
- 48. University of Wollongong
- 49. Victoria University
- 50. Other

6. Which of the following roles in University - Industry collaboration have you held?

- 1. Industry Sponsor
- 2. Project owner / Manager in Industry
- 3. Collaborator in Industry
- 4. Developer

Jump to question 7.

- 2. What is the name of the University that you are currently employed by or involved with?
 - 1. Adelaide Graduate School of Business
 - 2. Australian Catholic University
 - 3. Australian Defence Force Academy (ADFA)
 - 4. Australian Maritime College
 - 5. Australian National University
 - 6. Avondale
 - 7. Bond University
 - 8. Box Hill Institute
 - 9. Central Queensland University
 - 10. Charles Darwin University
 - 11. Charles Sturt University
 - 12. Curtin University
 - 13. Deakin University
 - 14. Edith Cowan University
 - 15. Flinders University
 - 16. Griffith University
 - 17. PGA International Golf Institute
 - 18. James Cook University
 - 19. La Trobe University
 - 20. Macquarie University
 - 21. Institute of Early Childhood
 - 22. Melbourne University Private
 - 23. Monash University
 - 24. Monash College
 - 25. Mt Eliza Business School
 - 26. Murdoch University
 - 27. New Directions Institute of Natural Therapies (NDI)
 - 28. Northern Territory University
 - 29. Queensland University of Technology
 - 30. RMIT University
 - 31. Southern Cross University
 - 32. Swinburne University of Technology
 - 33. University of Adelaide
 - 34. University of Ballarat
 - 35. University of Melbourne
 - 36. University of New England
 - 37. University of New South Wales
 - 38. University of Newcastle
 - 39. University of Notre Dame Australia
 - 40. University of Queensland
 - 41. University of South Australia
 - 42. University of Southern Queensland
 - 43. University of the Sunshine Coast
 - 44. University of Sydney
 - 45. University of Tasmania
 - 46. University of Technology, Sydney
 - 47. University of Western Australia
 - 48. University of Western Sydney
 - 49. University of Wollongong
 - 50. Victoria University

51. Other

3. How long have you been employed by / involved with this University for? (In Years)

4. Which of the following roles in University - Industry collaboration have you held?

- 1. Researcher (e.g. Post Doctorate, Associate Lecturer or Lecturer)
- 2. Senior Researcher (e.g. A/Professor, Professor or Research Fellow)
- 3. Student (Honours student or Postgraduate student)
- 4. New Graduate

5. How many years of experience have you had in the above selected positions in the Academic Field?

7. Which of the following forms of University-Industry collaboration have you been involved in?

- 1. Development project
- 2. Joint Research project
- 3. Students undertaking Industrial Training
- 4. University consulting
- 5. PhD, Masters or Honours research
- 6. Grant ARC, Linkage or Other

8. Which of the following best describes the extent of your experience with University-Industry collaboration?

- 1. None
- 2. Some
- 3. Regularly
- 4. Extensive

In the list below you will find 16 University-Industry Collaboration success factors. In the fields provided you need to decide on a weight for each factor relative to the others. The weight should reflect how important you perceive the factor to be in relation to the other factors. The weight for the factor should be between 0 and 1000. Thus, you do not have to provide weights for every factor, i.e. if you do not think it is at all important. Furthermore, if a factor is regarded twice as important as another factor then it should receive twice as high weight. The total sum of the weights must be 1000 when you are ready. Feel free to add any success factor, that you believe to be relevant which

is not listed below. These can be placed in one of the other fields, that can be described below.9. How do you consider the relative WEIGHT between the different success factors? Assign 1000 points over these different success factors:

- Champion at company ____
- Champions network within the company _____
- Buy in and support from company management ______
- Buy in and support from Industry collaborators ______
- Short term results and impact on Industry ______
- Short term results and impact on University ______
- Organizational stability (Industry partner) ______
- Researcher has a visible presence in Industry ______
- Regular meetings _____
- Relevant expertise of researcher (main person in the collaboration) ______
- Attitude and social skills of researcher ____
- Researcher's commitment to contribute to Industry needs ______
- Well-organized collaborative research project ______
- Research environment at the University ____
- Prior experience of Industry-academia collaboration ______
- Trust _____
- Other 1 _____
- Other 2 _____
- Other 3 _____

If you chose Other above, please name and best describe the Success Factor you believe should be included in the list.

Other 1

Other 2

Other 3

10. Do you have any closing comments?

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