Trust and Distrust in University-Industry Research Collaborations

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ABSTRACT

While the benefits of collaboration between universities and industry partners are widely acknowledged, how does one manage for future collaborative success? The issue is of importance, because successful collaboration is crucial for harnessing key, cross-disciplinary know-how into commercially and economically valuable science-driven industry projects. In the present study, failure to sustain collaboration was explored in interviews with a small number of U-I personnel, with data coded and arranged thematically. Results indicate that potential contributing factors towards collaboration failures include inability to demonstrate or establish one or more of competence, integrity and cross-cultural communication, all precursors to trust. We suggest a study of failures may contribute to better management of future successful collaborations.

Keywords: inter-organisational relationships; cross-cultural management; organisational cultures; strategic alliances; strategy and culture; strategy and structure.

Science-based industries are those that are reliant on science, as compared with industries that make discretionary use of science, as a source of innovation and competitive advantage (2004).

Biotechnology is one of the research-intensive science-based sectors characterised by innovations that are directly linked to technological advances, which in turn are based on results of fundamental scientific research derived from domestic and international research and development (Mohannak 2002). More so than in many European countries, there is a close relationship in Australia between the public-sector science base, private industry and universities (Shohet and Prevezer 1996). In Australia, on average, more than 40 percent of new biotechnology companies formed since 1966 have their origins in research institutions, which includes universities (Thorburn 1999). Hence, firms in the science-driven biotechnology sector are likely to draw upon universities and research institutes for knowledge (Bartholomew 2000; Shohet and Prevezer 1996) and human capital (Bartholomew 2000). They also access universities for expensive, specialised instrumentation (Bartholomew 2000). Thus, U-I collaborations allow the single firm to grow beyond the limitations of its resource boundaries (Bagchi-Sen 2001)

Despite the importance of biotechnology to Australia's future science and economy, comparatively little is understood of the nature of the institutional interactions and patterns of collaboration. U-I collaborations emerged in the second half of last century as key forces in the economy, particularly in
the science-based industries. Collaborations are defined as the creation of new value together by the parties (Kanter 1994). The U-I term encompasses a very broad range of organisational forms and institutional mechanisms for ordering such relationships. Not surprisingly then, U-I collaboration studies generally provide no insight into the research discipline or firm-type, making critical evaluation of the subject difficult. The review and case study by Newberg and Dunn (2002), which concluded that it is unlikely one could have a ‘best’ approach to structures and rules to achieve optimal collaborative benefits, provides a cautionary note to the analysis of and inference from practitioner papers on the topic.

There is a growing recognition of the complex inter-relationships amongst the parties in a collaboration and an evolution of relationships amongst the parties, producing a rich diversity of trust as different tasks, settings and parties become involved in the evolving collaborative process (Rousseau, Sitkin et al. 1998). Furthermore, it is acknowledged that it is the individuals, not organisations, who really define the levels of expectation forming, risk-taking and vulnerability in collaborations (Six 2005).

While the word ‘trust’ is well known and frequently believed to be understood, trust has been defined in many different ways, as described by Morton et al. (2006). Vlaar et al. (2007) confirms that trust and distrust are separate but related constructs and as such, we define trust according to Mayer et al. (1995) as a willingness to be vulnerable to the actions of another party and distrust according to Sitkin and Roth (1993) as negative expectations regarding another’s conduct. Given these definitions, it is also pertinent to note that placement of trust is seen as a subset of situations involving risk (Coleman 1990). This is because there is necessarily risk when one party cannot be certain that another party will deliver what they have promised or that circumstances will not intervene to prevent that party from fulfilling their agreement. Thus trust is only relevant where there is some risk of loss or disappointment (Mayer, Davis et al. 1995).
Furthermore, according to Lewicki and Tomlinson (2003), our trust in another individual is based on our evaluation of three factors. First is ability, which is knowledge, skill or competency. Second is integrity, the degree to which the trustee adheres to principles that are acceptable to the trustor. Third is benevolence, the evidence of which is honest and open communication, delegating decisions, and sharing control. When these three factors are consistently present, trust in a person is likely to grow (Lewicki and Tomlinson 2003). Not surprising, insofar as trust is associated with enhanced cooperation, information sharing, and problem solving, Lewicki and Tomlinson (2003) say that trust is the key element of successful conflict resolution (including negotiation and mediation). As such, trust is important to successful collaborations. In comparing aspects of trust found in long-term alliances with those of short duration, Bignoux (2006) concluded that ability and integrity are likely to be most influential early in a relationship, as information on one's benevolence needs more time to emerge.

The literature on trust relating to U-I collaborations highlights the impact of cultural differences on trust. U-I biotechnology research collaborators are each believed to have their own cultural approaches to a research collaboration. Practitioners attending the US Government University-Industry Roundtable (1998) stressed the importance of building trust between partners and effective ‘relationship management’ without which it was felt that the collaborators may enter into agreements with an inadequate understanding of the management, internal politics, decision-making structures and even fundamental interests of the other partner, resulting in slow decisions and insufficient resources. Indeed, it has been demonstrated that both transaction costs related to the formation of agreements and coordination costs are reduced by trust. This is because trust not only circumvents the need for explicit agreements, which are time consuming and expensive to construct (Adler 2001; Cvetkovich and Lofstedt 1999; Uzzi and Lancaster 2004), but communication protocols, common understanding and convergent expectations assist in the distribution of resources (Jones, Hesterley et al. 1997). In relationship management, Selnes (1998) found that satisfaction and trust have a complementary role in maintaining and enhancing relationships and both are important to achieve relationship continuity and enhancement.
Undaunted by Huxham (2005), who states that the complexity of collaborations and trust factors make it unlikely that researchers will get beyond the superficial in their research, the current study’s purpose is to explore U-I collaborations that fail. The lack of knowledge on this topic led us to pursue a broad research question: how do collaborators experience and deal with failure? A study of collaboration failures seems an important contribution to understanding how knowledge about failure experiences contributes to management of future successful collaborations.

**METHODOLOGY**

The literature has identified a limited understanding of how collaborators interact with one another in times of distrust. To generate a rich picture to explain or understand behaviour of collaborators, qualitative evidence is necessary (Williams, Money *et al.* 1998). Yin (1989) points to case study methodology as appropriate to how and why questions (e.g., how does distrust develop in a collaboration and why do the collaborators choose to end their collaboration in the face of conflict) where the events are contemporary and the investigator has no control over them. Marshall and Rossman (1989) confirm the appropriateness of case study to identify events, beliefs, attitudes and policies shaping the collaboration phenomenon. Multi-site studies are a means of increasing the generalisability of qualitative research (Gomm, Hammersley *et al.* 2000). The heterogeneity of the sites chosen for study is also likely to affect the degree of fit between studies and situations to which one might want to generalise (Kennedy 1979).

The purpose of the proposed case studies is to describe the breakdown of trust for U-I collaborations. At this stage of the research, the breakdown of trust will be generally defined as a discontinuation of interaction between the U-I parties.

With approval for the study granted by the university human ethics office, we embarked on the research by gathering information from biotechnology research collaborators associated with universities in Australia. Data was collected from individuals in four Australian states. In total, there were 52 participants with thirteen in each of four categories, which were: (a) university researchers (UR) who met the criterion of having collaborated with industry; (b) industry researchers (IR) who
met the criterion of having collaborated with university researchers; (c) industry administrators (IA) such as CEOs, Directors and Business Development Managers who had some operational or strategic management responsibility for U-I collaborations undertaken by the company; and (d) university administrators (UA) who managed commercialisation, contracts and U-I research collaborations. Interviews were carried out with each participant separately, with confidentiality and anonymity assured by use of coding on all data collected.

A structured questionnaire using both open ended questions and Likert-scaled questions was administered by the investigators to all 52 participants. The information collected comprised characteristics of the institution/company; organisational role; collaborative U-I research experiences; geographic spread of networks of research collaborations; perceived benefits of U-I collaborations; and perceptions of the role of universities in the biotechnology sector. A Multi-Criteria Mapping exercise followed, using MC-Mapper (Stirling and Barreau 2005). Sessions took two to three hours. The MC-Mapper program allowed participants to record the criteria they thought to be critical for ensuring successful performance of eight pre-defined scenarios covering models of university-industry collaborations.

During these sessions, it was possible to identify candidates to take part in a further unstructured interview to describe their experiences of an unsuccessful U-I collaboration. Consequentially, six individuals were selected to give different views of three failed collaborations, therefore providing a collective of three multi-site case studies on U-I collaborations and sufficient contextual data to allow inductive patterns to emerge (Eisenhardt 1989). Data gathered from these three case studies of collaboration failure are described in Table 1. Some of the features which mark this project as a case study (Merriam 1988) are that: (a) we identified the cases for study by purposive sampling, selecting specific cases where the collaborators responded to conflict during the collaboration by developing a level of distrust; (b) the cases were a ‘bounded system’, bounded by being a U-I collaborator and an event (breakdown of a collaborative relationship); (c) we used multiple sources of information gained from interviews, questionnaires and documents in data collection to provide the detailed in-depth picture of science-driven U-I collaborations; and (d) we spent time describing the context or setting for
the case, situating the case within an Australian university science research environment, along with
the events leading to the break-down of the collaboration and the aftermath.

All but two interviews took place at the office of the respondents. One of the interviewees had to
undertake some unexpected travel and changed the interview at short notice from a face-to-face to a
telephone interview. The other interviewee changed the meeting place at the last moment to a coffee
shop where the audio recorder did not work satisfactorily. All but this latter interview were
successfully recorded, with recordings used to check notes. When the interviewees were invited to
take part in the case studies, they were briefed on four broad questions that would structure the
interviews. These were: (a) what has been your role in the collaboration; (b) what happened; (c) what
has been the impact of this incident on the collaboration; and (d) what larger ramifications, if any,
exist from the incident. In all cases, there was no need to remind the interviewees of these questions
because they all went straight into their stories in a chronological fashion and covered the topics with
minimal prompting.

RESULTS AND DISCUSSION

Sixty seven percent of the 52 questionnaire respondents were males and 62% of the group was aged
between 34 and 55 years of age. All respondents believed universities should collaborate with
industry on applied research problems, but not for commercial reasons only. Each respondent defined
at least four criteria through MC-Mapper as being important to the success of U-I collaborations with
218 criteria defined overall. For ease of analysis, the researchers identified four broader groupings for
these criteria, namely: intellectual property matters; relationships; transaction costs; and project
outcomes. Figure 1 provides a graphical representation of the number of criteria in each grouping,
according to the participant group. Given that the criteria are a checklist of success factors for U-I
collaborations, they also provide a framework for interpreting the case study narratives of failed U-I
collaborations.

With respect to the case studies, extensive coding for patterns and themes within cases preceded
comparisons across cases. From this layering approach to the data analysis (Creswell 1998), three
themes emerged. These were: (a) establishing competence; (b) maintaining integrity; and (c) communicating to maintain trust. Incorporating ideas from Bignoux’s social exchange perspective (2006) and Selnes’ relationship marketing field (1998), these narrower themes were then combined into two overarching perspectives: (a) precursors of trust; and (b) consequences of trust, as modeled in Figure 2.

Table 1 summarises each of the cases with respect to participant demographics, length of the collaboration and overall collaboration experience. There were five men and one woman in the case studies aged within about twenty years of each other. Longevity of collaborations spanned five to twenty years.

The first theme identified was one of competence, also called ability, knowledge or skills by Lewiscki and Tomlinson (2003). For U-I collaborations, doing due diligence on the technical or business credibility of the individuals is a usual, observed practice to ensure time and effort of academics and business people are well invested. However, in all our cases, there were external referrals or imputed reputations, which helped to provide confidence to the prospective collaborating party. Case A’s UR reflected at the end of his narrative that he had been naïve, “believing what is said in a few words” and the IA in Case B said she was “too trusting” of the scientist, who, in her opinion “…did not realise that this was not a university or a patent library business, but a commercial company requiring revenues as soon as possible…”.

In summary, Case A’s UR was recommended to the industry collaborator by a third party ASX listed pharmaceutical company as somebody expert in their scientific field. The IA in Case A was introduced to the UR as having been a director of a well-known food franchisor and hence was assumed by the UR to have a successful business background. For Case B, the UR was known and trusted as a close friend for many years. The IA in Case B had been the CEO of a commercialisation company located within a university and so was perceived by the UR to be a seasoned ‘technology commercialiser’ ideally suited to helping him take his technology to market. The Case C UR had published scientific papers for many years in his field and was therefore well recognised as having
technical expertise. The IA in Case C was a CEO perceived by the UR as well-credentialed because he
had won a government award for his entrepreneurial success and was running the only company of its
kind in Australia.

The next theme identified was integrity. Evidence of this is provided by the degree to which the
trustee adheres to principles that are acceptable to the trustor. In our cases, we have a rich, deep,
descriptive dialogue of many of the issues identified as exemplifying lack of integrity. These are the
behaviours that eroded even the competence-based trust that built the foundations of the
collaborations. For example, the UR in Case A went on road shows with the IA to help raise money
for future research to be funded by the company in the UR’s laboratory. However, the UR lamented
that he quickly identified a lack of alignment between what was said by the IA to shareholders and
prospective investors and what he saw as the ‘reality’. The UR felt that money raised was “being
siphoned-off” to pay for costs in the company. For the IA in Case A, he listened throughout the road
show to the UR talk up the potential of the scientific discoveries and the need for research investment,
but was later frustrated when milestones were missed and reports to the company and granting bodies
described what would be done in the future rather than what had been achieved since the company’s
investment in the research.

The UR in Case B felt that as the founding inventor, he should be treated with respect and his opinions
listened to by his IA collaboration partner. Instead, he received little or no communication on
company strategy, he was not invited to Board meetings and he suspected that he was being
marginalised in the company. At the same time, the IA in Case B was suspicious of the integrity of
her collaborator when prototypes failed or their development was overdue. She started questioning
whether her UR collaborator had over-sold his technical competence.

After years of informal collaboration with his business collaborator, the UR in Case C was already
aware that his friend was not good at managing cash flow or paying bills. However, when the
relationship became formalised through university and government grant contracts, the UR, as a
university employee, had to side with the university in taking action to obtain money owed and letting
the IA know that his tardy behaviour was unacceptable. The IA in Case C was promised the expertise of his UR colleague for his company’s projects, if he supported the university in obtaining a government grant. When the grant was received, the promised expertise was not delivered. This made him angry when he was asked to deliver on his side of the bargain, particularly when he discovered at this time that there was a mismatch between the verbal agreement on intellectual property ownership for his project and what was recorded in the Commonwealth grant agreement by the university. He felt the earlier informality he had enjoyed with the researcher was being exploited by the university administrators to allow them to make a point to researchers on campus about the evils and pitfalls of developing relationships with industry that did not come through the commercialisation office.

The final theme identified was the existence (or absence) of benevolent trust, which is evidenced by honest, open communication and sharing of control (Lewicki and Tomlinson 2003). The UR in Case A made the astounding statement that after the failure of his five year UI collaboration, he still did not understand what his collaborating colleague had expected out of the association. Communication was lacking and there was no trust shown. Likewise, the IA in Case A claimed that even two years into the collaboration, he was no wiser on what the researcher planned to do, particularly since he wrote reports and plans in heavy scientific jargon, did not communicate informally and missed deadlines for milestones. He found that even after taking the researcher to football games, organising social dinners with spouses included and paying for trips to overseas conferences for the UR, he had not won his confidence and did not feel that he had control of the company’s strategic direction.

It was the UR in Case B who was deeply concerned about the covert behaviour of his industry partner, who would not share control of the enterprise even though he felt he was doing all the work. He said his “emotional and mental share of the company, for which he had started working 16 hours a day, became zero.” In Case B, the IA found herself working around the researcher and delegating control elsewhere because it became evident in her eyes that the UR’s concept of the product-to-market path was extensively compromised so it was “…a matter of acquiring the knowledge and the right expertise elsewhere and putting in place the right scientific team, by which time they had spent all the money raised and made too many mistakes.”
We now combine these narrow themes with the success criteria identified in the MC-Mapper exercise (Table 1) to derive two overarching themes from the case studies—precursors of trust and consequences of trust (Figure 2). In respect to the first theme and referring to Figure 2 for exemplification, our model shows some typical precursors to trust – competence, communication, commitment, conflict management and culture. The participants in the three cases frequently used these words when describing events and matters of concern. In discussing the four themes above, we highlighted the assumption of competence, which in some of the cases was later seen by the respondents to have been wrongly assessed, adding to their negative feelings about the collaboration. We also described the patterns of poor communication that prevented the respondents from moving to an enhanced, benevolent form of trust. The respondents identified their frustration at not being able to manage conflicts. For example, in Case A, even social events did not succeed in bringing the collaborators into a less adversarial relationship. Several of the collaborators commented on not understanding the cultural environment of the other party. For example, the UR in Case B said that he did not trust the venture capitalists but said, “…they are a ‘necessary evil’ if you want to take a product to market”. Likewise, the IA in Case B said he will never work directly with researchers again – he will need someone who understands both commercial and academic cultures to manage any future relationships with universities. The IA in Case C said that in future he would only deal with researchers via an intermediary and everything would need to be in the contract, otherwise, with the different cultures, there would inevitably be misinterpretation of expectations. Evidence of lack of commitment to the collaboration was also highlighted in some of the cases, such as Case A, when the IA described his frustration at the researchers missing milestone dates for reports and in Case C when the IA missed payment dates on the grant to which he was a signatory.

The respondents in the three cases had so little evidence of the precursors to trust in their relationships that one of the main consequences of trust, satisfaction (Selnes 1998), did not meet the levels needed by their personal thresholds to balance against factors such as risk and inconvenience. Although satisfaction with intellectual property emerged as a major success criteria in the MC-Mapper exercise, the UR respondents did not include it in their criteria whilst their industry colleagues rated it as the
most important of their criteria (Figure 1). Such mismatches in expectations highlight differences in culture existing between U-I collaborators that later can be important contributors to a miscommunication about expectations and the cause of conflict and failure to sustain collaborations.

Finally, Table 3 has been derived from a study of entrepreneurial failures by Singh (2007) and it is a useful method of summarising some of the negative factors accruing during or as a consequence of the collaborations in our three cases. It is therefore reasonable to conclude that our case studies did not lead to satisfaction and the participants chose the path to termination of the collaboration rather than trying again to establish the precursors of trust necessary for a continuity of collaboration.

**CONCLUSION**

The use of a multi-site collective of case studies to look at the embedded issue of U-I collaboration failure has provided context-rich narrative supported by multiple sources of information to shed light on factors essential for satisfaction of all parties involved in U-I collaborations. With collaborators from different organisational cultures, the findings suggest it would be prudent to develop policy and management practices that allow initial screening of parties for differences in expectations. The collaboration success criteria chosen by participants in the study provide research managers with a preliminary checklist of issues, which if monitored and addressed, would lead to continuous innovation in U-I collaboration management. Further, ongoing mentoring or coaching programs by research managers for U-I collaboration partners would encourage repeated and sustained instances of trustworthy behaviour at the interpersonal and organisational level. With heightened ongoing trust, the parties may increase their willingness to engage in a wider range of collaborations over time, or even in parallel and thus avoid the negative consequences of failed U-I collaborations. The findings and the limitations of this research give rise to several possibilities for future research. The model proposed for precursors and consequences of trust could be tested in different contexts, such as research collaborations between culturally different countries or in other industry sectors. Longitudinal studies with U-I collaborators would be valuable in tracking the evolution and interplay of interpersonal and organisational trust whilst the use of a larger sample might provide validity to the list of precursors and consequences of trust in the proposed model.
REFERENCES


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Figure 1 Comparison of the issues of most importance to university and industry administrators and researchers with respect to collaborations (n = #13 in each of the four groups with a total of n = #52 respondents)
Table 1. The highest ranked success criterion of each MC Mapper respondent, sorted into four groups, which are then classified as precursors or consequences of trust

<table>
<thead>
<tr>
<th>IR</th>
<th>Group</th>
<th>IA</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel involved (1)</td>
<td>1x R</td>
<td>Personal growth (27)</td>
<td>1x O</td>
</tr>
<tr>
<td>IP (2, 11, 12)</td>
<td>3x IP</td>
<td>Commercial outcomes (28)</td>
<td>1x O</td>
</tr>
<tr>
<td>Timeliness (3)</td>
<td>1x TC</td>
<td>Cost (29, 30, 37&lt;sup&gt;1/4&lt;/sup&gt;)</td>
<td>2.25xTC</td>
</tr>
<tr>
<td>Mindset (4)</td>
<td>1x R</td>
<td>Control over results (31)</td>
<td>1x IP</td>
</tr>
<tr>
<td>Confidentiality (5)</td>
<td>1x IP</td>
<td>IP ownership discernable (32)</td>
<td>1x IP</td>
</tr>
<tr>
<td>Research quality (6)</td>
<td>1x O</td>
<td>IP ownership (33)</td>
<td>1x IP</td>
</tr>
<tr>
<td>Ownership of results (7)</td>
<td>1x IP</td>
<td>Commercial outcomes (34)</td>
<td>1x O</td>
</tr>
<tr>
<td>Reliable confidentiality (8)</td>
<td>1x IP</td>
<td>Realism of time frame (35)</td>
<td>1x TC</td>
</tr>
<tr>
<td>Honesty (9)</td>
<td>1x R</td>
<td>Income (36)</td>
<td>1x O</td>
</tr>
<tr>
<td>IP managed commercially (10)</td>
<td>1x IP</td>
<td>Outcome driven (37&lt;sup&gt;2/4&lt;/sup&gt;)</td>
<td>0.25x O</td>
</tr>
<tr>
<td>Project IP integrity (13)</td>
<td>1x IP</td>
<td>IP control (37&lt;sup&gt;3/4&lt;/sup&gt;)</td>
<td>0.25x IP</td>
</tr>
<tr>
<td>UR</td>
<td>Income (14)</td>
<td>1x O</td>
<td>Direct researcher access (37&lt;sup&gt;4/4&lt;/sup&gt;)</td>
</tr>
<tr>
<td>Cost effective (15)</td>
<td>1x TC</td>
<td>IP (38)</td>
<td>1x IP</td>
</tr>
<tr>
<td>Benefits (16)</td>
<td>1x O</td>
<td>Timeliness (39)</td>
<td>1x TC</td>
</tr>
<tr>
<td>Quality of outputs (17&lt;sup&gt;1/2&lt;/sup&gt;)</td>
<td>0.5x O</td>
<td>Response (40&lt;sup&gt;1/2&lt;/sup&gt;)</td>
<td>0.33x R</td>
</tr>
<tr>
<td>Customer focus (17&lt;sup&gt;1/2&lt;/sup&gt;)</td>
<td>0.5x R</td>
<td>Systems for effectiveness (40&lt;sup&gt;2/2&lt;/sup&gt;)</td>
<td>0.33xTC</td>
</tr>
<tr>
<td>Prestige (18)</td>
<td>1x O</td>
<td>Cost effectiveness (40&lt;sup&gt;3/2&lt;/sup&gt;)</td>
<td>0.33xTC</td>
</tr>
<tr>
<td>Easy to make contact (19)</td>
<td>1x TC</td>
<td>Building a trusting relationship (41)</td>
<td>1x R</td>
</tr>
<tr>
<td>Mutual respect (20)</td>
<td>1x R</td>
<td>IP ownership (42&lt;sup&gt;1/2&lt;/sup&gt;, 46, 52)</td>
<td>2.5x IP</td>
</tr>
<tr>
<td>Independence of thought (21)</td>
<td>1x O</td>
<td>Commercialisation rights (42&lt;sup&gt;2/2&lt;/sup&gt;)</td>
<td>0.5x O</td>
</tr>
<tr>
<td>Accommodation of changing pressures (22)</td>
<td>1x R</td>
<td>Efficiency of technology transfer (43)</td>
<td>1x O</td>
</tr>
<tr>
<td>Bureaucracy low (23)</td>
<td>1x TC</td>
<td>Future benefits (44)</td>
<td>1x O</td>
</tr>
<tr>
<td>Able to publish (24)</td>
<td>1x O</td>
<td>No IP leakage (45)</td>
<td>1x IP</td>
</tr>
<tr>
<td>Research independence (25)</td>
<td>1x O</td>
<td>Documentation on IP arrangements (47)</td>
<td>1x IP</td>
</tr>
<tr>
<td>Publications (26)</td>
<td>1x O</td>
<td>Capacity to pay full cost of university research (48)</td>
<td>1x O</td>
</tr>
<tr>
<td><strong>Precursors of trust</strong></td>
<td></td>
<td><strong>Consequences of trust</strong></td>
<td></td>
</tr>
<tr>
<td>TC = Transaction costs; R = Relationship</td>
<td>IP = Intellectual Property; O = Outcomes;</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Participant # is in brackets; equally weighted criteria are shown as superscript fractions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Robust research possible (49) | 1x O |
Academic governance/efficiency (50) | 1x TC |
Rapport (51) | 1x R |
Table 2. Summary of three U-I collaboration case studies

<table>
<thead>
<tr>
<th>Cases</th>
<th>Subject</th>
<th>Age grouping (years)</th>
<th>Gender</th>
<th>Collaboration role</th>
<th>Collaboration failure experience</th>
<th>Collaboration duration (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>P1</td>
<td>56-71</td>
<td>Male</td>
<td>Uni researcher (UR)</td>
<td>Did not share the same values of integrity so communication and trust failed. Did not manage conflict.</td>
<td>5</td>
</tr>
<tr>
<td>A</td>
<td>P2</td>
<td>56-71</td>
<td>Male</td>
<td>Industry Administrator (IA)</td>
<td>Failed to understand the culture of researchers. Did not manage conflict.</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>R1</td>
<td>34-49</td>
<td>Male</td>
<td>Uni researcher (UR)</td>
<td>Did not sustain the industry partner’s confidence in his competency so open communication failed to develop.</td>
<td>5</td>
</tr>
<tr>
<td>B</td>
<td>R2</td>
<td>34-49</td>
<td>Female</td>
<td>Industry Administrator (IA)</td>
<td>Did not share control or establish open and honest communication with the researcher. Did not manage conflict.</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>J1</td>
<td>50-55</td>
<td>Male</td>
<td>Uni researcher (UR)</td>
<td>Delegated responsibilities and hence lost honest and open communication with partner.</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>J2</td>
<td>50-55</td>
<td>Male</td>
<td>Industry Administrator (IA)</td>
<td>Did not communicate sufficiently nor understand and adhere to the principles important to the collaborating partner’s institution. Did not manage conflict.</td>
<td>20</td>
</tr>
</tbody>
</table>
Table 3. Aspects of life affected by collaboration failure, after Singh (2007)

<table>
<thead>
<tr>
<th>Case</th>
<th>Impact</th>
<th>Case Description</th>
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| **A (UR)** | Economic    | - lost promotional opportunities at the university whilst focusing on the collaboration and will retire early  
              | Social   | - lost status at the uni because research productivity was low for the duration of the collaboration  
              | Psychological | - self confidence eroded for the short term  
              | Psychological | - would like to go into business to develop a product and have been reading extensively about management and governance |
| **A (IA)** | Economic    | - money and time invested by the company in the uni collaborators and lawyers set growth of the company back temporarily and was also an opportunity cost  
              | Psychological | - wiser but not soured  
              | Psychological | - still interested in pursuing a biotech venture but now has a more mature outlook on how to work with university personnel |
| **B (UR)** | Economic    | - with no research funds, unemployed after the collaboration failed  
              | Social     | - chose to severe contact with most former associates from the company, particularly one of the Board members, who he did not trust; no longer a close to long term IA friend  
              | Psychological | - became apathetic during the end of the company, closed mind off from its loss  
              | Physiological | - was hospitalised for several weeks towards the end of the collaboration with the flare up of a pre-existing problem |
| **B (IA)** | Economic    | - had to found a new venture and start again  
              | Social     | - pleased that friendships remained intact even though the company did not  
              | Psychological | - self critical of the poor choices made and lack of brutal honesty applied  
              | Psychological | - frustrated at the attitude of Australians towards failure of companies and their CEOs  
<pre><code>          | Physiological | - Became mentally and physically exhausted |
</code></pre>
<p>| <strong>C (UR)</strong> | Economic    | - a PhD student on the ARC grant project had his candidature interrupted while IP was |</p>
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<tr>
<th>C (IA)</th>
<th>Economic</th>
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<tbody>
<tr>
<td></td>
<td>- ARC grant project mothballed with respect to him so lost investment</td>
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<td>- time consuming to sort out the mess</td>
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<td>- lost money on the patent applications because the ownership became clouded</td>
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<td>- works only with small universities now where there is a better cultural match with his philosophies</td>
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<td>- works only through the research contracts office where he gets everything in a contract, there are no surprises and he does not have to meet the researcher doing the work, just pay the money and he owns all the IP</td>
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<td>Social</td>
<td>- still sees the researcher but the close friendship has gone</td>
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<td>- will not work with any researcher at a university – everything must go through the commercialisation company/office of the university</td>
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<td>Psychological</td>
<td>- anger was strong – complained to the commercial office, complained to local member of parliament in his state, complained to the university Deputy Vice Chancellor; ripple effect was that people were moved from the university commercial office, probably as a direct consequence of the event</td>
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Figure 2. A model of trust precursors and consequences, including categories of success criteria in U-I collaborations