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Managing University-Industry Collaborations in Malaysia by Examining its Critical Success Factors: A Dyadic Approach

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This paper examines critical success factors required to manage successful strategic university-industry collaborations in Malaysia, using a dyadic approach. The scientific literature tentatively suggests that success factors include mutual trust, reward and benefits to individuals, organizations and institutions, open and transparent communication, and commitment and support of management. An additional factor (government support) is added to this study. Adopting a qualitative research strategy, utilizing a dyadic approach, participants from both universities and industry were interviewed. Similarities and differences from the perspective of universities and industries add to the body of knowledge in investigating the critical success factors in successful relationships between profit-oriented organizations and non-profit knowledge-based institutions. University respondents stated that mutual trust is the most critical success factor, followed by commitment and the support of the university's senior management, open and transparent communication, rewards and benefits to individuals, organizations and institutions, and government support. In contrast, interviews with industry revealed that funding from government is of the utmost importance, followed by open and transparent communication, mutual trust, and commitment and support of the management. Understanding the similarities/differences from both perspectives help individuals and universities to understand and manage future collaborative relationships.

Keywords: Strategic Management, University Industry Collaboration, Critical Success Factors, Dyadic Approach, Qualitative Research Method.

1. Introduction

The accelerated growth of global production of goods and services has brought global structural transformation where economic entities are driven to specialise in their comparative strengths and advantages. The development of a production economy has also increased expenditure on education, infrastructure and social services, which in turn increases labour costs (VINNOVA 2006). As a result, countries with labour-intensive industrial strategies need to consider moving to knowledge-intensive and innovation-driven economies in order to sustain themselves in the global market. Research funding available to universities has

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gradually declined and there is a greater need for external funding, placing ever greater need on the research environment (VINNOVA 2006). The reduction in national subsidies to universities is in tandem with the Malaysian government policy of encouraging self-reliance among universities to generate their own income (MoHE 2007b). In Malaysia, Research Universities have been established to focus on research and innovation activities. These universities are urged to generate 45% of their operating costs and another 25% in development expenditure from sources other than governmental fund and fees (MoHE 2007b). Malaysia also targets to commercialize 5% and 10% of its universities' R&D outcomes by 2010 and 2020 respectively (MoHE 2007a, 2007b). As a result, collaboration with industry for research funding, ideas generation and R&D commercialization are of utmost importance. The Secretary General of the Ministry of Higher Education (MoHE) Malaysia also recognizes, and emphasizes, the importance of partnership between universities and industries (MoHE 2007a).

A past study has asserted that the establishment and introduction of regional policies in the United Kingdom have encouraged the increase in university-industry linkages (Potts 2002). The same study carried out in Belgium by Looy, Debackere and Andries (2003) indicated the same results. In order to increase UIC initiatives in Malaysia, changes are required with respect to the rules and regulations governing innovation policy, education policy and labour market policy. To assist, the Enhancement Plan of Strategic University-Industry/Community Engagement has been launched (MoHE 2010) to urge universities to collaborate with industry, enhance internship and lecturer placement in industry, encourage knowledge and technology transfer, and establish consortium-based research. A study in Japan emphasized the importance of UIC as part of the reformation of universities (Kitagawa 2009). Another study indicated that Japanese small and medium-sized enterprises (SMEs) advocated the importance to be different from its competitors by continuously embarking on new innovations and capability building (Motohashi 2007). The World Bank encourages the deployment of UIC as a strategy to improve the relevance of education in Malaysia and to service SMEs that do not have a high level of technology adoption and innovation know-how (World Bank 2007). Another study, conducted in a Swedish environment, revealed that the emergence of UIC as a tool in science policy has provided a competitive advantage for the country (Hellstrom & Jacob 2005). Hence, UIC is a much sought-after solution.

The research presented in this paper examines the critical success factors that contribute to successful UICs in Malaysia. In addition, this research presents qualitative findings using multiple cases and a dyadic approach. The rich interview data collected from two diverse perspectives, and multiple industries, has provided similarities and differences in determining the factors which are seen as critical to the success of UICs in the Malaysian context. Thus, understanding the similarities and/or differences from the perspective of universities and industry help individuals to understand and manage future collaborative relationships better.

The following sections will present the review on past literature on the critical success factors of university-industry collaborations, follow by research approach used in this study, then discussion on research findings from interviews, and conclusion and recommendations derived from this study.

2. Literature Review

UIC is often related to industrial training for students, scientists' attachment to companies, joint courses, research chairs, consultations, contract R&D and commercialization activities such as licensing and incubation activities, investment in university's start-up companies, knowledge/technology transfers, and taking R&D outputs to market. All universities in Malaysia have, in one way or another, participated in UIC but there have been limited studies looking at the critical success factors that contribute to successful UICs. Past studies undertaken in overseas contexts, namely US, Germany, Korea, Canada, Mexico, Ireland, and UK, have described successful models, policies, criteria to benchmark collaborations, managing UIC projects, and challenges or outcomes to successful UICs (e.g. Bruneela, D'Este & Salter 2010; Feng, Ding & Sun 2011; Kabins 2010; Markkula & Lappalainen 2009; Nangia & Pramanik 2011; Perkmann, Neely & Walsh 2011; Philbin 2010; Ramos-Vielba & Fernández-Esquinas 2012; Ryan, Wafer & Fitzgerald 2008; Sa & Litwin 2011; Schilling & Klamma 2010; Tijssen, Leeuwen & Wijk 2009; Torres et al. 2011; Xu 2010; Yee, Abas & Chong 2009; Zakaria, Yee & Chong 2012). The UIC success factors include trained individuals and entrepreneurial training for academics (Kunert et al. 2012), innovation and flexibility (Ryan, Wafer & Fitzgerald 2008; Siegel et al. 2003), university's support (Ryan, Wafer & Fitzgerald 2008), technology transfer offices and reward systems (Bruneela, D'Este & Salter 2010; Siegel et al. 2003; Villasana 2011), IP management and ownership (Burnside & Witkin 2008; Lucia et al. 2012), and commitment and trust (Frasquet, Calderon & Cervera 2012). Government support (i.e. funding and policies) is a notable factor in successful UICs, particularly in developing countries. This is important at the start of collaborative efforts (e.g. Brimble & Doner 2007; Deutch 1991; Feng, Ding & Sun 2011; Intarakumnerd & Chaminade, 2007; Looy, DEbackere & Andries 2003). Zhao (2000a, 2000b) suggested a set of performance measures, proposing five critical factors, to ensure satisfactory UIC performance. These critical measures are (1) mutual trust; (2) rewards and benefits to individuals, organizations and institutions; (3) open and transparent communication; (4) commitment and support from management; and (5) government support.

This paper utilizes these five key success factors (Zhao 2000a, 2000b) in gauging their contribution to successful relationships (from an individual's perspective). The understanding of these five factors is critical in managing successful UICs and factors are discussed in more detail below. The effectiveness of the technology transfer office could not be tested because in 2008-2009, when this study was undertaken, there were a limited number of technology transfer offices in the 69 universities in Malaysia. Moreover, Intellectual Property was not an issue to the individuals interviewed at that time.

2.1 Mutual Trust

Mutual trust is crucial in the building of a relationship and to enable it to later flourish into a longer-term collaborative relationship (e.g. Birchall & Chanaron 2006; Chakrabarti & Santoro 2004; Conlon & Giovagnoli 1998; Flore'n 2003; Lam 1997; Lambert 2003; Mohr & Spekman 1994; Sharp & Yarborough 2006; Vogel 2005; Wolff 1994). A mutually trusting environment enables the parties to obtain high market efficiency and to avoid conflict (Bleeke & Ernst 1991). A high-level of conflict is detrimental to the success of inter-organizational collaboration and leads to failure in sustaining a relationship (Alter 1990; Gulati 1998). However, trust is difficult to quantify while the sharing of information beyond normal transactions can be difficult to

qualitatively evaluate (Rackham, Friedman & Ruff 1996). Past studies have shown that it takes time to develop trust, but it is a worthwhile objective in the long term (e.g. Draugalis & Coons 1995; Santoro & Saparito 2005; Shankar & Barrett 2005; Wolff 1994). In other studies, Lavie, Haunschild and Khanna (2012) advocated that organizational and institutional culture and routines facilitate trust and commitment.

2.2 Rewards and Benefits

'*What is in for me?*' is a common question asked in any partnership, alliance, or collaboration. A reward system has to be established within an organization to motivate respective individuals to achieve shared goals and contribute to the success of a strategic collaboration (Lee 2000). Both individuals and organizations must be able to gain benefits from the collaborative efforts on a win-win situation (Kisker & Carducci 2003; Lendrum 2004), on short term and long term basis. Empirical evidences have shown that different benefits and rewards are able to be gained from a UIC relationship such as financial, profit, royalty, recognition, acknowledgement and promotion of researchers, increased reputation of the university, and the creation of new knowledge in the enhancement of learning, new technology, tangible and non-tangible outcomes (e.g. Audretsch & Link 2006; Doz & Hamel 1998; Hamel, Doz & Prahalad 2002; Matsuura & Ebato 2004; Mindutra 2012; Santoro & Betts 2002; Santoro & Saparito 2005; Tomes & Phillips 2003; Woolgar 2007). Yet, the incentives have to be significant to entice institutions, organizations, and individuals to collaborate. Börjesson, Bruce and Forsberg (2000) stated that individual achievements need to be rewarded accordingly, namely through profit-generation and consultancy, royalty, profit-sharing, public visibility, and effective promotion based on social skills and customer handling. Santoro and Saparito (2005) asserted that successful collaborations can enhance the prestige and reputation of the higher learning institution. Student's participation will enhance his or her employability (Rizvi & Aggarwal 2005). In addition, the benefits that both the university and its industry counterpart are able to reap in successful strategic UIC include innovative breakthroughs, niche market identification and differentiation, cost leadership, human capital development, and social development and transformation.

2.3 Open and Transparent Communication

Successful collaborations are based on direct communication with honesty, transparency, and openness among all parties involved (Fontana, Geuna & Matt 2003; Little et al. 1988), and need to be managed well. According to Porter (1985), the ultimate goals of a company are to maximize shareholder return and to enhance its competitive advantage. The goals of the university are to expand human knowledge (Foote & Borsting 2001) and its capabilities (Kerr 1974). Due to the differences in the goals of the two parties, empirical studies revealed that the management has to clearly communicate the roles and goals of its organization to individuals and its partners to avoid any misunderstanding, distrust, doubt, and the risk of failed collaboration (Hsieh 1997; Li 2005). Partners have to be transparent and openly discuss interests, directions, objectives, issues, and action plans with respect to each other, (Kisker & Carducci 2003; Li 2005; Steward 1999) at the individual and organizational level. Getting personnel consensus from all levels is necessary (Hamel & Prahalad 2006). Both parties have to be forthright in expressing their interests, values, and directions before entering into a collaboration, both at the individual and institutional/organizational level (Doz & Hamel 1998;

Saruwono 2006; Sharp & Yarborough 2006), especially in ensuring the success of strategic UIC relationships.

2.4 Commitment and Support from Management

Senior management commitment and leadership are vital for innovation in strategic collaborations (e.g. Hamel & Prahalad 2006; Kisker & Carducci 2003; Steward 1999; Tyler & Steensma 1999). The commitment of senior management ensures that the stakeholders receive sufficient and appropriate resources, and it also convinces the parties involved of the needs to collaborate (Elmuti & Kathawala 2001). In addition, a high level of commitment leads to achieving joint goals and shared objectives, and the elimination of opportunistic behavior (Anderson & Weitz 1992). The importance of commitment is revealed at the University of Warwick where the senior management established the principle to bridge the university-industry divide via a total commitment to partnership (Lorenz 2002). However, an individual, organization or institution has to realize the extent and limit of the commitment one can make (Wolff 1994). Universities need to consider how to optimize their limited resources and manpower while individuals need to consider optimization of limited time and other priorities. Furthermore, the success and sustainability of UICs can be at risk with a lack of continuity and consistency. The change of a Vice Chancellor/President in a university often reflects a change in direction and strategic goals. Support and participation of senior management in a UIC project are important to the success of any collaborative relationship. Bureaucracy could also be an obstacle to successful collaboration and slow the momentum of collaborative efforts.

2.5 Government Support

Governmental support in the form of funding and policy is important to boost strategic UIC initiatives, especially in developing countries. The World Bank (2000) indicated that higher education systems in developing countries are reliant on additional resources to catch up academically and in research, as compared to developed countries. Empirical studies also support the need for governmental support and motivation, in terms of funding and policies in developing countries to boost R&D activities and UIC relationships (Brimble & Doner 2007; Intarakumnerd & Chaminade 2007). Government funding is also critical in the initial stages of research collaboration, to encourage a collaborative culture and spirit (Deutch 1991; Looy, Debackere & Andries . 2003). A study carried out by Chang and Chen (2004), demonstrated that national subsidies such as interest-free loans and grants have a stimulating impact on an SME's performance and its R&D contribution to national innovation and growth. In Malaysia, research grants are given to SMEs and universities to stimulate R&D activities and UICs. For example, TechnoFund from Ministry of Science, Technology and Innovation (MOSTI) was introduced in the Ninth Malaysia Plan and is aimed at fostering a greater degree of collaboration between universities and industries (MOSTI 2007). An industry partner is a requirement in the application for such a grant.

3. Research Approach

A qualitative methodology is applied in this study. Qualitative research is defined by Creswell (2009) as a process of understanding based on a distinct methodological inquiry that explores a social or human problem. The confidence of the data is buttressed on local grounding due to

collection of data at close proximity in a specific situation which is both focused and bounded. The data has its context embedded in the local content and has a strong understanding of latent, underlying, or non-obvious issues (Miles & Huberman 1994). Furthermore, '*the richness and holism of data with strong potential for revealing complexity provides thick descriptions that are vivid which are nested in a real context, and have a ring or truth that has strong impact on the reader*' (Miles & Huberman 2002, p.10). Qualitative data that is collected over a sustained period is powerful for studying any process. Moreover, the inherent flexibility of qualitative studies gives further confidence that the researchers have truly understood the underlying concepts (Miles & Huberman 2002). Qualitative data, with its emphasis on people's lived experience, is well suited for locating the '*meanings'* people place on the events, processes and structures of their lives, and connecting these meanings to the social world around them (Miles & Huberman 2002). Thus, the 'experiences' of the respondents are gathered in this study. This study builds on a complex and holistic picture, analyzed words, reports with detailed views of informants, and in a natural setting (Yin 2003).

Researchers approached 57 universities, with 25 universities responded. The final list contained 455 contract research projects and 37 TechnoFund funded projects for the period 2000-2008. From these 492 projects we selected 49 projects randomly, reselecting if the project leaders did not want to participate in the study. Researchers stopped at 49 projects as saturation was reached at that point. The selected UIC projects have collaborative outputs, i.e. high value, have the potential of generating new innovations and ideas, development of leading-edge technologies, able to contribute to, and have an impact on, the building of an innovation-driven economy and a private-led economy. The duration of a UIC project is usually one year, sometimes more, and has a long-term objective of continuing collaboration between both partners. Therefore, we interviewed respondents (i.e. project leaders) based on their involvement in UIC projects that met this criteria.

A dyadic approach is used in this study, where interviews are carried out at the project level, on a paired basis (refer to Table 1). Researchers interviewed the university respondents (project leaders) and later contacted their industry counterparts to carry out interviews, or vice-versa. Researchers are able to compare critical success factors from the perspective of university and industry respondents using a dyadic approach. 21 paired interviews were carried out, 26 respondents denied to be interviewed (10 respondents from university and 16 respondents from their industry counterpart), and two respondents mentioned that their collaborators are overseas companies and do not have a presence in Malaysia. There are many reasons given for denial of interviews inclusive of lawyer letter issued by university to researchers, and busy schedule of project leader(s) and Director(s)/Industry Senior Officer(s). In total, 69 respondents were interviewed. Interviews were conducted on semi-structured basis and the audios were then transcribed. Thematic analysis is carried out to identify the critical success factors that contribute to successful UICs.

Table 1: List of paired respondents interviewed

No	University	Industry	Pair	Denied	Overseas
P1	R1	R45	1		
P2	R2	Denied		1	
P3	R3	R41	1		
P4	R4	Denied		1	
P5	R5	Denied		1	
P6	R6	Denied		1	
P7	R7	R60, R65, R68	1		
P8	R8	overseas			1
P9	R9	overseas			1
P10	R10	Denied		1	
P11	R11	Denied		1	
P12	R12	Denied		1	
P13	R13	Denied		1	
P14	R14	Denied		1	
P15	R15	R67	1		
P16	R16	R43	1		
P17	R17	R59	1		
P18	R18	R59	1		
P19	R19	R59	1		
P20	R20	Denied		1	
P21	R21	Denied		1	
P22	R22	Denied		1	
P23	R23	R59	1		
P24	R24	R69	1		
P25	R25	Denied		1	
P26	R26	R47	1		
P27	R27	Denied		1	
P28	R28	Denied		1	
P29	R29	R58	1		
P30	R30	R40, R49	1		
P31	R31	R50, R51	1		
P32	R32	R61	1		
P33	R33	R62	1		
P34	R34	R56	1		
P35	R35	R63	1		
P36	R36	R63	1		
P37	R37	R43	1		
P38	R38	R46	1		
P39	R39	Denied		1	
P40	Denied	R42		1	
P41	Denied	R44		1	
P42	Denied	R48		1	
P43	Denied	R52		1	

P44	Denied	R53		1	
P45	Denied	R54		1	
P46	Denied	R55		1	
P47	Denied	R57		1	
P48	Denied	R64		1	
P49	Denied	R66		1	
Total			**21**	**26**	**2**

Paired – paired interviews done
Denied – interview is denied either by university or industry respondent
Overseas – industry counterpart are based in overseas and do not have presence in Malaysia

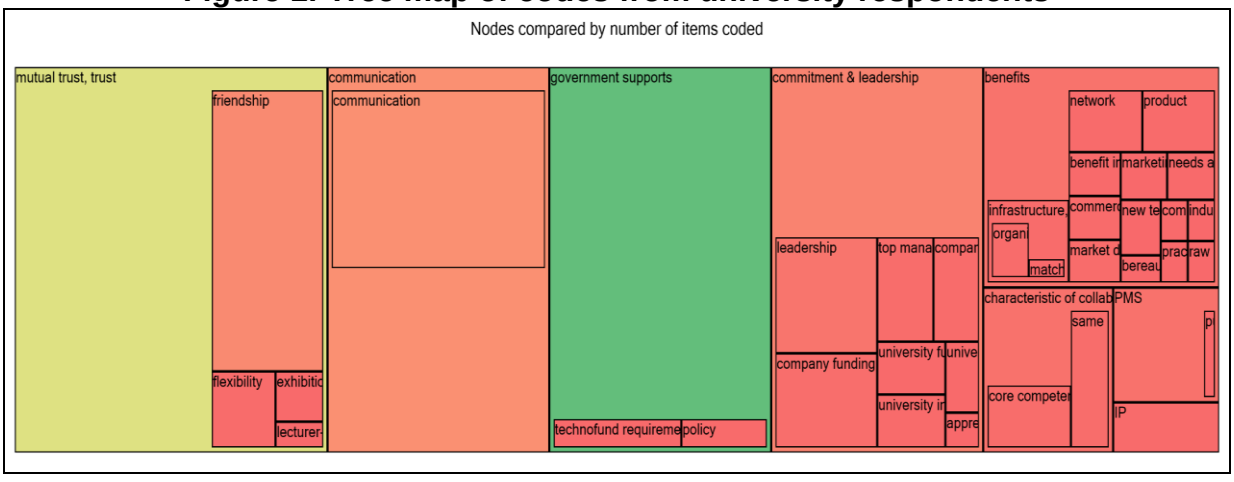
4. Findings

Interviews with 69 respondents, who are project leaders, are represented by 39 respondents from universities (R1 to R39) and 30 respondents from industry (R40 to R69). The findings from university and industry respondents are presented in the remainder of this section. The similarities and differences of comments from both university and industry respondents are also discussed.

4.1 University Respondents' Perspectives

University respondents indicated that mutual trust is the most critical success factor to a successful strategic university-industry collaborative relationship (refer to Figure 1). It is then followed by commitment and the support of university's senior management, open and transparent communication, rewards and benefits to individuals, organizations and institutions, and government support.

Figure 1: Tree map of codes from university respondents



Three respondents (R41, R60 and R65) mentioned that their trusting relationship is due to the lecturer/student relationship. Mutual trust is crucial in maintaining a successful collaborative relationship and it takes '*almost two decades to build trust*' (R13). R29 was of the opinion that people involved in UIC projects need to identify and understand both parties' interest, whereas in his case, the collaborative relationship starts from being *strangers* and not from an existing

friendship or lecturer/student relationship. R30 stated that '*trust can be tested during the probation period to see how much the industry trusts us as the institution that has the expertise in the specialised skill*'. Trust can also be built by individuals, by delivering on what was promised, and producing the promised (or better) results for the industrial partner (R12). R60 added that '*a relationship needs to go beyond trust to be sustainable*'. In contrast, three respondents (R26, R27 and R28) said that trust is not so important in their UIC projects because the financial funding of the project is small. R23 revealed that there are challenges in building a trusting relationship across two parties of different cultures, visions, objectives, and goals. R23 further stated how the team tries to give their best in assignments with open and transparent communication. A trusting relationship can also be developed through constant communication by identifying clear responsibilities and the contribution from both parties, coupled with transparency and openness will avoid misunderstanding and distrust among the team members and between collaborators (R1-R39).

Besides mutual trust, R3, R8 and R30 asserted the importance of the university's senior management's commitment and support. They shared that '*my university's senior management has been giving me 150 percent support to my UIC project especially the Vice Chancellor. The Vice Chancellor is also involved in my project by giving his ideas*'. R21 said that in his case, he received support from the university via mediators such as the Research Management Centre and through arranged meetings with companies. However, R15 revealed that commitment from their industry counterpart also helps to strengthen the UIC relationship. He said that '*the parent company has commitment and they have policy to improve their product line through innovation breakthrough. The parent company also imposes similar policy to companies established in Malaysia and encourages local staff to embark in research initiatives to build research culture*'. The interview with R24 revealed that the company also ensured that the university understood the corporate environment through participation in developmental programs and discussions with the company. Funding from the company or university also reflects the commitment of the senior management towards the UIC. R30 emphasized that he receives funding from the company and he also supported his own research out of his own pocket without any funding from the government. The reason is that his research is in a non-priority area of the nation.

Benefits to an individual, an organization and an institution, when collaborating, are important. There are tangible and intangible benefits that can be derived from UIC relationships. All university respondents agreed that the major benefit gained through a collaborative relationship is providing the platform for student internship and a means of imparting practical experience to students prior to employment. Many benefited from solving operational issues for companies (R1, R7, R10, R12, R13, R17, R18, R23, R32, R35 and R36) such as learning gaining knowledge of different software products, technologies, techniques, and/or processes, application of theory to real life, and an improvement in their soft skills. Furthermore, scientists are able to share their success with business in the form of profit sharing, royalty, commission, licensing fee, shareholding, and/or director fee (R3, R4, R5, R6, R8, R20, R30 and R31). Joint scientific publications with industrial partners also contribute to promotion possibilities for academic staff. Sharing of new knowledge and new technology between universities and industry, and vice versa, is supported by all respondents. Universities also gain from (1) the donation of equipment from industry; (2) sponsorship of software for laboratories; (3) having the space and technology for lecturers to work; (4) financial benefits through commercialization

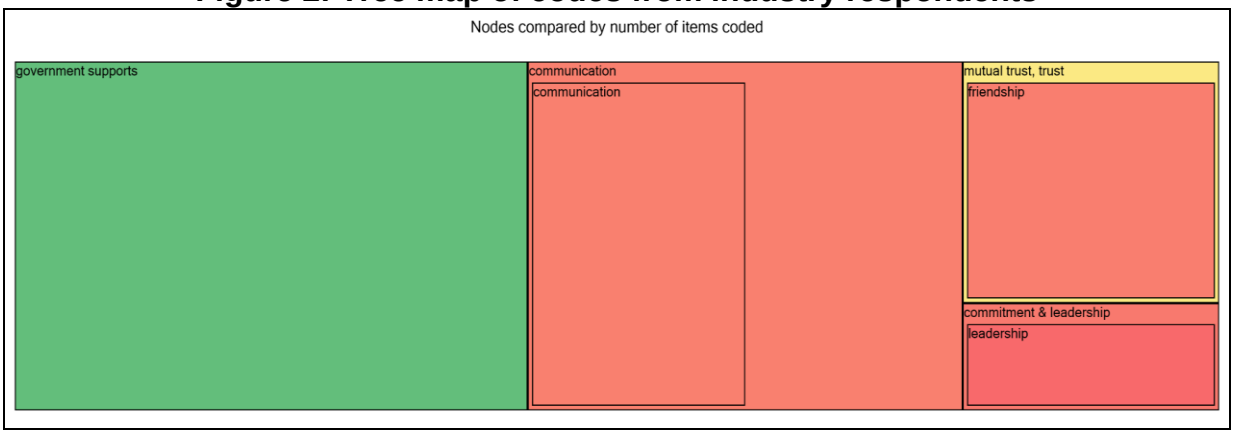
of scientific outcomes; as well as (5) the building of the university's reputation (R4 and R23). Other intangible benefits include satisfaction, acknowledgement, personal enhancement, increase in the reputation of the university, and respect from industry and academic peers. Interviews (R7, R8, R15, R16, R20, R23, R26, R27, R28, R31, R38 and R39) revealed that UIC is not part of the criterion for promotion of an academic and lecturers get involved in UIC projects mainly due to their passion and the satisfaction of their achievements as compared to their peers. Collaboration with industry (in terms of spin-off, royalty and commercialization of scientific outcomes) is not an element measured in the performance of an academic but is part of the research and consultancy performance measure in Malaysia.

In addition to the above, most university respondents also asserted that their research opportunity began with governmental funding due to the high risk and uncertainty associated with basic research. R20 specifically commented that she will not even embark on research activities if there is no funding from government as it is difficult to get funding from companies for basic research. R20 has successfully commercialized her scientific outcomes and collaborates with a company to explore international markets. Six university respondents (R4, R11, R16, R20, R29 and R37) indicated that their research is able to be commercialized by collaborating with industry and getting financial support from the government through TechnoFund. Despite the positive experiences of interview respondents, six other respondents (R1, R3, R7, R15, R30 and R38) also shared their disappointment in relation to obtaining government support for their research activities. R7 and R15 stated that there is a lack of encouragement and government support in certain areas. In addition, R3 said that it takes a long time for TechnoFund approval.

4.2 Industry Respondents' Perspectives

Interviews with industry revealed that funding from government is of the utmost importance (refer to Figure 2), followed by open and transparent communication, mutual trust, and commitment and support of management.

Figure 2: Tree map of codes from industry respondents



Interviews with industry personnel revealed that government support for research loans, research grants, and training on R&D awareness were lacking (R40 to R69). Furthermore, the double tax deduction scheme to encourage R&D initiatives in Malaysia was not significant to

SMEs. R41 commented that even though it received pioneer status as a tax incentive, the company faced difficulties in getting financial support from government due to the grant application process. Another respondent (R54) suggested that a short-term loan from the government would help to boost the R&D initiatives amongst SMEs. In contrast, R64 said that her company receives support from the government in terms of double tax deductions on R&D spending. R49 indicated that his company receives funding from the state government to carry out R&D in collaboration with universities. He further added that the company is fully owned by the state government with the objectives to initiate R&D activities and to help scientists commercialize their R&D output.

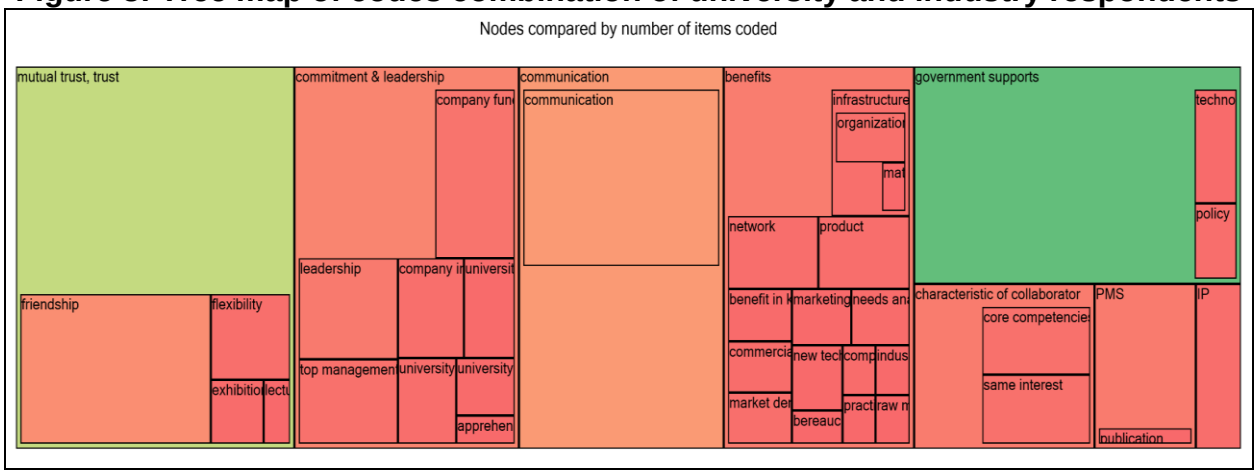
R50 mentioned that his collaboration with a university is based on trust and the strong friendship that both parties have built over the years. R41 advocates that '*if you cannot trust, you cannot maintain a relationship*' and R42 shared that '*trust in UIC is like the romantic view of business*'. R46 explained that trust is a two-way relationship, '*you trust them and they trust you*'. In addition, 12 industry respondents (R40, R43, R46, R49, R50, R51, R53, R54, R55, R56, R57 and R69) shared that their collaborative relationships with universities started from a friendship. Trust is important to ensure that the research outcome is not shared with any competitors and the university does not copy the technology that the company owns (R60 and R58). A trusting relationship will result in further collaborative projects on a long-term basis as well as referrals of the university to other companies or friends. Hence, '…. *trust needs to be worked on and not inherited. We will be more cautious in the next relationship if we experience a bad relationship*', said R57, R59 and R64. A respondent (R64) indicated that a legal agreement signed acts as a binding of trust between university and company. However, the company will continue the collaborative relationship without any legal agreement if the university has proven its credibility, competency, and ability to deliver results.

R45 revealed that trust and respect are important in presenting factual results in a relationship. Thus, open and transparent communication is required to ensure a lasting collaborative relationship. All industry respondents (R10 to R69) indicated that there is a need to have effective communication between the collaborative parties, in terms of the progress of the project, the financial aspects, and the operational matters, on a periodical basis. The support of the company's senior management also plays a role in ensuring successful collaboration with a university counterpart. Interview findings revealed that companies involved in UIC projects are led by businessmen who appreciate innovation, have research backgrounds, and realize that the company is able to gain competitive advantage by innovating new products, new materials and/or new processes (R40 to R69). Interviews with SME owners revealed similar remarks and they are very optimistic in believing that innovation is the way forward for their business, and for the country (R40 to R58 and R69). When R60 was asked to describe the level of commitment of her management, she said '*I would say the level of commitment is 50:50 because my bosses have a research background, especially those from the Head Office in Germany and they will be very interested in new breakthroughs*'. R59 commented that his company's commitment to research is a long-term commitment and the company have funded a large amount of research grants to five universities in Malaysia, on a multi-disciplinary basis. R64 shared that her company commits 3% of their annual sales to R&D initiatives with universities. However, R63 asserted that commitment develops over time, after trials of the relationship, and when trust is built.

4.3 Similarities and Differences of University and Industry Respondents' Perspectives

Figure 3 shows the tree map when the text coding between university and industry respondents are combined for analysis. The four critical success factors of strategic UIC are: (1) mutual trust; (2) open and transparent communication; (3) government support; and (4) the commitment and support of management.

Figure 3: Tree map of codes combination of university and industry respondents



University respondents ranked trust as of the utmost importance, while industry respondents ranked it third. University respondents had, on a few occasions, experienced unpaid royalties and licensing fees, promises not being fulfilled and industry overestimating the commercialization opportunities without a full understanding of the market. In contrast, industry respondents voted for government support as the most important factor, for example, government support through various funding mechanisms made available for companies and motivation though policies to stimulate investment in contract research and commercialization of R&D outputs of universities. Companies in Malaysia, especially SMEs, require assistance to allow them to innovate and collaborate with universities to develop better products, services, knowledge, and/or technology transfer, in addition to simply surviving in ever competitive conditions.

Interview respondents have shared the types of benefits that are important from their experiences, namely accessing to resources (e.g. manpower, facilities, technology, expertise and funding), obtaining practical experience, benefiting from commercialization of R&D outcomes, achieving competitive advantage, and increased recognition and reputation. Personal satisfaction/achievement gained from the collaboration is the highest ranked intangible reward by university respondents, but not so by the industry participants. The academics who participate in strategic collaborations did not do it for academic promotion but rather for self-satisfaction. The benefits from collaboration are obvious to the industry respondents but university respondents revealed that academics who participated in the strategic collaborations did not do it for academic promotion but rather for self-satisfaction. University respondents (R1 to R39) emphasized that collaboration with industry is not a specific element measured in the performance of academics but is included in their general research and consultancy performance measure. Thus, academics that choose to collaborate

with industry will have to work harder and wait longer for academic recognition, including promotion.

Collaboration without commitment, and support from the senior management of university/company will slow the strategic collaborative process. Commitment of the individuals involved is also important. Commitment in terms of resources is also examined in this study. The university normally contributes knowledge, while industry normally contributes natural and financial resources.

The similarities and differences in factors presented as 'critical' by university and industry personnel will form the basic underlying understanding for managing successful UIC relationships in Malaysia. The dyadic approach has indicated the different emphasis of success factors as 'critical' by university and industry personnel where the result will close the gap dividing between university and industry. The finding will also provide a guide to academics who wish to collaborate with industry, and for industry personnel to understand the academic viewpoint and perception. Understanding the similarities and differences of the critical success factors on both sides, will help to better manage the UIC relationship.

5. Conclusion

This study has presented the critical factors that influence the success of UIC relationships, and this knowledge is important in managing such relations. Both universities and industry need to realize that successful strategic collaboration is grounded on the interactions of individuals and not organizations or institutions, as advocated by Maister (2003). By having a coaching system to mentor and retain the right persons will help in ensuring successful strategic UIC relationships. This research has also revealed that each critical success factors cannot exist by itself, but are intertwined with each other. Therefore, concentrating on the critical success factors mentioned in this study will escalate strategic collaborative relationships on a '*win-win*' basis. This effort will also help to close the divide between universities and industry, and managing collaborative relationships, by observing the challenges of successful collaboration between university and industry, and understanding its critical success factors. In addition, universities embracing globalization and innovation in search of mutual benefits on a win-win situation will bring significant growth in strategic UIC relationships. We recommend that a further study on success factors that contribute to successful UICs at regional level will be useful for cross-boundaries' research collaborations between universities and companies.

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