Critical Success Factors for Knowledge Transfer Collaborations between University and Industry

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Abstract: *In a fast moving business environment university-industry collaborations play a critical role in contributing to national economies and furthering a competitive advantage. Knowledge transfer from university to industry is supported by national governments as part of their innovation, national growth and competitiveness agenda. A university-industry landscape involves multiple stakeholders with multiple, and often contradicting, objectives and organizational mind-set and cultures. The paper is based on a systematic literature review of the effectiveness of university-industry collaborations from a holistic perspective in order to identify drivers and barriers to a fruitful collaboration. A dedicated section explores knowledge transfer in the emerging market context to provide an international dimension to a growing international trend in university-industry collaboration. The key findings on success factors relate to organizational and individual contexts, knowledge attributes and relational aspects. The literature research findings are further tested through a survey of key stakeholders: university managers, researchers, industry managers and government representatives, revealing differences in perception among various stakeholders' groups. The paper provides an insight into drivers and potential barriers in university-industry collaborations. The findings enable developing a practical framework for the universities to support their decision-making process. The framework can be used a support tool for evaluating university-industry collaborations both generally and in the international context.*

Keywords: *triple helix, university-industry collaboration, knowledge transfer, critical success factors, emerging markets, developing countries, competition*

Introduction

A global knowledge exchange landscape is swiftly changing, moving towards open innovation. The open innovation paradigm demonstrates the need to exploit internal and external knowledge and knowledge transfer pathways in order to remain competitive in a market place. Industrial companies are increasingly facing pressure from growing competition, a shortening product life cycle and increased complexity. There is a growing trend to explore external sources for innovation to acquire new ideas, develop new capabilities and access the latest academic research. Furthermore, engaging in partnerships with universities allows companies to leverage government funding and reduce the cost of their Research and Development (R&D) (Perkmann, 2011).

Similarly, universities are experiencing pressure to transform from an ivory tower mentality to an entrepreneurial mind-set and to contribute to national innovation agendas (Etzkowitz, 2000). They demonstrate a growing appetite to exploit their knowledge base and commercialize their intellectual property and technologies.

At a policy level, governments are actively influencing university-industry collaborations through supporting public-private partnership, developing strategies to support open innovation and creating a dynamic small to medium enterprises (SME) sector to accelerate technology commercialization. The triple helix (university-industry-government) development strategy is becoming a powerful national tool to develop an innovation mechanism and build stronger links between private and public research sectors (Etzkowitz et al., 2000; Ranga et al., 2008).

Objectives

This research paper focuses on studying knowledge-transfer collaborations between academia and industry. Our specific objective is to identify success factors for such activities in the emerging market context. The aim of our research is to develop a framework for knowledge-transfer collaborations to support a strategic decision making process in order to evaluate potential collaborations between universities and industry.

Our research makes an attempt to undertake a holistic analysis of university-industry partnership in a multi-domain knowledge transfer context in order to identify critical success factors from multiple stakeholder perspectives.

The paper is based on a comprehensive literature review and develops a theoretical conceptual framework. The results of the literature review were used to design a stakeholders' questionnaire. The survey verified our findings from the literature review and provided new insights of the drivers and barriers in university-industry collaborations.

Literature Review and Theoretical Framework

For the purpose of our research we developed a theoretical framework integrating prior research in the field of knowledge transfer between universities and industry. The framework will be further tested through a stakeholders survey to verify and analyze our findings.

Literature Overview

The following sections provide a brief summary of key topics discussed in literature, which are relevant to our research topic.

Publications on our research topic widely cover an emerging trend in exploiting knowledge as a mechanism of national growth and the triple helix model (Etzkovitz & Dzisah, 2008; Ranga et al., 2008). There is a comprehensive discussion about knowledge transfer typology, process and determinants relevant to our research which are essential to understanding knowledge transfer mechanisms (Landry et al., 2007; Barbolla & Corredera, 2009; Lockett et al., 2009). A number of authors join a debate on knowledge transfer effectiveness citing organizational, individual and institutional aspects of organizations involved in knowledge exchange (Phan & Siegel, 2006; Pertuze et al., 2010; Burnside & Witkin, 2008; Horng & Hsueh, 2005; Wilson, 2012; Cummings & Teng, 2003; Khalozadeh, 2011). The research on critical success

factors often correlates with discussions on barriers to effective collaboration and ways for their reduction (Bruneel, 2010; Perkmann et al., 2011; Wilson, 2012; Siegel et al., 2003, 2004; Khalozadeh et al., 2011).

There is a less explored area of knowledge transfer effectiveness in the international context (Kedia & Bhagat, 1988; Madu, 1989; Kumar et al., 2007; Duan et al., 2010; Svensson, 2007) with an additional layer of complexity related to market conditions, local capabilities and cultural values. Furthermore, due to its nascent nature, knowledge transfer in the emerging market context is even less explored.

Triple Helix as a Strategy for National Growth

Knowledge production and diffusion is widely accepted as a critical factor for economic growth (ConceiÇão et al., 2002) with universities playing a key role in developing a knowledge-based economy. One of the models describing knowledge transfer interactions is a triple helix development model, which focuses on creating strong links between industry, government and universities. The model is proposed as a strategy for developing countries to accelerate their transition to the knowledge-based economy (Etzkowitz & Dzisah, 2008).

Many authors stress an increasingly complex interaction between universities, government and industry in collaboratively developing roadmaps and foresight strategies which can potentially lead to a more sustainable economic growth and competitive advantage (Etzkowitz et al., 2000; Ranga et al., 2008).

Knowledge Transfer Determinants

The term knowledge transfer is often interchanged with "knowledge dialogue", "knowledge exchange" and "knowledge translation" (Lockett, 2009). A diagram of the knowledge transfer cycle is presented in Figure 1.

Knowledge transfer activities between university and industry can provide substantial benefits for all partners as summarized in Figure 2.

Universities benefit from industrial funding, access to industrial testing facilities and practical case studies demonstrating translational impact. Industry potentially saves on R&D and the need to develop a specific expertise in-house. It further benefits from access to a talent pool, laboratory facilities and cost sharing. As a result, such partnership supports open innovation, competitiveness and national growth.

Effectiveness of University-Industry Knowledge Transfer Mechanisms

A university-industry collaboration landscape is complex and varies in scope, duration, funding mechanism, geographic location, expected outcomes and impact. These variables make it challenging to evaluate effectiveness of university-industry collaboration and develop metrics for comparison.

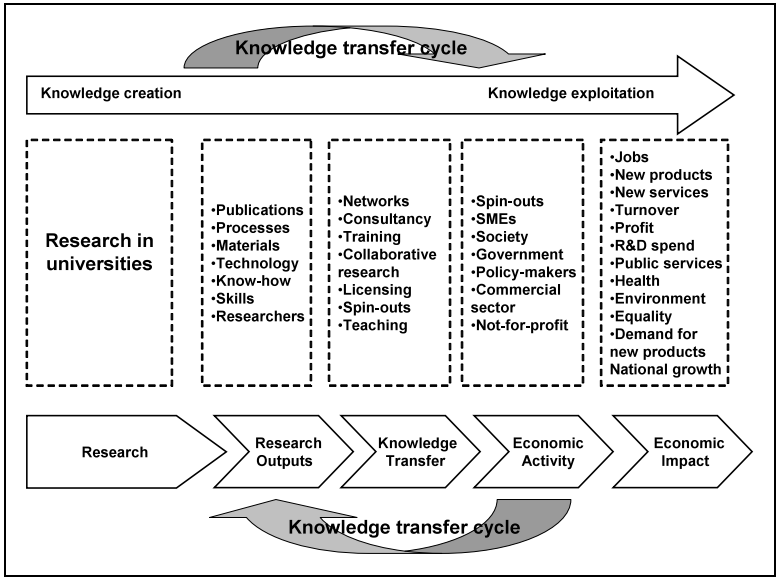

Figure 1. Knowledge transfer cycle. Adapted from Lockett (2009), UNICO report (2008), "Increasing the economic impact of Research Councils" (DTI, 2006).

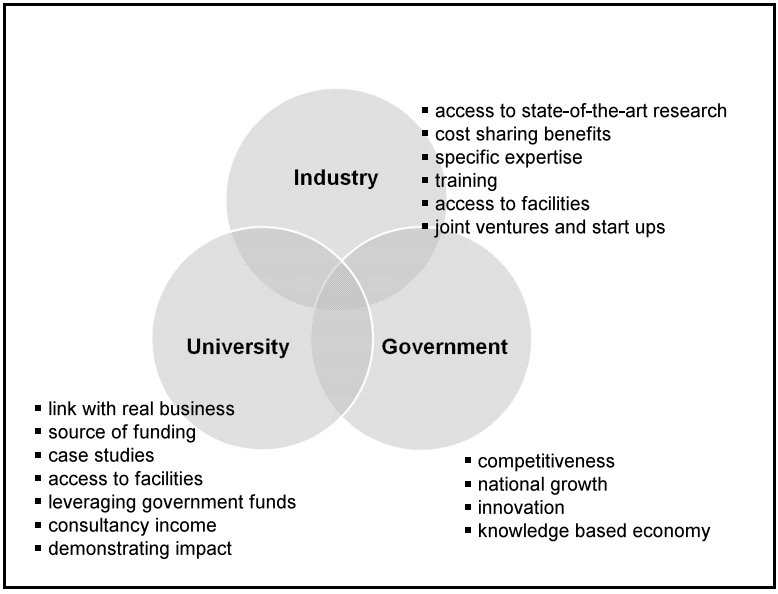

Figure 2. Potential benefits from academia-industry interactions (adapted from Link and Tassey, 1989; Lambert, 2003; Landry, 2007, Etzkowitz & Dzisah, 2008).

There is limited research on effectiveness of university-industry collaboration exploring it as a holistic activity with multiple stakeholders and objectives. Phan and Siegel (2006) propose a framework simultaneously considering three contexts: institutional, organizational and individual.

Barbolla and Corredera (2009) propose a framework comprising company, university, technical and relationship perspectives (Table 1). From the knowledge perspective, key factors affecting the success or failure of a project include technology maturity, readiness for application, well-defined objectives and scope of the project, technical risks and technical feasibility to implement results. Some authors (Pertuze, 2010) acknowledge a strategic alignment of technology with the company research portfolio.

Table 1. Factors for Knowledge Transfer Analysis
(Adapted from Barbolla & Corredera, 2009; Pertuze, 2010)

TECHNICAL FEATURES	UNIVERSITY FEATURES
• technology maturity • technical risk • project viability and technical feasibility • well-defined objectives • stakeholders involvement • application capacity / usefulness • strategic context	• level of general know-how • level of specific know-how • researchers motivation • staff and resources • incentives and reward structure • senior management support • strong leadership • experience of working with industry
COMPANY FEATURES	**RELATIONSHIP ASPECT**
• absorptive capacity • ability to integrate technology into value chain • confidence in results • experience of working with academia • senior management support • sufficient resources • change management capacity • effectiveness of internal communication	• mutual confidence • shared vision • professional and personal relationship • cultural interface • established planning and coordination • clarity of role and responsibilities • access to information / transparency • flexibility • effective project management • long-term relationship

From the organizational perspective, critical factors from the company's point of view are the firm's absorptive capacity and the ability to integrate new technology into the business value chain. Other authors (Pertuze, 2010) support this notion claiming that companies value research impact over a project outcome. A critical factor to evaluate knowledge transfer effectiveness is how the new knowledge will increase a company's performance. At a university level, important factors affecting collaboration include researchers' motivation, incentives structure, senior management support and strong leadership.

There are a number of symmetrical factors for both university and company which influence a success of collaboration: senior management support, flexibility, information flow and transparency, sufficient resources at both ends and past experience.

The relational aspect is critical to build confidence and trust between partners. Knowledge transfer between academia and industry depends on balancing push and pull factors and aligning multiple objectives. The challenge in this process is asymmetry of information (Landry, 2007), where industry may experience difficulties in evaluating results and their potential applicability. Therefore, relational aspect is a critical dimension to foster trust, confidence and linkages between partners.

Barriers in University-Industry Collaboration

Despite a growing number of academia-industry collaborations, there are certain issues and barriers, which affect collaboration mechanisms (Link & Tassey, 1989; Bruneel, 2011; Perkmann & Walsh, 2008): *inherent differences in mission and objectives:* a different time horizon (short-term industry versus long-term academia orientation), confidentiality and exclusivity (open source and publication approach by universities versus competitiveness and result protection by industry); *organizational differences:* this issue has a direct impact on the level of funding, university cost structure, academic incentives and different focus of research. While university researchers are driven by curiosity and academic prestige, industry is driven by profit-driven problem-solving and results; *cultural differences:* university research has a more explorative nature while industrial R&D focuses on applied problem-solving research. This can potentially create a serious conflict between academic and industrial partners due to conflicting values and misperception.

There is a plethora of discussion on potential barriers to university-industry collaboration related to intellectual property (IP), ownership and exploitation. Some authors (Fazackerley 2009; Siegel et al., 2003) suggest that academics often attach a higher value to their ideas, which can make an entire collaboration cost prohibitive. While this view is commonly shared by industry, universities normally invest time and resources in negotiating their IP value to protect their publication rights, keep results for their future research and negotiate a market-rate compensation for their IP. This debate resonates with Bruneel's (2011) argument that universities are becoming much savvier players in collaborative partnership with industry and aim to exploit their knowledge commercially.

Cultural and informational barriers are often cited as inhibiting factors to a successful collaboration (Siegel et al, 2004). Different organizational cultures result in mismatch between business needs and university strategy, time scale, expectations, failure to agree on IP terms and contrasting views on liabilities (Wilson, 2012).

Similar notion is expressed by Anderson et al (2007) who identify culture differences, bureaucracy and inflexibility of universities' processes and policies, lack of well-designed reward mechanisms and inefficient management of knowledge transfer transactions as barriers to knowledge transfer between academia and industry.

However, there is a recent growing trend from universities to engage with industry on a more open and collaborative basis opening their IP for evaluation and development by industry. For example, a number of universities in the UK have joined in the Easy Access IP project, which provides quick access to universities' technologies thus maximizing knowledge transfer from universities for public benefits.

Knowledge Transfer Challenges in the Emerging Country Context

Knowledge transfer across countries has additional challenges deriving from geographical, economic, political and cultural gaps (Duan et al., 2010).

Literature analysis reveals (Madu, 1989; Svensson, 2007; Williams, 1996) that knowledge transfer enhances growth opportunities for emerging markets. Large-scale knowledge transfer collaborations are often sponsored by the state as they require a high level of funding, significant resources and have a strategic economic importance to develop indigenous innovation capabilities (Kumar et al., 2007). A strategic role of such projects creates a high interest from potential stakeholders and produces a knowledge spill-over effect. However, a long term economic growth can be achieved if the knowledge obtained is fully utilized and developed.

Madu (1989) argues that in order to enable a successful knowledge transfer process it has to be integrated into a national development process. Key elements in this process are: (i) raising awareness of knowledge transfer initiatives, (ii) training and education of local workforce to reduce resistance and (iii) increasing a knowledge adoption level. Research suggests (Svensson, 2007) that knowledge transfer effectiveness depends on the level of development of the host country. In the least developed economies (LDEs), the absorptive capacity is much lower and therefore requires more activities on capacity building and training during collaboration. In newly industrialised economies (NIEs) (e.g. Brazil, India, Russia), the level of education is higher, which increases an absorptive capacity and need for cooperation.

While there is a growing trend in knowledge transfer from western economies to developing countries, there are barriers (Harvey et al., 2002) which relate to: limitations associated with a transferring country: legislation, currency exchange risk, payment process, inflation, stability, political tension, infringement of IP rights limitations associated with knowledge: relative advantage, compatibility, modularity, trial opportunities, reputation of transferring country/organization in particular field, and relative price to acquire and develop knowledge limitations associated with a receiving country: low payment capacity, low absorptive capacity, bureaucracy and a multi-level decision-making process of receiving country/organization.

In his framework of transnational knowledge transfer effectiveness, Duan (2010) identifies top success factors including (i) cultural awareness, (ii) motivation, (iii) knowledge distance between partners, (iv) openness and trust, (v) selection of partners and (vi) relationships between them, (vii) clear objectives for knowledge transfer collaborations and (viii) language. Other success factors frequently cited in literature are: existing relationship between collaborative partners, experience and skills of partners, their reputational capital and local networks of the knowledge supplier (Svensson, 2001).

As knowledge transfer collaborations are increasingly forming a part of national economic development strategies, the role and stability of local political systems is critical. Research suggests (Madu, 1989) that industrial partners should conduct a due diligence review on government policies, tax regime, foreign exchange, joint venture legislation, IP rights legislation and foreign investment policies. A due diligence review also helps reduce risks before engaging in time-consuming and costly knowledge transfer activities (Harvey et al., 2002).

While cultural differences and their impact on business are widely studied topics (Hofstede, 1993, 1994; Ashkanasy et al., 2002; Bakascsi et al., 2002; Gupta, 2002), there are fewer studies on cultural implication in the knowledge transfer context (Kedia & Bhagat, 1988; Madu, 1989; Swensson, 2007; Duan et al., 2010). Kedia and Bhagat (1988) argue that in the context of knowledge transfer from developed to a developing economy, societal culture is the most important element in determining knowledge transfer success. The key finding from the authors' conceptual model for understanding cultural constraints on international knowledge transfer collaborations is that knowledge transfer to developing countries depends on cultural compatibility between the receiving and transferring nations.

Research (Kedia & Bhagat, 1988) suggests that a process- and person-embedded knowledge transfer is more culture dependent than a product-based knowledge transfer which has more tangible elements and is more codified. When such processes are embedded in a transnational context national and organizational cultural differences become critical and these differences need to be considered by both the transferring and receiving organizations. The authors argue that knowledge transfer is easier between countries with similar cultural characteristics. Another conclusion is that individualistic countries are more successful in absorbing and diffusing imported technology. The same conclusion applies to collectivist countries with a high masculinity score. Countries with a high power distance are potentially less efficient in absorbing knowledge as it may affect a balance of power distribution at either organizational or societal levels (Kedia & Bhagat, 1988).

Research suggests that international alliances can create a quick avenue to new resources and innovation. However, it is important to consider invisible costs related to "liability of foreignness in the host country," which includes culture, legal and economic legacies as well business norms (Hitt et al., 2009). To align different objectives and motivation factors requires a high degree of flexibility and adaptability from the project management team. Adler (2003) recognises a higher stress level in international teams due to initial lack of trust and differing perceptions of communication messages.

Theoretical Conceptual Framework

Based on the literature review of the effectiveness of knowledge transfer between universities and industry, we identified the most frequently mentioned factors affecting knowledge transfer success. We combined findings from the literature review, integrating them into a conceptual framework (Figure 3) that enables further analysis and provides a basis for a questionnaire design.

As discussed earlier, literature broadly divides these factors into internal, i.e. factors that can be controlled, and external, i.e. beyond the partners' control. External factors reflect economic, political, legal, social and technological conditions of the country receiving knowledge. Although these factors are beyond the partners' control, they can be identified through a due diligence review process to mitigate external risks (Madu, 1989). At the next level of analysis, there are internal factors related to organizational, individual, process and financial assets of each actor of the analysis: university, industry and a funding body (Landry et al., 2007, 2010; Cumming & Teng, 2003; Phan and Siegel, 2006; Barbolla & Corredera, 2009; Pertuze, 2010; Duan, 2010; Madu, 1989; Kedia & Bhagat, 1988).

The type of knowledge itself has its impact on the effectiveness of knowledge exchange and is characterised by novelty, research field and complexity (Landry et al., 2010), technical risk, application capacity (Barbolla & Corredera, 2009; Pertuze, 2010), and type of knowledge (Kedia & Bhagat, 1988).

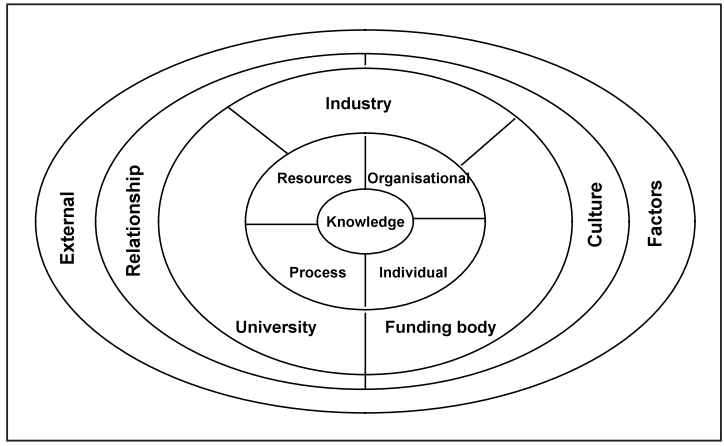

Figure 3. Conceptual framework of knowledge transfer dimensions

Finally, knowledge transfer effectiveness in the international setting is further affected by national cultural differences and relational assets developed through the project life cycle (Cumming & Teng, 2003; Duan, 2010; Madu, 1989; Kedia & Bhagat, 1988).

Survey Method

Based on the analytical conceptual framework developed form the literature review, we designed a questionnaire categorizing questions into six levels: (i) institutional, (ii) individual, (iii) technical, (iv) process, (v) financial and (vi) relationship levels. These dimensions correspond with internal and relationship levels in the conceptual framework. We limited the questionnaire to internal and relational factors which can be controlled or partly controlled by a university therefore can provide a meaningful insight into potential collaboration and its outcome. A sample questionnaire is presented in Table 2.

Table 2. Critical success factors for knowledge transfer collaboration between university and industry

Level of analysis		1	2	3	4	**5**
I	**Institutional / organizational level**					
1	University's ranking and reputation play a significant role in a selection process					
2	University's size is an influential factor in selecting a University partner					
3	University's multidisciplinary nature of research is a critical factor for public-private collaborative research projects					
4	Senior management support is vital for international projects development and implementation					
5	A well-established mechanism for incentives is critical to stimulate academic interest to take part in commercial research					
6	Well established communication and linkages between University's departments are vital for efficient development of commercially funded projects					
	Average score					
II	**Project level**					
1	Focus on users' needs is key for a project success					
2	Translational nature of the project is critical for a project success					
3	Novelty of research is critical for a project success					
4	Complexity and tacit nature of knowledge transfer affect the project success					
5	Agreement on Intellectual Property rights is crucial for a project success					
	Average score					
III	**Individual researcher level**					
1	Experience of individual researchers is an influential factor for a project success					
2	Gender of a researcher plays a role in project development and/or implementation					
3	Level of seniority of Principal Investigator affects a project success					
4	Professional ethics and conduct are key factors for a successful project					
	Average score					
IV	**Process level**					
1	Experience of a national research partner is vital for success					
2	Efficient information flow is a critical factor for a project success					
3	Technical competences of a project team is vital					
4	Strong project management is necessary for a project success					
	Average score					
V	Financial level					
1	Funding transparency and clarity is necessary for a successful project development					

2	Commercial focus of the project adds complexity to project development, negotiation and delivery					
3	Public funding adds complexity and/or bureaucracy to an application and/or negotiation process					
4	Transparent and clear reporting requirements are crucial for a project success					
	Average score					
VI	**Relational level**					
1	Differences between cultures of transacting institutions increase a risk of a project failure					
2	Trust between research partners and project stakeholders reduce a risk of a project failure					
3	Establishing relationships between partners is vital for a project success					
4	Knowledge of a local language is important for a project success					
5	Motivation of individual researchers is critical for a project success					
6	Geographical distance has a negative impact on a project implementation					
7	Selection of research partners is a key part of a project's due diligence					
8	Openness between partners is critical for a project success					
	Average score					

Score: 1 - strongly disagree; 2 - disagree; 3 - irrelevant; 4 - agree; 5 - strongly agree

To limit the bias, we selected knowledgeable informants who view the research phenomenon from different perspectives, different hierarchical levels and different cultural contexts (Eisenhardt, 2007).

A survey sample included all actors engaged in the university-industry collaboration including government, industry, academic research partners and business support functions with the university. Each category of survey participants plays an important role in developing an innovation ecosystem and driving the knowledge based agenda pursued by national governments.

The sample was selected using a non-probability sampling technique on a judgemental basis. We identified 50 participants who have been involved in the chosen case study or worked with the researcher on a number of similar large-scale international collaborative projects in emerging markets (e.g. Russia, Qatar). The sample population was selected to ensure a fairly equal representation from each stakeholder group: academic researchers, university managers, industry representatives and government/funding bodies (Table 3).

In addition to different roles in collaborative research, the respondents represented a good mix of nationalities (British, Russian, Italian, Greek, Latin American, Lebanese and German), which added value to an international dimension explored in this research. Regardless of nationalities, most of the respondents had an extensive international experience therefore the results of the survey and subsequent interviews represented a broad perspective both from the specific roles and international perception of international research collaborations.

Table 3. Survey Statistic by Respondent Groups and Response Rate

Questionnaire	Researcher	University Manager	Industry Representative	Government/ Funding Body	**Total**
Sent	14	12	14	10	50
Received	9	10	6	8	33
Response rate	64%	83%	43%	80%	66%

The respondents answered questions using a five-point Likert-style scale. In addition, the respondents were asked to add their comments, which provided a strong qualitative dimension to our findings and enhanced our understanding on critical factors for successful research partnership.

Results and Discussion

The results of the stakeholders' survey are presented in Figure 4. We calculated average scores for each level of analysis (knowledge, institutional, process, individual, resources and relational contexts) for each stakeholders' group.

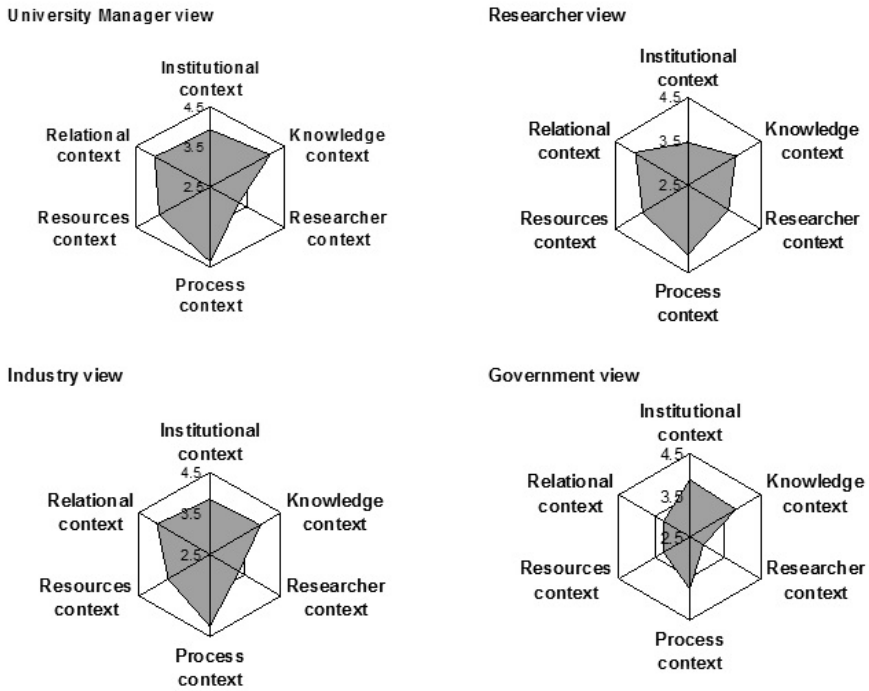

Figure 4. Stakeholders' view on critical success factors for university-industry collaboration (ranking is presented using a 5-point Likert-style scale from 1 (lowest) to 5 (highest)).

Quantitative analysis of survey results confirmed our findings from the literature review, highlighting the importance of process, relational and knowledge aspects as most critical factors for a successful international collaboration. The results presented in Figure4 show that knowledge, process and relational aspects scored the highest mark by all respondent groups. This overall finding correlates with the conceptual framework (Figure 3) developed from the literature review and analysis.

At individual stakeholders' levels, some factors were perceived more important than the others. The knowledge context (translational nature, applicability) was highly marked by university management (4.1) and industry (3.93), revealing a stronger business acumen of these stakeholder groups. Process and project management context was particularly ranked high (4.25) by industrial partners. This finding correlates with previous research (Siegel et al., 2005) which identified a high level of bureaucracy and inflexibility of universities as a barrier to collaboration.

The resources context was of major importance to university managers (3.88) and least important to the government group (3.25). Similar findings were produced by Siegel et al. (2005), who identified insufficient resources allocated to knowledge transfer collaboration cited by 53.3% of university managers.

The relational context was given the highest score of 4.01 by the university managers, followed by the industry (3.98), academics (3.97) and the government group (3.25). Most of previous research findings conform to this result, e.g. Siegel et al. (2005) identified lack of understanding as a major barrier to a successful collaboration acknowledged by 90% of industry and university managers and 75% of researchers.

In addition to assigning scores to questions, the respondents provided free comments which we used to substantiate the quantitative results.

For examples, the most frequent comment referred to a more ambiguous nature of university-industry collaborative project and a greater risk for "runaway". The very nature of such projects means that they have more variables and a greater complexity in understanding goals, timelines and attitudes. The industry group particularly commented on the importance of academic ability to convey their knowledge to an outside world to ensure their audience understands the benefits of their research for practical use.

To conclude, the most cited factors for successful collaborations in the international context were: (i) understanding of customer needs, (ii) common goals, (iii) a clear focus on translation, (iv) an understanding of intellectual property issues and (v) early technical scoping of the project to ensure the alignment of mutual goals and objectives. Most respondents agreed that mutual trust and cultural empathy are critical success factors in developing international research partnership.

Table 4. Summary of critical success factors for knowledge-transfer university-industry collaborations

	Enabling Factors	Barriers
Knowledge Context	- partners' mutual confidence - strong translational focus - alignment of research objectives and with partners' strategic objectives	- industry's ambitions to commercialize results in a short-term - misalignment between research and commercialization objectives
Organizational Context	- university ranking - support at the senior level - network assets - policies and incentives for knowledge transfer activities - risk taking propensity - well-developed IP strategy	- difficulties to identify project ownership - complex organizational structure - low buy-in at a junior level - lack of resources and protected time - difficulties in delegation and controlling results - risk aversion
Decision-making Context	- support at senior management level - decision on project ownership at an early stage - framework for assessing feasibility of international collaborations	- institutional bureaucracy - lack of ownership - multiple priorities
Individual Context	- relative academic freedom - academic champion - entrepreneurial expertise - personal motivation - personal goals	- lack of incentives - lack of personal motivation - time pressure - multiple competing objectives
Project Management	- flexibility and adaptability - strong project management - industry early involvement in the process - past experience of partners - effective communication	- process complexity - multiple stakeholders with different objectives - geographic distance - complex information flow and logistics - time pressure
Market Context	- supportive national Government - absorption capacity and ability to learn from best practice - strong market knowledge - thorough due diligence analysis - risk assessment and mitigation strategies	- uncertainty related to long-term development - emerging markets bureaucracy - political context - complex legal framework - limited knowledge transfer experience in emerging markets - lack of national benchmark to evaluate successful collaboration
Relational and Cultural Context	- knowledge of national culture - trust and openness - long-term commitment - knowledge of local language	- lack of cross-cultural understanding - different cultural values - different levels of business skills and acumen between partners - focus on quick wins

Conclusion

University-industry partnership is increasingly playing a key role in developing innovation supply chains and knowledge transfer ecosystems. It is critical to understand the nature of university-industry collaboration, its effectiveness and potential barriers to ensure effective knowledge transfer, competitiveness and developing knowledge-based economies.

Knowledge characteristics play a significant role in affecting university-industry collaborations. Partners' mutual confidence, strong translational focus, understanding of industry needs and objectives, alignment of mutual goals and research objectives are contributing factors to a successful partnership.

At a higher level of analysis there are three broad levels affecting potential collaboration: internal, environmental and relational and cultural. Internal factors are related to organizational, individual, process and resource contexts and can be partly controlled. External factors relate to market conditions, political, economic and legal risks, which can be mitigated though due diligence. Relational and cultural factors can ultimately enhance or inhibit the success and are critical for developing viable collaborations.

Knowledge transfer collaborations in the emerging markets have additional challenges such as market stability, knowledge absorption capacity, local education, capabilities and cultural value systems. Our findings highlighted cultural empathy and trust as key success factors.

The proposed framework can be successfully utilized as a decision-making tool for evaluating potential research collaborations with international partners. At a practical level, the developed framework can help evaluate probability of success and potential challenges for specific knowledge-transfer projects. We propose using a framework considering all levels of analysis: (i) type of transferred knowledge, (ii) internal (individual, organization, process and resources) applying it to all stakeholders involved in collaboration, (iii) external or environmental level and (iv) cultural level for international collaborations.

Based on our findings, we recommend further research focusing on a holistic approach to critical success factors for collaborative university-industry research. The focus should be placed on knowledge characteristics and its translational ability, organizational dynamics and processes, market-related risks and impact of national cultural differences.

An interesting topic for future research is how to build international market capacity beyond research collaboration to ensure sustainability of results. Such types of collaboration require an active engagement with national industrial partners to create industry demand and conditions for knowledge transfer from academia to industry. They also require a close cooperation with national policy-makers to enable development of effective policies for transnational university-industry collaboration.

Most existing literature only considers individual parts of the knowledge-transfer cycle. Future research should explore the entire value chain and interdependence of various phases as well as multiple stakeholders: universities, industry, public funding bodies, policy-makers, venture capitalists and knowledge brokers.

Author's Note

The opinions, findings and conclusions in this paper are those of the author and do not necessarily reflect the views of Imperial College Consultants, a wholly owned subsidiary of Imperial College London, UK. This paper is part of a thesis submitted for the degree of Masters of Business Administration, Warwick Business School, UK.

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