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# Heterogeneous inter-organizational social capital: the case of Faraday Partnerships for technology transfer

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## Abstract

*Given its tripartite impact on society, industry, and university, the phenomenon of university-industry partnership (UIP) has become a valuable research endeavor. However, examining UIP-related literature shows limited understanding from a social capital (SC) perspective, albeit its relevance (as UIP comprises extensive social interaction) and capacity (being an important resource latent in networks system). Likewise, it is noticeable that research on inter-organizational SC has been predominantly conducted from the perspective of homogenous organizations (i.e., have consistent expectation, mission, and culture). However, the perspective of social interaction between heterogeneous organizations (i.e., belong to different sectors thus inherently different) is limited. We address these two gaps by investigating the idiosyncrasy of SC development in the setting of UIP, as a unique context for heterogeneous inter-organizational SC. We contribute to the literature by exposing the various facets of SC dynamics as evolve in this uncommon domain. Also, we identify four factors as moderating the interaction between the three dimensions of SC that eventually influence the dual processes of technology translation and transfer.*

## Keywords

University-industry; partnership; social capital dimensions, technology transfer; technology translation

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## **Abstract**

*Given its tripartite impact on society, industry, and university, the phenomenon of university-industry partnership (UIP) has become a valuable research endeavor. However, examining UIP-related literature shows limited understanding from a social capital (SC) perspective, albeit its relevance (as UIP comprises extensive social interaction) and capacity (being an important resource latent in networks system). Likewise, it is noticeable that research on inter-organizational SC has been predominantly conducted from the perspective of homogenous organizations (i.e., have consistent expectation, mission, and culture). However, the perspective of social interaction between heterogeneous organizations (i.e., belong to different sectors thus inherently different) is limited. We address these two gaps by investigating the idiosyncrasy of SC development in the setting of UIP, as a unique context for heterogeneous inter-organizational SC. We contribute to the literature by exposing the various facets of SC dynamics as evolve in this uncommon domain. Also, we identify four factors as moderating the interaction between the three dimensions of SC that eventually influence the dual processes of technology translation and transfer.*

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## 1 Introduction

Despite University-Industry Partnership (UIP) has had a long history (Perkmann et al., 2013; Welsh, Glenna, Lacy, & Biscotti, 2008), there has recently been substantial interest and increase in these kind of organisational arrangements (Perkmann & Schildt, 2015; Bruce S. Tether & Abdelouahid Tajar, 2008). While firms perceive UIP as a channel to generate, internalize, and commercialize knowledge (Hemmert, Bstieler, & Okamuro, 2014), and a source for both radical and incremental innovation (Perkmann & Schildt, 2015), universities seek them to lessen the pressure of their tight research budget (S. Ankrah & Al-Tabbaa, 2015), and increase the relevance and usability of their abstract knowledge (Manyika & Roxburgh, 2011).

However, examining UIP-related literature shows limited research from a social capital perspective (Al-Tabbaa & Ankrah, 2018), defined as the actual and potential resources made available through reciprocal interactions and trusting relationships (Adler & Kwon, 2002; Arregle, Hitt, Sirmon, & Very, 2007), despite its reported impact in enhancing performance (Winter, 2003), boosting creativity and product innovation (Elfenbein & Zenger, 2014), and reducing transaction costs (Oni & Papazafeiropoulou, 2014). Few studies have merely mentioned social capital in UIP context (e.g., Santoro & Chakrabarti, 2002b; Doris Schartinger, Rammer, Fischer, & Fröhlich, 2002). Others have applied the social capital concept in a narrow perspective, that although contend that the concept of social capital is useful to understand how to build and maintain collaborative research partnerships, they barely addressed the relational dimension (as an essential component of social capital) (e.g., Carayannis, Alexander, & Ioannidis, 2000; Thune, 2007). For instance, Murray (2004) relied on the structural dimension (in terms of connections network between firms and academic scientists) to explore the value of social capital in the case of collaboration between scientists and firms. Similarly, Datta and Saad (2008) focused primarily on the structural dimension (another component of social capital), employing social networks to investigate the use of social capital as a resource firms can use when searching for potential exchange partners.

On the other hand, our review of the social capital-related literature unfolds that the mainstream research on the organizational social capital has been predominantly conducted from the perspective of homogenous organizations (see for example, A. Inkpen & E. Tsang, 2005; R. Lee, 2009; Payne, Moore, Griffis, & Autry, 2011). In principle, research in the area of organizational social capital can be categorized as intra or inter-organizational (Maria & Barclay, 2011). The former concerns the capital generated by means of interaction between

actors from different social groups belong to one organization (Arregle et al., 2007), where the latter involves external resources become available to an organization through its relationship and interaction that span its boundaries to other organizations (Dess & Shaw, 2001). We extend this notion by arguing that inter-organizational social capital can emerge from the interaction between either homogenous or heterogeneous organizations. Homogenous inter-organizational social capital relates to actors' interaction from two or more different organizations, yet these organizations belong to the same setting and/or are generally similar in organizational characteristics (e.g., companies from the same industry, organization with similar commercial activities, buyer-supplier, etc.).

By combining the above two issues, a salient research gap can be realized: we know little about the idiosyncrasy of social capital development in UIP as an interestingly unique context for studying social capital that can evolve via interaction between heterogeneous organizations. Such investigation is necessary because the inherent discrepancies rooted in their mission, organizational characteristics, policies, and procedures, are likely to affect how social capital evolves as a result of the actors' interaction from these organizations.

Therefore, we specify our main research question as: How does social capital evolve when embedded in the relationships between university and industry actors? Given the early stage of research on heterogeneous inter-organizational social capital in general, and in the case of UIP in specific, we sought to answer this question by systematically analyzing data derived from five case studies of partnership that have been part of the Faraday Partnership Initiative (S. N. Ankrah, Burgess, Grimshaw, & Shaw, 2013). This is a government-sponsored initiative that was designed to be a novel and fundamental change to the way transfer of technology is carried out in the UK between universities and other public research organizations on the one hand, and industry on the other hand (Airt, 2001). We center our attention on university and industry actors because they are significant stakeholders in UIP, and the various facets of social capital would be stored in and realized through relationships and regular interactions (Hovelja & Vasilecas, 2013). Therefore, their perceptions regarding these relationships and the policies that govern them are essential for understanding UIP dynamics and impacts and also for developing such policies (Welsh et al., 2008).

Our study makes a number of key contributions. First, much of the research on UIP takes one of three perspectives which appear to be quite restrictive in terms of capturing the dynamic relationships. The first is the resource-based view, either at the level of the firm (e.g., Santoro & Chakrabarti, 2002a) or the individual academic researcher (e.g., Rijnsoever, Hessels, &

Vandeberg, 2008). The focus in this perspective is made merely upon tangible and intangible resources organizations possess, where it theoretically underestimates the value of interorganizational interaction; the essence of UIPs. The second perspective is the institutional level which emphasizes relationships between universities, industry and governments in terms of a 'triple helix' which considers the role of the knowledge sector in relation to the political and economic infrastructure of society (e.g., Etzkowitz, 2008). And the third perspective is the economics approach which considers the impact of relationships on national or regional innovation systems (e.g., Mansfield, 1998). In contrast, our research employs explicitly social capital as an organizing framework to fully capture the dynamic relationships in UIP by applying broadly the three facets of social capital, namely structural, relational, and cognitive dimensions (Nahapiet & Ghoshal, 1998). As social capital in the context of alliances has been described mainly in terms of structural and/or relational factors (Gopalakrishnan, Scillitoe, & Santoro, 2008; Moran, 2005), our study highlights the additional significance of the cognitive dimension in its interaction with the other two dimensions. This therefore contributes to and complements research on the dynamic relationships among partners that integrates all three dimensions (e.g., Ibarra, Kilduff, & Tsai, 2005; Leana & Pil, 2006).

Second, research in the area of organizational social capital can be typically categorized as intra or inter-organizational, the former concerns the capital generated by means of interaction between actors from different social groups belong to one organization (Arregle et al., 2007), where the latter involves external resources become available to an organization through its relationship and interaction that span its boundaries to other organizations (Dess & Shaw, 2001). We extend this notion by exposing how inter-organizational social capital can emerge from the interaction between heterogeneous, rather than homogenous, organizations. As such, we theorize how the three dimensions of social capital interact in the context of UIP. Thus, we respond to the challenge to advance our understanding of the various facets of social capital as unfolded in different contexts (Payne et al., 2011; Zheng, 2010). We also suggest four factors as moderating the interaction between the three dimensions of social capital, including pre-existing relationships between university and industry actors, clear objectives shared by these actors, specific collaborative projects, and partnership intermediaries.

Finally, Finally, unlike many previous studies on UIRs which limit perspective by focusing on particular informant types such as the university or industry partner, our study analysed data from multiple informants in universities, industry, intermediaries and three key stakeholders of the Faraday Partnership Initiative. This broad spread of data enhances depth, quality and rigour

of the findings, since interviews with different informant types capture a variety of reinforcing perspectives.

The next section discusses the literature on social capital. We then present the context of the empirical case studies, and specify the research method including the primary data collection and analysis, before presenting the results of our analysis. Finally, we discuss emerging issues, and highlight the study's implications for research and practice.

## **2 Analyzing social capital literature**

Social capital can be conceptualized as a long-lived group of actual and potential (albeit uncertain) resources stored in the network of relationships which are established and maintained by individuals or organizations (Adler & Kwon, 2002). Furthermore, it has a unique characteristic of being possessed by all actors involved in the relationship (Filieri, McNally, O'Dwyer, & O'Malley, 2014). Seeking to understand the building blocks of social capital, Nahapiet and Ghoshal (1998), identified three attributes; labeled as social capital dimensions (or capitals), which we adopt as our theoretical framework in this study.

The structural dimension of social capital concerns series of connections (as a matter of resources) that social units or individuals have with others. Thus, it focuses on the patterns and ties strength among the members who have common relationships. The structural dimension of social capital can be viewed as series of connections that individuals or organizations have with others, or the networks that connect them (Winter, 2003). Accordingly, structural dimension (or capital) includes the patterns of social interactions and the strength of ties among the members of a collective (Hovelja & Vasilecas, 2013). These interactions comprise information channels that lessen the amount of time and investment required to assemble information (Filieri et al., 2014; Hughes & Perrons, 2011).

The relational dimension specifies the resources created through actors' interaction in the relationships, thus captures the quality aspect of these relationship (Hovelja & Vasilecas, 2013). Trust, as one example of these resources, can drive collective work and reduces transaction costs (Careya, Lawsonb, & Krausec, 2011). Obligation, another resource, would emerge from a willingness to return a favor with a favor, where the willingness is a function of the connection strength between the particular actors (Maria & Barclay, 2011). However, shared norms, a third resource evolves in relationship that facilitates communication, may cause unrealistic expectations of obligatory behavior that can create conflict due to the perception of free-riding act (A. Inkpen & E. Tsang, 2005).

Finally, the cognitive dimension includes resources, such as common understanding and interest (Zheng, 2010), which enhance the establishment of systems of meaning among individuals comprising a network thus optimize their interpretation of exchanged information (Thune, 2007). Accordingly, developing a common language (as one aspect of the cognitive capital) can facilitate individuals' ability to gain access to people and their information (Nahapiet & Ghoshal, 1998). Common context could also be extended to shared narratives that provide powerful ways for creating, exchanging and preserving rich sets of meanings such as myths, stories and metaphors. Thus, shared narratives make possible the creation and transfer of new interpretations of events in a way that facilitates the creation and combination of different forms of knowledge, including those largely tacit. This stresses one of the critical issues in heterogeneous interorganizational social capital, where actors have asymmetrical working contexts.

Despite the various benefit of this concept, the value of social capital is still debated (Winter, 2003), where research suggests that its impact should not be considered as constantly positive. As such, in some cases of buyer-supplier relationship, extensive social capital practice has the potential to negatively affect performance by, for example, manipulating the objectivity of actors involved decision making (Villena, Revilla, & Choi, 2011). In the same vein, Adler and Kwon (2002) concluded that the establishment of strong structural connection does not necessary guarantee the realization of social capital benefits.

## 2.1 Organizational social capital

As discussed above, social capital can create several benefits to organizations. However, the value of social capital can be derived from organization's intra (internally or within the organization) and inter (externally or between organizations) relationships (Indre Maurer, Bartsch, & Ebers, 2011; Wernerfelt, 1984), as illustrated in Figure 1 and Table 1. Intra-organizational social capital (intra-OSC) concerns the capital generated inside the organization by means of interaction between different individuals and social groups belong to that organization (Arregle et al., 2007). These social groups include, for example, project teams from various departments, or business units, staff across organizational levels, and informal groups such as communities of practice. This kind of organizational social capital has a vital role in facilitating internal coordination (Sirmon, Hitt, & Ireland, 2007) and enhance knowledge mobilization, and assimilation, and use between organization's actors (Winter, 2003). In other words, it affects how organization's internal resources are managed and leveraged, for instance, by enhancing the effectiveness of management (e.g., reducing



transaction costs) of activities from various functional units through improving the formal and informal flow of information and experience between the members of these units (Hitt, Lee, & Yucel, 2002). Yet, research shows that the relational aspects (e.g., strength of ties and level of trust between actors) are more important than structural aspects (e.g., number of ties) in intra-OSC in regards to internal knowledge transfer (Hansen, 1999; Winter, 2003). Typically, a greater number of ties may increase actors' awareness of exiting knowledge sources inside their organizations - as part of knowledge transfer process (Garengo, Biazzo, & Bititci, 2005). Nonetheless, given the tacitness nature of knowledge, the assimilation and use of knowledge (the remaining parts of knowledge transfer process) are more costly and cumbersome (Szulanski, 1996). Therefore, the recurrence of interaction (i.e., tie strength) and trust between actors are more critical in optimizing the internal learning and knowledge transfer as an outcome of intra-OSC (Winter, 2003; Zander & Kogut, 1995).

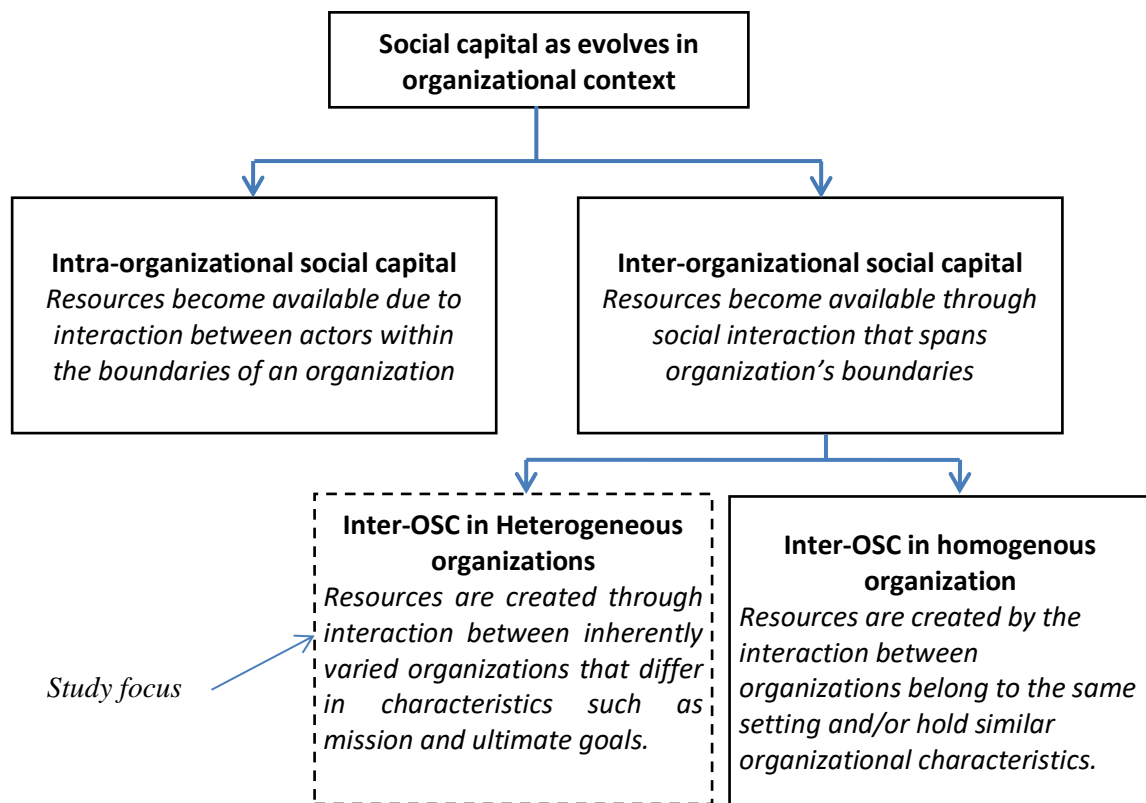


Figure 1: A typology for organizational social capital

Table 1: Analyzing organizational social capital

Social capital type	Study	Research setting/context	Main findings
Intra-organizational social capital	Zahra, Gedajlovic, Neubaum, and Shulman (2009)	Large telecommunication company that suffered from various organizational turbulence.	Several factors can influence the development of internal social capital (within organization staff), including workload (-), organizational change (-), job security (+). Further, perceived social capital has a positive correlation with affective commitment of staff.
	Hong and Snell (2013)	Focuses on single organization (conceptual research)	The structural capital of employees (identified in terms of relationship strength) influences the relational (represented by trust) and cognitive (represented by collective goals and actions) capitals. The latter two capitals mediate organization performance (measured as: costs reduction and benefits creation).
	Winter (2003)	Knowledge transfer in cross-organization projects within several engineering industries	The study concludes that knowledge transfer mediates the relationship between organization members' intra-organizational social capital and organizational performance as measured in growth and innovation performance.
	Salancik and Pfeffer (1978)	The development of new inter-unit connection in multinational corporation.	This paper investigates the effects of social capital (measured as social structure and network formation) and strategic relatedness on new linkage creation for resource exchange. The results show that the interaction between social capital and strategic relatedness significantly affects how new intra-organizational linkages are formed.
Homogenous inter-organizational social capital	Lumpkin and Dess (2001)	The interaction between global high-tech start-ups and their largest single foreign customer	Structural dimension has found to exert positive impact on knowledge acquisition of start-ups. However, relational and cognitive capitals have negative effect on knowledge acquisition.
	Pirollo and Presutti (2010)	Start-ups and main customers (buyer)	Focuses only on the structural dimension (the strength of ties). The development of different configurations of inter-organizational social capital (in terms of strong and weak ties) has positive impact on a startup's performance during its life cycle.
	Krause, Handfield, and Tyler (2007)	Buyer-supplier (manufacturing sector)	The study shows that the relationships of structural and relational capitals vary depending on the type of performance improvement considered.
	Roden and Lawson (2014)	Strategic buyer-supplier relationship (various)	Both the structural and cognitive dimensions determine the relational capital. However, this relationship is moderated by the extent of the relationship adaptations made by each firm and its supplier.

	Carayannis et al. (2000)	Collaborative research partnerships between government, university and industry	Social capital in the form of networks, norms, and trust can facilitate coordination and cooperation across the three sectors. In return, better coordination and cooperation drive leveraging knowledge, learning, and innovation.
	Hovelja and Vasilecas (2013)	Inter-sectoral cooperation among public agencies, nongovernmental organizations (NGOs), and grassroots groups.	The shape of networks of association and relationship, mutual trust, and norms of reciprocity (as indicating the development of social capital) are found to positively affect (NGO)-mediated cooperation and grassroots-centered cooperation.
Heterogeneous inter-organizational social capital	Filieri et al. (2014)	The network of pharmaceutical industry with organizations the academia	Focusing on the structural capital, structural holes are vital for facilitating the access complementary and heterogeneous knowledge between the two sectors. However, this result is moderated by the level of commitment, trust, fine-grained information exchange, and joint problem solving.
	Manyika and Roxburgh (2011)	Public procurement using inter-departmental coordination and long-term partnership relations with suppliers	Partnership with external bodies (businesses) can build social capital, however, these resources (i.e., social capital) can have both positive and negative effects for public procurement, for example, by increasing opportunisms, reducing competition, and restricting information on supply costs.
	Choudrie and Papazafeiropoulou (2007)	Innovation in the context of business-NGOs partnerships for corporate social responsibility	Social capital, when exploited adequately, is significant in enhancing innovative in these partnerships as it increases the efficiency of information diffusion, reduces transaction costs and facilitates the absorption of knowledge.

Inter-organizational social capital (inter-OSC), on the other hand, describes external resources become available to an organization through its relationship with other organizations (Dess & Sauerwald, 2014). Resource-dependence theory suggests that all organizations need access to external resources, where the level of control on such resource determines their competitiveness and thus survival (Pfeffer & Salancik, 2003). In particular, inter-OSC can scale up the awareness, and thus the exploitation, of intangible resources such as technology, knowledge, distribution networks, and also relationships with critical constituencies (e.g., government contacts in a foreign market). In addition to the direct effect on performance, these resources may have indirect impact such as facilitating the development of innovation (F. T. Rothaermel, 2001), cumulating experience, and seizing of new opportunities (Dess & Sauerwald, 2014). However, we argue that inter-OSC should be categorized as homogenous and heterogeneous, as in Figure 1. Homogenous inter-OSC reflects the case of interaction between organizations from the same setting or hold similar characteristics, whereby scholars perceive organizations' environment through the same lens. Closer examination of research in this area indicates that the majority of literature on inter-OSC can be found as addressing homogenous organizations. Examples include: family firms (e.g., Arregle et al., 2007), configuration of social capital in buyer-supplier context (e.g., Hughes & Perrons, 2011), start-ups performance growth (e.g., Pirolo & Presutti, 2010), radical innovation in manufacturing and service sectors (e.g., Pérez-Luño, Cabello Medina, Carmona Lavado, & Cuevas Rodríguez, 2011), alliances success in steel industry (e.g., Koka & Prescott, 2002), and broad social capital impact on R&D new funding in the electronic industry (Chen, Ho, & Hsu, 2013). It is worth noting that studies of homogenous inter-OSC consider have, in general, addressed both inter and intra aspect of the organizations, where organizations' external and internal ties are highly related (Payne et al., 2011).

However, we propose that heterogeneous inter-OSC is essentially different to homogenous one. The former refers to a situation when the inter-OSC is created through interaction between inherently different organizations. Examples of this includes interaction between organizations belong to different sectors (e.g., private and public sectors) but addressing the same issue (e.g., protecting the environment) where policies and systems control interaction between actors are likely to vary significantly in terms of flexibility, speed, and autonomous. Interaction between organizations pursuing fundamentally different missions, for instance, when an NPO that its mission is to solve society problem engage in partnership with a company that eventually targets extracting economic returns through CSR initiative (Al-Tabbaa, Leach, & March,

2014), provides another example. A third example when two organizations collaborate in project where each one has different agenda. For instance, in the case of university-industry collaboration, university actors would interact with industry actors to explore practical problems (Jong, 2008), become aware of cutting-edge technologies (Santoro, 2000), and obtain practitioners' feedback on the applicability of research proposals (Arvanitis, Kubli, & Woerter, 2008). From industry viewpoint, university networks could be valuable to access wide range of academic research expertise as well as other research infrastructures and capabilities which would be essential in enhancing industry overall innovation capacity (Santoro & Chakrabarti, 2002b; Yusuf, 2008). Moreover, we expect important differences between the homogenous and heterogeneous organizations when socially interact, as heterogeneous organizations are less likely to enter into direct competition given the variants between the two as discussed above. This in turn would affect how they interact in relation to social capital aspects. For example, where the chance that collaborating university and company to become direct competitors is very little (as each one seeks to fulfil different goal), there is much bigger probability for a buyer and supplier companies with external ties to each other (as an example of homogenous inter-OSC) to become direct competitors if the buyer sought backward integration by acquiring a similar supplier company and thus targets the same segment of customers (Villena et al., 2011).

Despite these salient differences, and apart from few studies that explicitly addressed this issue (e.g., Chakrabarti & Santoro, 2004; Filieri et al., 2014; Thune, 2007), it is evident that we have limited understanding about the configuration of the various aspects of inter-OSC in the setting of heterogeneous organizations. This implies that there is a need for further micro-level studies that focus on the interaction process between these organizations. The diversity between the organizations involved in this process suggests that there might be conflict of interest and disagreement about the progress on the social interaction (e.g., for instance, how the external ties between actors from different organizations might be initiated and developed).

### **3 Methodology**

The setting of our study is the Faraday Partnership Initiative (FPI). This is a government-sponsored program aimed to transform how technology and knowledge can be exchanged between the UK higher education sector and the industry (Airo, 2001). Two bodies took the responsibility of administration: the Engineering and Physical Sciences Research Council (EPSRC), and the Department of Trade and Industry (DTI). The principle activities of the FPI were designed to open effective communication channels between universities and businesses

institutions (e.g., designing business-related post-graduate training scheme, organizing of networking events, and stimulating and facilitating joint research project). The participation in the FPI was open to all interested universities and companies (as there were no eligibility criteria), but if a group of members agreed on a particular partnership project, formal contract was required. During the period 1997-2002, four calls for participation were made, asking interested institutions to submit collaboration proposals (as a group of members). The DTI was responsible for evaluating the proposals and allocating funds. The four calls resulted in 24 partnerships, and the total value of the FPI research portfolio in the fourth call was £160 million (Airto, 2001).

### 3.1 Data collection

Given the focus of our research question, to investigate the nature of inter-OSC, we centered our enquiry on participants' perceptions of their relationships with others using the multiple case study approach. In particular, we drew on five cases of the 24 Faraday Partnerships.

To evaluate the relevance of data collection approach and refine our research protocol we conducted two pilot studies, including an interview with the operations director of one partnership, and a technology translator (i.e., a partnership facilitator). For primary data collection, we used semi-structured interview technique with multiple respondents for each Partnership to capture different viewpoints, establish comparability and enhance the reliability of the research data. The total number of interviews was 37, with an average of 77 minutes. All interviews were transcribed verbatim.

For each case (i.e., individual partnership), our informants (almost all of whom had been with their partnerships from their founding stage) comprised at least a representative from university, a representative from business and two representatives from the partnership intermediary. We ensured that university and industry representatives were the leading individuals in their institutions in regard to the partnership. The industry actors came from different industries including plastics, health products, oil, and engineering. Those from the university side were from science and engineering schools. To increase research overall validity, by including all relevant stakeholders (Yin, 2009), we also interviewed representatives from the DTI, EPSRC, and Quo-Tec Limited. The latter was a company contracted by the DTI to perform consultation services and facilitation for all the Partnerships.

Our study utilized three key strategies in the data collection to strengthen research validity and increase the transparency of findings including: (1) case study protocol, (2) triangulation, and

(3) case study database. The Research Protocol provided structure to the data collection process and served both as a prompt for the interview and a checklist to make sure that all topics were covered. The research protocol, therefore, included questions on the experiences of the informants with respect to the three dimensions of social capital (Nahapiet & Ghoshal, 1998) in the context of their relationship and interaction within any of the five partnerships. On the structural dimension of social capital, the themes of the questions were focusing on the structure of the relationships (i.e., how the connections were made) between the university and industry actors, means of communication, partnership formations process, and pre-partnership phase (i.e., the process of finding partners). Questions that related to the relational dimension involved the issue of trust, and trust formation (e.g., impact of external factors), facilitators for the technology transfer process, issues associated with publication from collective research project, self-interest vs collective interest, expectations and norms as evolved during the course of the partnership, and how they influenced the progress in the collaborating process. Finally, the cognitive capital was probed using questions on issues including the common understanding that actors were sharing, in regard to technology utilized, and partnership aims and objectives, and perceptions of the effectiveness of the initiative. Moreover, we deployed data triangulation (Creswell & Clark, 2011) by using secondary data collected from archival data about the Partnerships, which was provided by the interviewees and also collected from dedicated partnerships websites. Using of these secondary data was critical to increase the reliability of data and gives richness to case study evidence, where Eisenhardt (1989) avers that triangulation provides stronger substantiation of constructs and propositions.

### 3.2 Data analysis

Our analysis combines established techniques of qualitative data analysis for theory development. It involved travelling back and forth between the data and the emerging structure of theoretical argument in an iterative fashion (ESCA, 2016). More specifically, we adopted a mixed of Miles and Huberman's (2008) three steps of analysis (data reduction, data display, and drawing and verifying conclusions) and Gioia et al.'s (2013) procedure. We started by reducing the data through summarizing, as such each of the interview the transcripts was epitomized from between 30 and 60 pages into between 15 and 30 pages (e.g., by deleting repetition or irrelevant content), which then entered into the NVIVO for coding. However, before commencing the coding, all summarized transcripts were sent to corresponding interviewees for verification. The feedback was, in general, satisfactory and only five

interviewees provided complementing information or asked for some minor parts to be removed.

We started coding by reading through the content of the each transcript. A series of provisional categories were created (a process akin to (Strauss & Corbin, 1998) notion of open coding), where we tried to adhere to informants' terms in labelling these categories. As the analysis progressed, we started seeking similarities and differences among these provisional categories. Accordingly, the provisional categories were then gradually collapsed, by combining categories of similar meanings, into a set of 1<sup>st</sup> order concepts. After several iterations, each group of concepts that were found as theoretically relevant, were condensed into a more abstract, or 2<sup>nd</sup> order theme. To do so, we looked for information that would disconfirm or add to the existence of any relationship between the various 1<sup>st</sup> order concepts. Indication of relationship was realized in direct statements as explained by participants. Other information about relationships came from identifying patterns that seemed to co-occur or to cause one another (Saldana, 2012, p. 218). Throughout the analysis, all categories and themes were centred around the three dimensions of social capital.

In addition, we scrutinized the organizational documents following the previous steps. We compared these themes with the themes identified from interviews transcripts analysis. This comparison allowed us to confirm the interpretation derived from the interviews data. In addition, evidence extracted from the document review was used in specific places in the findings to corroborate or extend the arguments when the evidence from interviews is perceived as limited or inadequate (Tashakkori & Teddlie, 2003).

## **4 Findings**

We structured our findings across the three dimensions of social capital. We expose the particularity of each dimension in the context of UIP, and provide discussion which is underpinned by rich quotes on detailed examples.

### **4.1 Structural capital in UIP**

The university and industry actors in our cases allocated a significant amount of their resources and attention on making structural connections using a number of different activities. The most prevalent themes from the interviews and the secondary data sources were: face-to-face meetings, communication (including voice, mail, email, and conference calls), and interaction events (including conferences, workshops, seminars, and symposia). Importantly, these activities were essential in boosting the exchange of ideas and experience. However, it was



realized that bringing people from diverse institutional and cultural backgrounds to communicate regularly was a difficult undertaking, thus specific resources were dedicated in all partnerships to facilitate inter-organizational interaction from the outset.

*“We use events such as workshops and conferences as important events to promote networking for the university and industry participants. There is funding, which we provide for the setting up of these events or to co-ordinate these activities, chairing the sessions or managing the groups” (TT)*

In the same vein, the analysis uncovered externally-managed activities for building the connections, including the use of the Collaborative Awards in Science and Engineering (CASE). This is a studentship program (a UK government-funded) was utilized through the Faraday Scheme to encourage the interface between university and industry individuals through students’ involvement in industrial projects, joint supervision of dissertations and thesis by academic and industry personnel, and the use of facilities including libraries and laboratories.

*“We got a PhD which is financed from a CASE award, and that involves several times a year personally visiting the University, and this has been very beneficial to us, because ...you get advice for your business from people you would not normally get access to - they brainstorm with you and they offer new ways forward” (IA)*

In addition to the above activities, university and industry actors were utilizing uncommon activities (when compared to homogenous interaction) in establishing and developing their structural capital, including: lectures by industry members at universities and vice versa by academics, customised educational programmes for industrial personnel, exchange, transfer or secondment of personnel to work at one another's research facilities, employment of graduates particularly those related to the project, exposition, trade shows/fairs/exhibitions, use of newsletters and bulletins, and joint publication of research outcome (e.g., academic papers and industry reports). These activities were, in particular, enhancing the common understanding (i.e., cognitive capital) between the actors from both sectors. For instance, the following quotes highlight the role of these activities in enhancing the structural connection between the individuals.

*“With input from academics, we produce and disseminate information on emerging technologies which are relevant to our technology area, and we also work with the*

*training providers [the university academics] to align the training provision in our technology area to meet the needs of industry” (TT)*

*“We publish a bulletin every month or two, which provides information on the Partnership’s existing activities to connect people to others and also to let people think about how that could impact on their businesses” (PMD)*

However, because of the differences between the overall aim of each sector (the industry is driven by commercialization of technology whereas the university is motivated by knowledge creation and dissemination), the effectiveness of these activities was perceived asymmetrically. For example, the views on publications ranged from encouragement by university to publish, to outright refusal to publish by industry.

*“We co-author with them [referring to industry], in good journals, and that gives them some publicity. You will find industrial names to some of our publications on our website. But on the other hand, there are some who want to maintain strict confidentiality, and so we do not publish” (AA)*

Interestingly, we noticed that the nature of technology of which each partnership was considering has influenced the prevailing of certain communication activities. In other words, although the majority of activities were common to all the Partnerships, we found some activities to be specific to particular Partnerships because these activities were more common to the technology areas the Partnerships focused on. For example, only one Partnership had university and industry actors involved in ‘Training Courses in Universities’, and ‘Industry involvement in curriculum development’. Also, only one Partnership was involved in ‘Distance learning Courses’ and ‘Technology Exchange Consortium’. In addition, three Partnerships were involved in ‘Representation of university academics on Industry Boards and industry members on University Committees’.

#### 4.2 Relational capital in UIP

We found that pre-existing relationships seemed to have played a significant role in the formation of the majority of Partnerships, as a number of the university and industry actors already knew each other from previous relationships. More specifically, these relationships have fostered an environment which helped to reduce to a large extent the influence of the differences between the academic and industrial cultures because of the trust that already existed between the partners and the mutual perception of trustworthiness.

*“From my experience, for a successful partnership, I think you do need a degree of successful relationship between parties before you start” (PMD)*

*“I will say it is definitely true that my links with University ... and also Dr.... played a key role in our involvement with this partnership ...it is difficult to trust and partner with someone who you have just met” (IA)*

The interactions from the networking promoted by the activities discussed earlier such as conferences, workshops, seminars, symposia and forums, also helped to build trust amongst university and industry actors who did not have the benefit of prior relationships. These networking activities also further enhanced trust among those partners with prior relationships. Yet, in the setting of UIP, it is worth noting that due to the difference in working domain (i.e., between university and industry) the emphasis on pre-existent relationships was mostly between individuals rather than between the organizations themselves, which appears to be a bit out of tune with the literature (e.g., Dover & Lawrence, 2011).

*“[Pre-existent relationship] has been in a sense, but it has been a relationship between people rather than organizations. So there was not really a relationship between our two organizations, but there was a relationship between the assistant director of [name of organization] and me” (PMD)*

Mutual trust and trustworthiness therefore appeared to be an important factor that facilitated the relationships between the actors. However, the technology translators and management representatives (i.e., partnership managing directors), who acted as intermediaries, were essential in building and enhancing trust between the university and industry actors.

*“If we are exposed to their [i.e., industry] plans, we can point them to where they could get that technology capability [i.e., from university] to move their business forward. So that trust is absolutely key to the technology translation process. But fortunately, most of them see us as honest brokers, and so we usually do not have any problems with trust.” (TT)*

In addition to trust, we observed a sense of mutual reciprocity (or obligation) to be embedded in the relationship between university and industry actors. For instance, university actors expected to access industry’s complementary expertise, state-of-the-art equipment and facilities, and also secure employment opportunities for university graduates through, for example, CASE studentships. On the other hand, industry actors expected to have access to university students for internship or ultimate hiring through the CASE Studentships.

Importantly, the evolved sense of mutual reciprocity was influential in enhancing their personal commitment to the partnership.

*“The academic members value the Partnership in terms of the collaborative projects with industry they get out of it, as it is a straight impact arrangement which is mutually beneficial to both of us, and it stimulates and encourages our commitment to get on with it” (IA)*

Interestingly, the overall objectives set down (externally) by the DTI for the Faraday Partnerships together with the Partnerships’ own specific objectives, were acting as shared values, thus motivated the university and industry actors to fulfil their obligations and act in a favourable manner towards each other.

*“It is true to say that I did not know some of our industry partners when we actually started. But once we came together, we all had the responsibility for delivering the Faraday objectives, which in a way bound us together and kept us focused to meet our obligations” (AA)*

However, despite the sense of mutual obligation, all partnerships were controlled by official contracts in order to eschew any potential disputes. Issues relating to ‘inflexible university policies’ including Intellectual Property Rights (IPRs), publication rights, and patents and contractual mechanisms’, are all areas of potential conflicts. In particular, industry actors expressed concerns about stringent attitudes adopted by some universities towards IPRs. A University academic validated these concerns:

*“The biggest stumbling block is always IP [Intellectual Property], and the stumbling block these days is the universities, not necessarily industry”*

Therefore, the Faraday principles objectives were vital in this regard as they provided guidance for the conduct of the partnerships, as they were directing all partnership players all the time toward the common aim of the initiative: to facilitate technology transfer between the two sectors. This shows that the Faraday scheme principles and objectives as well as objectives of each specific partnership were substantial in establishing relationship mainstream norms and understanding (i.e., as part of the conative capital), thus helped to reduce the influence of cultural inconsistency between the actors from heterogeneous organizations. At the same time, the mitigating influence of the intermediaries in helping overcome the institutional, cultural and social barriers between the university and industry actors in the Partnerships was another factor which also helped to reduce the influence of any cultural differences.

*“The industry and academia speak two different languages. When industry describes a problem, it is not necessarily in a way that academia sees it in terms of finding a solution. Also academia’s solution is not particularly in a way useful to industry to fixing their problems, and that is where we [i.e., the intermediaries - the technology translators] come in to work at the interface” (TT)*

*“I think academics talk one language and industry talks another language. And I think you need somebody in the middle that can communicate at both levels, somebody that can talk both languages to facilitate the two coming together synergistically” (AA)*

Finally, the pre-existing relationships between the university and industry actors, the interactions from the many face-to-face activities, coupled with facilitating role of intermediaries (mainly the TTs), all helped individual actors to identify further collaboration opportunities.

#### 4.3 Cognitive capital in UIP

The Faraday principles and the specific objectives of each Partnership provided a common understanding that was shared by the university and industry actors in each Partnership. For example, the DTI representative stated:

*“Our experience with such schemes shows that establishing such principles or objectives right at the onset provides a fundamental understanding about what the scheme [i.e., the Faraday Partnership Initiative] is all about. So that is very important and goes a long way to help concentrate their attention on what activities to pursue” (MR)*

Pursuing collaborative and communication activities (i.e., as part of the structural capital dynamic) also enhanced the level of shared meaning among the university and industry partners as supported by the following point from an academic about a project he was involved with:

*“We have regular communications with the academics and industry people, both face to face and through email, teleconferencing and letters to make sure that we are aware of what is happening...enhanced our mutual understanding by discussing the problems being addressed”(AA)*

Also, these collaborative projects provided opportunities for creating effective relationships across the various university and industry actors as these individual were evolving (through frequent interaction) high level of shared interest and common understanding.

*“My experience is that such projects require a lot of meetings and discussions, which are very much involving, but actually, they are not a waste of time at all because all of those things develop our capacity for closer engagement”, (AA)*

This next comment from an academic also showed that pre-existing relationships helped to promote a common understanding between the university and industry actors.

*“As I said earlier on, there are a number of people in our Partnership including industry people - I can certainly count at least five people I worked with for quite some time before Faraday. And if you have consistently worked with people, a common understanding of how to do things is already there” (AA)*

Furthermore, accounts or narrative by various speakers during the conferences and at training courses, and the exchange of useful tips and anecdotes including the sharing of experiences by university academics and industry personnel at the different types of meetings (such as the seminars and workshops) enhanced the cognitive dimension of social capital within the relationships. This enabled the individuals to better understand the context of best practices in other organisations and other Faraday Partnerships.

*“The conferences are excellent, they are really good. We get the opportunity to listen to cutting edge technologies, others’ experiences and also share our own experiences. It is a great forum for conveying technology or knowledge across, which of course leads to other opportunities” (IA)*

Interestingly, and despite the effort of technology translators, we realized that there was some inconsistency regarding how technology translation concept (as a main construct in Faraday Partnership scheme) is defined. In principle, we found that respondents’ views were based on their perceptions of the meaning of the two terminologies. One group of respondents defined technology translation in a narrow perspective while they defined technology transfer in a broad perspective (i.e., technology translation was conceived as a subset of technology transfer). A second group reversed the previous order, thus follow Gillham (2005), who defines technology transfer as a process of moving technology from one organizational entity or location to another. A third group opined that technology translation and transfer are actually exchangeable concepts. Surprisingly, a fourth group emerged, four respondents, one academic and three industry representatives acknowledged that they did not know the meaning of this terminology. These varying perceptions suggested that ‘technology translation’ was not a very well understood terminology (despite being a principle objective in the partnership scheme),

which appeared to detract from the shared understanding experienced by university and industry actors in the Faraday Partnership Initiative.

Due to this confusion, the technology translators (individuals expected to have years of experience at the academic/industry interface) sought to establish consistent understanding regarding technology translation as a concept across all partnership members (i.e., enhancing the cognitive capital). In principle, the process of promoting interactions between the partners was termed, in the Faraday Partnership, as technology translation, and it required the skills and experience of technology translators, who acted as intermediaries to facilitate the process, by relating industry's needs to the knowledge base and the knowledge base's capabilities to industry's needs. Importantly, this sheds more light on the role of intermediators in strengthening the cognitive capital in such inter-organizational relationships, we discuss the technology translation in more details next as an outcome of Faraday Partnership.

#### 4.4 The role of technology translation

In spite of the previous inconsistency, with the help of technology translators, the concept of technology translation was emphasized during the partnership as one antecedent (i.e., activities) of technology transfer across the two sectors. As such, the technology transfer has been defined as (Airto, 2001, p. 14):

*“A central function in a Faraday Partnership. It is the activity of spanning communities of interest and linking individual participants in a way that goes far beyond older concepts of business support programs or outreach activities of universities. It requires skills and experience often found only in established intermediaries or in individuals with years of experience at the academic/industry interface”*

Taking the previous definition into consideration, the majority of respondents from universities and industry felt that technology translation within the Faraday Partnerships was reasonably effective in bridging the gap between industry and academic institutions for technology transfer. 82% of all the respondents including 66% of university academics, 91% of industry representatives and 85% of management representatives and technology translators claimed that the Faraday Partnership they were involved in had met the aims and objectives of their own organisations through technology translation.

In particular, they expressed the view it had successfully improved research understanding, research communication and research cooperation between the university and industry partners. Therefore, the scheme served to build closer alliances between the organisations

involved in the Partnerships in different ways. In some cases it had served to initiate ‘first-time’ collaborative activities while in other cases it had served to extend existing collaborations. They also claimed that technology translation improves the existing technology transfer schemes between university and industry, as it is easier, it helps to mitigate the effects of the strong language barriers between academia and industry, and more importantly, it is quicker because of the prominence of networking and the bringing together of all required parties around one table through an intermediary.

*“Academics can feed into a technology translation process and industry can gain something from a technology translation process. When this is successful, it is technology transfer. So technology transfer is what comes out of the translation process. So the translation is the process of having somebody interpret between academic and industry, and technology transfer is what they do when they got it right” (AA)*

In addition, technology translation is quite challenging, and has a broad context that includes research and development (R&D) and training. Furthermore, it has the capability to expose industry to new ideas and technology at a relatively small cost, and it results in mutual benefits for all involved.

A number of projects including research and training outcomes were reported as having been successfully achieved through the five Faraday Partnerships investigated in this study. The majority of these projects had measures of success in terms of step changes in thinking and different approaches for industry. But, there was also evidence that in at least four of the Partnerships studied, some companies had been able to come out with specific products, some of which were bringing in profitable income. These companies included those in the electrical and electronics industry and the chemical industry.

## **5 Discussion and conclusion**

In general, the findings indicate the importance of the three dimensions to underpin the development of social capital in UIPs. In relation to the structural dimension, actors in the Faraday Partnerships used different activities to establish their structural connections. Several studies have argued that the larger the physical distance between the parties, the slower and less effective the technology transfer (Lambert, 2003; Lhuillery & Pfister, 2009). Our study, thus, underlines the importance of people interacting with each other on a close personal level. The interactions between the university and industry actors through, in particular, the face-to-face activities helped to bridge the cultural gap between the university and industry actors and



promoted trust during the relationships. Prior research has suggested that trusting relationships evolve from social interactions (Gulati, 1995; Moran, 2005). As two actors interact, their trusting relationship becomes more genuine, and enables them to perceive each other as trustworthy (Y.-H. Tsai, Ma, Lin, Chiu, & Chen, 2014). In addition, the interactions made it easy for the partners to identify with one another and provided opportunities for narratives and sharing of experiences which enhanced the cognitive dimension of social capital. Therefore, tacit knowledge cannot be transferred to others unless there is a rich interaction between individuals based on a shared understanding of meaning, assumptions and context (Santoro & Saporito, 2006). Moreover, interactions among actors are vital because they amplify the possibilities of value creation by maximizing the number of linkages among the actors and limiting the scope for potential conflict in the value creation process (Kumar & Worm, 2003). In the same vein, Lawson, Tyler, and Cousins (2008) found that relationships structured with frequent communication allows for better planning, goal setting and problem solving. We were, however, initially surprised that joint publications was not one of the frequently used activities to make structural connections, despite research shows that joint research with industry often results in academic publications (F. Rothaermel, Agung, & Jiang, 2007). Yet, this finding can be attributed to opposition by some of the companies we studied who appeared not to be inclined to full disclosure, as this would negatively influence their strategic competitiveness.

Considering the relational capital, our study showed mutual trust and trustworthiness as being an important factor in the relationships between university and industry actors. Interestingly, the analysis exposed how the norm of mutual reciprocity was prevailing in the relationships between the university and industry actors. This would enable firms to internalize university by accessing the sticky-tacit knowledge inherent in researchers working on generating new fundamental ideas for product or technology development (Yusuf, 2008). Other components of the relational capital emerged the social norms of openness and teamwork, which are key features of learning and knowledge acquisition (Starbuck, 1992). However, despite the openness and norms of mutual reciprocity or obligation between the university and industry actors, formal contracts were used to spell out the set of institutionalized rules and norms that governed appropriate behaviour between them. Philbin (2008) Indicates that using contracts does not necessarily mean that an inferior form of trust exists between the partners, but rather, formalized contracts may be an indication of a relationship already based on trust. Whilst we expected that there would be some difficulties in the area of IPRs, we did not expect this to be as pronounced as observed because of the moderating influence of intermediaries in the

Faraday Partnership Initiative to help both university and industry actors overcome their institutional, cultural and social barriers. This leads us to conclude that contractual mechanisms in UIPs, in particular, those associated with IPRs, is a contentious area, and thus requires more attention in practice.

Reflecting on the cognitive-related findings, our study found that shared goals from the Faraday principles and the Partnerships' own specific objectives provided a fundamental understanding to the university and industry actors about what the Initiative was about, helped to focus their attention, provided clarity and guided them in the conduct of the relationship. In fact, a shared goal can help the alliance members to generate similar perceptions on how to interact with one another, which promotes mutual understandings and exchanges of ideas and resources, and facilitates the integration of knowledge (Coates & McDermott, 2002; A. Inkpen & E. W. K. Tsang, 2005). However, shared goals should also include the extent to which network members share a common understanding and approach to the achievement of network tasks and outcomes (I. Maurer & Ebers, 2006). Another aspect of the cognitive capital, which received prominence, was the sharing of narratives and experiences as occurred through interaction between partnership members during various activities such as workshops, conferences, and networking event. In principle, these events enabled the development of common context between the actors (Roden & Lawson, 2014), that was crucial to overcome the cultural and conceptual discrepancies between the two sectors by maintaining rich sets of meanings in groups (Hovelja & Vasilecas, 2013).

### 5.1 Understanding social capital dynamic in university-industry partnership

Combining our analysis, we propose an integrative framework that explains the nature of social capital developed through interaction between university and industry actors in UIP, as depicted in Figure 2. The framework also shows four influencing factors exerting a positive influence on the dimensions of social capital.

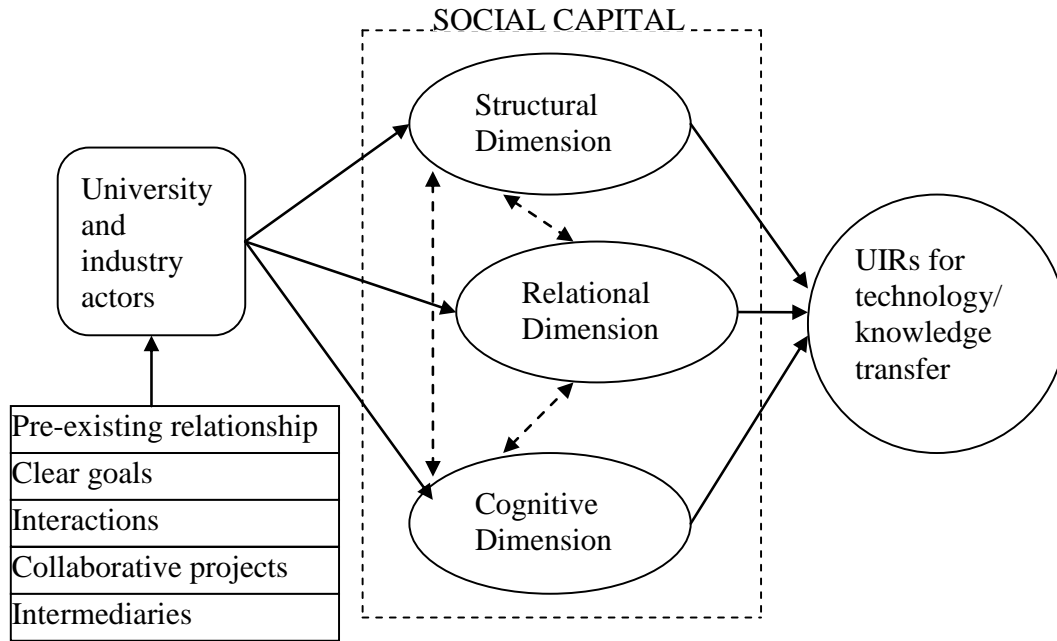


Figure 2: Conceptualizing social capital dynamic in UIP context

In general, the most common way social capital has been operationalised in research is typically through the structural dimension focusing on social network analysis (e.g., Burt, 2000; Filieri et al., 2014; Seibert, Kraimer, & Liden, 2001). Therefore, several researchers have called for the social capital construct to be defined more broadly to include not only the structure of relationships among actors, but also the nature and content of those relationships (Adler & Kwon, 2002; R. Lee, 2009), since there is additional variance in outcomes beyond that explained by structure alone (Leana & Pil, 2006). Although there are a number of studies using both the structural and relational dimensions (e.g., Moran, 2005; W. Tsai, 2000), the application of the cognitive dimension simultaneously with the structural and relational dimensions in the same study appears to be deficient (R. Lee, 2009; I. Maurer & Ebers, 2006; Winter, 2003), especially for UIP setting. Our research therefore reinforces the additional significance of the cognitive dimension and how it interacts with the other two dimensions of social capital.

Furthermore, whereas some scholars (e.g., A. Inkpen & E. W. K. Tsang, 2005; W. Tsai & Ghoshal, 1998) have suggested that the structural dimension is an antecedent to both the relational and cognitive dimensions, and the cognitive dimension is an antecedent to the relational dimension, the findings from our study suggest that the dimensions are not necessarily antecedent of one another, but are mutually reinforcing of one another. For

example, the interactions from the activities engaged in by the university and industry actors helped to build trust and trust worthiness and made it easy for the actors to identify with one another. On the other hand, trust between the actors made them willing to engage in collaborative projects or other activities. The collaborative projects and the shared narratives at the conferences, workshops, training courses, etc. led to the sharing of experiences which enhanced the level of shared meaning between the actors. The Faraday principles constituted shared goals which influenced or determined the activities the university and industry actors engaged in (i.e., cognitive → structural). The trust between the actors encouraged sharing of their experiences at the conferences and workshops, while the Faraday principles and the partnerships own objectives provided a common understanding which facilitated the fulfilment of their obligations in a favourable manner towards one another. Therefore, we propose that in UIP, as a heterogeneous inter-organisational interaction domain, the three types of social capital resources are not contingent on each other, but rather have reciprocal impact on each other, which in sum would facilitate the process of technology translation and transfer.

Furthermore, the analysis shows that four re-occurring themes played a vital role by exerting a positive influence on the three dimensions, and thus the relationships between university and industry actors, as in Figure 2. These themes (or factors) are: pre-existing relationships, clear objectives shared by the actors, specific collaborative projects, and intermediaries.

Pre-existing relationships between university and industry actors appeared to lessen the influence of cultural differences between the actors, and instilled trust and trustworthiness between them. Consequently pre-existing relationships played a key role in bringing these actors together (and generally in the formation of the Partnerships). This finding agrees with Das and Teng (1998), who argued that pre-existing relationships are an important factor in affecting assessments of trust and trustworthiness in locating potential partners in an alliance. Moreover, past collaborative experience has the potential to lower individual and institutional barriers (D. Schartinger, Schibany, & Gassler, 2001). Pre-existing relationships also promoted a common understanding between those with prior relationships and made it easier for them to identify with one another on similar interests. In particular, familiarity with a potential partner through prior alliances provides first-hand knowledge including a partner's resources, personnel, culture and decision-making processes which reduces the fear of opportunism by the partner, furthers mutual understanding (Gopalakrishnan et al., 2008; Gulati, 1995) and develops strong ties for knowledge transfer in alliances (Holahan, Sullivan, & Markham, 2014).

Clearly laid down objectives through the Faraday principles and the Partnerships' own specific objectives influenced the types of structural connections or activities that the university and industry actors engaged in. At the same time, these objectives were important to lay the foundation for common understanding, thus reducing the impact of cultural divergence. Moreover, the objectives, acting as a stimulant, helped the university and industry actors to fulfil their obligations towards one another. Furthermore, the objectives aided the partners in identifying with one another and enhanced the level of shared meaning between them. These observations have some support from the alliance literature. For example, Das and Teng (1998) argued that, in addition to helping set the direction for the alliance, clear objectives also facilitate the institution of specific rules and regulations, which are important for formal control mechanisms. Importantly, these objectives would specify what is expected of partners, thus make it easier for the partners to identify the activities to engage in (Das & Teng, 1998) in order to exploit their learning potential (Tsang, 2002).

The pursuit of specific collaborative projects or specific ventures that are compatible with the mutual interests of university and industry actors enhanced trust and developed a sense of mutual reciprocity between them. In specific, the pursuit of defined collaborative projects enhances trust and creates a sense of mutual reciprocity which makes university and industry partners committed to the relationship (Boddy, Macbeth, & Wagner, 2000). Importantly, the collaborative projects might become much more important form of knowledge transfer. For example, Mueller (2006) claim that university researchers ranked collaborative research and informal contacts as the two most important interaction types between universities and industry. These collaborative projects facilitate the partners identifying with one another and also enhance the level of shared meaning between them. In addition, these collaborative projects provide opportunities for deep relationships between university and industry individuals which are helpful in facilitating the creation and transfer of both tacit and explicit knowledge.

Finally, the technology translators and management representatives, acting as intermediaries, helped partnership members to overcome their institutional, cultural and social barriers. The intermediaries were also influential in building and enhancing trust between actors from both sectors, made it easier for them to identify with one another and link with those with similar interests. These findings underlie the role and importance of intermediaries in UIP. More generally, intermediaries are found to play a particularly important role in facilitating links between universities and the potential users of knowledge, especially, commercial firms (K.

Lee, 2011). For instance, Yusuf (2008) argued that intermediaries perform a ‘midwifery’ role by assisting knowledge exchange between universities and industry via the creation of bridging ties and interfaces, by identifying needs, and by establishing a dynamic framework for change and working to ensure the change is realised through financing and other means. Therefore, we conclude that the value of the bridging or brokering function of intermediaries means that, studies considering only non-intermediated industry-academic links are failing to notice an important part of the picture (B.S. Tether & A. Tajar, 2008)

## 5.2 Implications for research and practice

This study has presented the results of an exploratory qualitative in-depth case study research, which has offered significant benefits in terms of understanding how social capital is produced through the relationships between university and industry actors to facilitate technology transfer, an area of little previous research.

We see the potential to extend our fundamental analysis to other UIP settings or situations, since all networks are essentially about social relationships (Hibbert & Huxham, 2010), and, therefore, social capital dimensions would have applicability irrespective of the network type (A. Inkpen & E. W. K. Tsang, 2005). Nevertheless, the extent to which these findings would apply to these other settings would depend on the degree to which such situations or settings match the situation presented in this study. In particular, we would expect differences in the findings between our study and other types of UIPs which do not use intermediaries or are not state-supported, especially with regards to the five influencing factors, see Wright, Clarysseb, Lockett, and Knockaertd (2008) for different types of UIP. Another area that might require further research concerns the issue of the operationalization of the dimensions of social capital. We may not have fully captured all the factors that influence the development of social capital through the relationships between the university and industry actors. We suggest more work in this area to further advance theory on social capital in UIP.

In addition to research, there are two main managerial implications from our study. First, the findings indicate that the various aspects of social capital can be useful in enhancing the effectiveness of technology transfer process during UIP. This understanding is helpful in assisting managers to intervene more appropriately when targeting resources to support these relationships. In particular, government departments (and other agencies) that sponsor such relationships could emphasise explicit mechanisms such as structured objectives for these partnerships, as this facilitates the formation and sustenance of these links. Structured objectives also enable the collaboration’s success to be measured by the achievement of these

objectives. In addition, we suggest that wherever possible, UIP should build on pre-existing relationships between committed partners. Notwithstanding the value of pre-existing relationships, it is important that a partnership is properly institutionalised to mitigate against partnership breakdown through key players moving on, since personnel turnover during the lifetime of collaborations could be significant. Second, there is a need for make substantial attention upon contractual mechanism (e.g., in the case of IPRs), as this issue can significantly influence the stability and prospect of any UIP. Therefore, we emphasize the need for maintaining a flexible approach in regard to the intellectual property rights. For example, the sponsoring body (e.g., the government) can play an important role in designing a plausible approach that can balance between the university eagerness toward disseminating of knowledge and industry view of protecting and sustaining competitive advantage.

In conclusion, the growing interest in UIP has resulted in an abundance of literature on these partnerships from a variety of perspectives. Yet, few scholars have studied these relationships from a social capital perspective, despite the productiveness of this theoretical stance and its application to a broad range of phenomena. At the same time, little research has been conducted to understand social capital generation through the interaction of heterogeneous organization. In this paper, we have sought to partially fill these gaps by investigating how social capital is produced through the relationship between university and industry actors in UIP for the purpose of technology transfer. In conducting this investigation, we largely drew on the three main dimensions of social capital. Importantly, we demonstrate how the dimensions interact, and suggest four factors to moderate the interaction of these dimensions which to facilitate and enable the development of social capital in the setting of UIP.

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