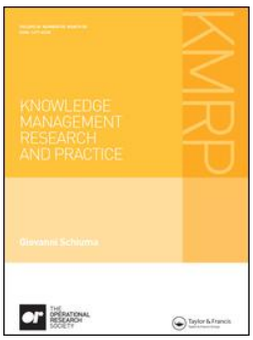

Knowledge Management Research & Practice

ISSN: 1477-8238 (Print) 1477-8246 (Online) Journal homepage: https://www.tandfonline.com/loi/tkmr20

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To cite this article: Jeandri Robertson, Ian P McCarthy & Leyland Pitt (2019): Leveraging social capital in university-industry knowledge transfer strategies: a comparative positioning framework, Knowledge Management Research & Practice, DOI: 10.1080/14778238.2019.1589396

To link to this article: https://doi.org/10.1080/14778238.2019.1589396

Published online: 20 Mar 2019.

KNOWLEDGE MANAGEMENT RESEARCH & PRACTICE
https://doi.org/10.1080/14778238.2019.1589396

Leveraging social capital in university-industry knowledge transfer strategies: a comparative positioning framework

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ABSTRACT

University-industry partnerships emphasise the transformation of knowledge into products and processes which can be commercially exploited. This paper presents a framework for understanding how social capital in university-industry partnerships affect knowledge transfer strategies, which impacts on collaborative innovation developments. University-industry partnerships in three different countries, all from regions at varying stages of development, are compared using the proposed framework. These include a developed region (Canada), a transition region (Malta), and a developing region (South Africa). Structural, relational and cognitive social capital dimensions are mapped against the knowledge transfer strategy that the university-industry partnership employed: leveraging existing knowledge or appropriating new knowledge. Exploring the comparative presence of social capital in knowledge transfer strategies assists in better understanding how university-industry partnerships can position themselves to facilitate innovation. The paper proposes a link between social capital and knowledge transfer strategy by illustrating how it impacts the competitive positioning of the university-industry partners involved.

ARTICLE HISTORY
Received 8 October 2018
Revised 18 January 2019
Accepted 23 February 2019

KEYWORDS
Knowledge transfer; social capital; regional strategy; university-industry; competitiveness

1. Introduction

Interest in university-industry partnerships stems from the belief that these collaborative research efforts may be a source of innovation (Ambos, Mäkelä, Birkinshaw, & D'Este, 2008; Ankrah, Burgess, Grimshaw, & Shaw, 2013; Bruneel, D'Este, & Salter, 2010).

In 1998, Nahapiet and Ghoshal stressed the organizational importance and competitive advantage of understanding the knowledge sharing capabilities embedded within organizational networks. The interest that this topic still generates in the management and organizational literature today, suggests that there is still much to explore to better understand the impact of social community networks on the speed and efficiency of knowledge transfer (Kogut & Zander, 1996). Operationally defined, knowledge transfer describes the process in which organizational units "exchange, receive and are influenced by the experience and knowledge of others" (van Wijk, Jansen, & Lyles, 2008, p. 832). It requires the assimilation of differentiated knowledge and is demonstrated when changes occur in the knowledge bases of an organizational unit, and knowledge acquired in one setting is applied to another (Argote & Ingram, 2000; Filieri & Alguezai, 2014; Inkpen & Tsang, 2005).

The impact of knowledge transfer on commercial success and sustained competitive advantage has shown to be of strategic value (Edwards, Handzic, Carlsson, & Nissen, 2003; Rajalo & Vadi, 2017; Siegel, Waldman, Atwater, & Link, 2003; Teixeira, Veiga, & Fernandes, 2018). It also encompasses a strategic challenge. Formulating a knowledge strategy that has a clear anticipatory vision of what the future might hold implicitly means posing questions that relate not only to what is already known, but also to what is still needed to know (Bolisani & Bratianu, 2017). In addition, a fast-changing global competitive landscape and an increase in technological advancements, have compelled organizations to secure knowledge partnerships that would provide a pipeline of ideas for capitalization from outside the firm (Han, 2017; Plewa et al., 2013; Thorgren, Wincent, & Örtqvist, 2009). For organizations seeking specialized research expertise, universities have established themselves as interesting partners (Al-Tabbaa & Ankrah, 2016; Ambos et al., 2008; Autio, Hameri, & Nordberg, 1996; Schofield, 2013). Traditionally serving public interest through research and education (Bruneel et al., 2010), universities are nowadays also expected to "exploit the value of their knowledge base" (Plewa et al., 2013, p. 22). The strategic imperative of this "third mission" (Zomer & Benneworth, 2011), places an increased emphasis

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on the transfer of knowledge between university and firm (Bekkers & Freitas, 2008; Mueller, 2006; Plewa, Quester, & Baaken, 2005). Consider, for example, university research parks. These are property-based ventures that accommodate and foster the growth of firms by being affiliated with a university based on proximity, ownership, and/or governance (McCarthy, Silvestre, von Nordenflycht, & Breznitz, 2018).

Governments actively encourage university-industry knowledge transfer initiatives, as the commercialization of research has the potential to firstly boost economic growth (Bercovitz & Feldmann, 2006; Ismail & Mohd, 2015), and secondly ensure the relevance and accessibility of academic research to industry (Tether & Tajar, 2008). On an institutional level commercialization is considered a prime example of generating academic impact, as it constitutes immediate and measurable market acceptance for outputs of academic research (Markman, Siegel, & Wright, 2008; Perkmann et al., 2013). Concomitantly, it is also widely accepted that processes of inter-organizational knowledge transfer, such as between university and firm, are affected by the presence (or lack) of social capital in which the organizations are embedded (Filieri & Alguezai, 2014; Inkpen & Tsang, 2005; Simonin, 1999; von Krogh, Nonaka, & Aben, 2001).

As the aggregate product of embedded resources derived from a network of structural, relational and cognitive connections, literature has shown that social capital plays a complementary role in organizational knowledge transfer (de Wit-de Vries, Dolfsma, van der Windt, & Gerkema, 2018; Kang & Hau, 2014; Leposky, Arslan, & Kontkanen, 2017). In other words, social capital is the value that one can derive from who and how you know others. These interactions provide value through the opportunities and resources they can afford to an individual or organization. Social capital facilitates the accessibility, integration and creation of different types of knowledge (Filieri & Alguezai, 2014). For example, strong relational network ties would afford more favourable interaction opportunities to exchange tacit knowledge (de Wit-de Vries et al., 2018) and improve the absorptive capacity between partners (Cohen & Levinthal, 1990). As a result, the heightened interaction may lead to higher innovation performance (Tsai, 2001).

The various social capital dimensions that facilitate knowledge transfer across different network types have also been thoroughly explored (Argote, McEvily, & Reagans, 2003; Carayannis, Alexander, & Ioannidis, 2000; Inkpen & Tsang, 2005; Manning, 2010; Nahapiet & Ghoshal, 1998; van Wijk et al., 2008). A commonly-cited caution, however, is to guard against a one-size-fits-all approach. In recent years, there has been a call for a more strategic analysis of how social capital is leveraged across regions with organizational differences and goals (de Wit-de Vries et al., 2018; Gulati, Nohria, & Zaheer, 2000) – especially in the context of university-industry knowledge transfer (Bruneel et al., 2010; Maietta, 2015; Perkmann et al., 2013). Substantial contributions have been made to the region as institutional environment for strategic advantage (Ferreira, Raposo, Rutten, & Varga, 2013), as well as the strategic leveraging of knowledge in university-industry partnerships (Carayannis et al., 2000). However, the impact of social capital on the knowledge transfer strategies employed within a university-industry partnership context is still uncharted territory.

To address this gap and contribute to the debate, the purpose of this paper is to assist university-industry knowledge transfer partners to optimize their strategic positioning, as well as aid in the identification of gaps within respective regional knowledge strategy maps. To achieve this, the objectives of this paper is threefold. First, we distinguish between the respective social capital dimensions that are leveraged during the process of university-industry transfer across three different regions: a developed region (Canada), a transition region (Malta), and a developing region (South Africa). Three social capital dimensions and their accompanying sub-dimensions, as originally proposed by Nahapiet and Ghoshal (1998) and refined by Inkpen and Tsang (2005) are used as guideline for this purpose. Second, we explain the intent of the knowledge transfer activity to better understand the strategic imperative: either gaining new knowledge (appropriating strategy), or leveraging existing knowledge (leveraging strategy). Finally, we present a social capital university-industry knowledge transfer framework to guide university-industry knowledge partners to better align their knowledge strategy with their respective competitive imperative.

The rest of the paper is structured as follows: we begin with a review of the literature on university-industry knowledge transfer, which includes operationally defining knowledge transfer and assessing knowledge transfer strategies. Thereafter, the link between knowledge transfer and social capital is explored in more detail. The research design and methodology are then presented, followed by the results section and the social capital university-industry knowledge transfer framework. Finally, a discussion of the results is offered, including areas for future research.

2. Literature review

2.1. University-industry knowledge transfer

Knowledge transfer within university-industry collaborations, in particular, has gained increased

attention amongst researchers and business managers in recent years (Agrawal & Henderson, 2002; Bekkers & Freitas, 2008; Perkmann et al., 2013; Pinto, Fernandez-Esquinas, & Uyarra, 2015; Riege, 2005; Teece, 1998). Extant research asserts that organizations who can effectively transfer knowledge are more productive than those less capable of doing so (Argote, Beckman, & Epple, 1990; Baum & Ingram, 1998; Mowery, Oxley, & Silverman, 1996). A renewed push towards regional development strategies to drive the goal of sustainable economic growth (Ferreira, Raposo, Fernandes, & Dejardin, 2016), has further paved the way for a heightened emphasis on university-industry knowledge transfer and triple helix (university-industry-government) initiatives (Etzkowitz & Leydesdorff, 2000). These initiatives are seen as powerful tools to develop innovation mechanisms that could establish stronger links between the private and public sectors.

Practically, university-industry knowledge transfer examples are particularly evidenced in strategic high-technology industries, such as pharmaceuticals or biotechnology (e.g., Boyer-Cohen "gene-splicing" rDNA technique), where university-based knowledge arising from research in particular areas has been transferred to industry for commercial exploitation and use. Such transfer can often occur through licensing of technologies which is an important and growing stage of the innovation process (McCarthy & Ruckman, 2017). The premise is that the knowledge spillover from university to industry would promote accelerated regional learning and alignment, facilitating innovation by virtue of the provision of new ideas. In turn, this would enhance market performance (Riege, 2005) as a domino-effect of the development of better products or processes, faster go-to-market, the commercialization of research, as well as skilled human capital (Etzkowitz, Ranga, & Dzisah, 2012). As a strategic imperative, university-industry knowledge transfer thus provides bidirectional access to institutional knowledge (Inkpen & Dinur, 1998), with both parties standing to benefit from the collaboration (Barbolla & Corredera, 2009). Table 1 provides an overview of the major studies in this particular area over the past ten years. As evident, there has been an emphasis on assessing the extant literature to identify barriers and drivers to the flow of knowledge between industry and university partners, with scant attention given to the knowledge strategy employed to facilitate the exchange.

Conceptually defined, von Krogh et al. (2001) assert that knowledge strategy is the implementation of knowledge processes in new or existing knowledge domains, for the purposes of achieving strategic goals. Kasten (2007) functionally contextualizes it as a component of the organizational strategy, which connects the organization's strategic decisions to its knowledge structures and activities. The aim of knowledge strategy is to convert knowledge into a source of sustainable competitive advantage by doing something useful with it (Archer-Brown & Kietzmann, 2018; Davenport, Davies, & Grimes, 1998). Driven by "the synthesis of the contradictions between the organization's internal resources and the environment" (Nonaka & Toyama, 2003, p. 4), the term is underscored by four core assumptions. First, it takes a process-focused approach and operates from the underlying assumption that knowledge is dynamic. Second, it assumes that knowledge domains are starting points rather than end states. Knowledge strategy thirdly entails choice, as the organization needs to decide which knowledge domains and processes to allocate resources to. Finally, the definition operates from the belief that the knowledge domain will be impacted by the knowledge processes applied to reach a strategic goal.

The ability to exploit knowledge is perceived to be a strategic imperative in most organizations (Birkinshaw & Sheehan, 2002). A review of the literature on the motivations of inter-organizational knowledge transfer between strategic alliances, such as university-industry partnerships, suggests that knowledge transfer can fulfil a number of functions. It allows the firm access to the competencies and skills of the partner (Baum, Li, & Usher, 2000), and acts as a learning experience between partners with both given the opportunity to leverage strengths and develop new capabilities (Nahapiet & Ghoshal, 1998). The general consensus is that knowledge can take different forms (Asheim, 2007).

DeCarolis and Deeds (1999) state that as a "stock", knowledge assets are in a constant state of flux. Archer-Brown and Kietzmann (2018) propose that knowledge is embedded in an organisation's intellectual capital, with its constituent parts being human capital, structural capital and social capital. Human capital incorporates human competencies that relate to knowledge, social and personality attributes. Structural capital enables human capital as it refers to the infrastructure and processes that support the transfer of knowledge in a university-industry partnership (Maddocks & Beaney, 2002). Social capital acknowledges the relationship between the human participants in the partnership and incorporates the value of the knowledge that flow between the entities to generate value (Archer-Brown & Kietzmann, 2018). All these dimensions are interweaved to create value and serve as competitive advantage.

Due to its dynamic nature, research on the knowledge transfer process has defined the term in alternative ways, including *knowledge sharing* (Tsai, 2002); *knowledge flows* (Gupta & Govindarajan, 2000); and *knowledge acquisition* (Grant, 1996; Lyles & Salk, 1996). Filieri

Table 1. Overview of major studies in the past ten years on university-industry knowledge transfer.

Author	Topic of study	Recommendations based on findings
Bekkers and Freitas (2008)	An examination of the knowledge transfer channels between universities and industries to assess the relative importance of different channels in different sectoral contexts.	The results suggest that the industrial activities of firms do not significantly explain differences in importance of a variety of channels through which knowledge is transmitted. The variety is better explained by disciplinary origin, characteristics of the underlying knowledge, characteristics of the researchers involved in producing and using the knowledge, and the environment in which the knowledge is produced and used.
de Wit-de Vries et al. (2018)	A systematic review of extant literature on university-industry research partnerships, with the purpose of identifying barriers and facilitators for the exchange.	Based on the reviewed literature, identified barriers to knowledge transfer are knowledge differences and differences in goals resulting from different institutional cultures. These barriers result in ambiguity, problems with knowledge absorption and difficulties in applying the knowledge. Facilitators to knowledge transfer are trust, communication, the use of intermediaries and experience, which all assist in resolving the identified barriers.
Perkmann et al. (2013)	A systematic review of academic engagement in research collaborations for university-industry knowledge transfer.	Academic engagement is closely aligned with traditional academic research activities and distinct from commercialization. Academics pursue these collaborative opportunities to access resources which would support their research agendas. Policy interventions are suggested.
Plewa et al. (2013)	A qualitative study on research commercialization which examines the dynamic nature of university-industry linkages.	Proposes a descriptive framework of drivers for successful university-industry linkages, accompanied by the respective phases linked to the evolution of the relationship.
Pinto et al. (2015)	Assessing universities and knowledge intensive business services as sources of knowledge for innovative firms in peripheral regions.	Knowledge intensive business services do not demonstrate a higher propensity to interact with universities in peripheral regions. Absorptive capacity is a critical dimension in interactions, with evidence of knowledge circulation during these interactions.
Schofield (2013)	Systematic literature review of university-industry collaborations and subsequent quantitative study to identify drivers and barriers for successful collaborations.	A framework is presented with seven enablers and seven barriers to effective collaborations. Enablers include alignment of research objectives as well as senior management support. Barriers include institutional bureaucracy, lack of incentives and complex information flow and logistics.

and Alguezai (2014), further differentiate the knowledge transfer process as *knowledge assimilation* – the process of analysing, processing, interpreting and understanding the knowledge obtained from external sources; and *knowledge integration* – the activity of combining new external domain of knowledge with an existing internal domain of knowledge.

To further highlight this differentiation, von Krogh et al. (2001) proposes a knowledge strategy typology, delineated based on two structural categories: knowledge domain (existing knowledge or new knowledge), and knowledge process (knowledge transfer or knowledge creation). Within the process of knowledge transfer, the transfer of existing knowledge is termed a leveraging strategy, while the transfer of new knowledge is described as the appropriating strategy. Figure 1 provides a visual representation of the two knowledge transfer strategy delineations.

The leveraging strategy is set forward from existing knowledge domains and focuses on transferring knowledge to the various stakeholders within an organization to allow for faster innovation, achieving efficiency and flexing resource capabilities. Using this knowledge sharing strategy bolsters the trust between parties and reduces the risk of repeating failures (Mueller, 2006). It also nurtures creativity and entrepreneurship (Plewa et al.,

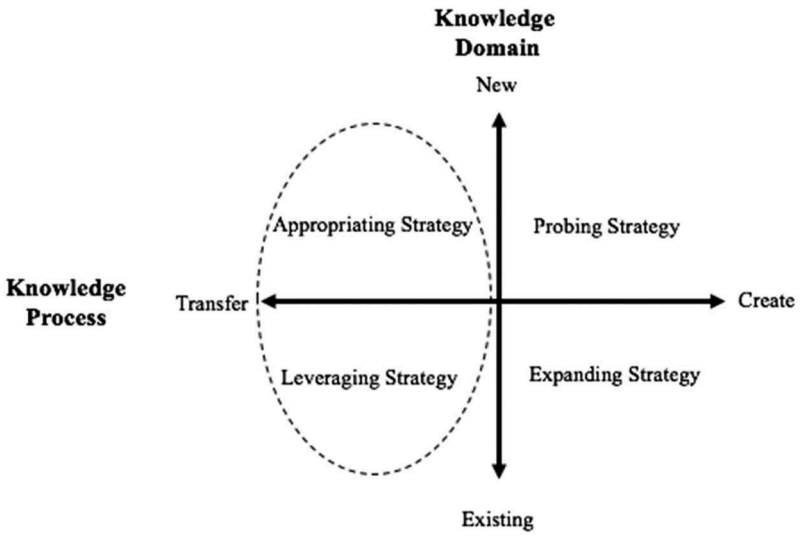

Figure 1. Knowledge transfer strategy delineation, as adapted from von Krogh et al. (2001).

2013). The appropriating strategy is predominantly externally oriented, as the key challenge is to construct a new knowledge domain by channelling knowledge transfer from outside of the organization and appropriate it to a new internal domain. In contrast to the leveraging strategy, the knowledge domain does not yet exist within the organization in the appropriating strategy (von Krogh et al., 2001). The focus of the appropriating strategy is to bring partners on board from which the organization can capture and transfer knowledge from.

Existing knowledge influences the extent to which new knowledge is created, whilst the new knowledge is converted to existing knowledge in the form of the resultant new innovative product or service (Hargadon & Fanelli, 2002). One needs to strike a balance, however, as there are cautionary trade-offs between pushing the boundaries in a new scientific area versus improving the route to market logistics. For example, in a stable and mature industry with limited new technological developments, existing knowledge will be leveraged and refined. In this context, university-industry knowledge transfer provides both the academic and industrial partner with new sources of insight and experience.

2.2. Knowledge transfer and social capital

In this paper, we focus on assessing the leveraged use of social capital in university-industry knowledge transfer strategies. Growing interest in the antecedents of university-industry knowledge transfer has led to scholarly research covering multiple areas within the domain in recent years to compare and identify pertinent themes (Perkmann et al., 2013; van Wijk et al., 2008). Frequently cited themes include knowledge characteristics (Birkinshaw, Nobel, & Ridderstråle, 1998, 2002), organizational characteristics (Gupta & Govindarajan, 2000; van Wijk et al., 2008), and network characteristics (Schofield, 2013; Tsai & Ghoshal, 1998). The literature on network characteristics increasingly focuses on the social embeddedness in network relationships, which comprise a diverse group of organizational actors (Inkpen & Tsang, 2005). As a concept that provides a foundation for describing and characterizing a set of relationships, both within and between organizations, social capital has drawn increased interest from management and organizational scholars. As a set of resources rooted in relationships (Andriani, 2013), social capital conceptually provides a measure through which to assess the cooperative reciprocity of associations.

With limited consensus on how social capital should be defined, Lin (2008) proposes that it is constructed of social obligations and connections between members of a group, which builds on Coleman's (1988, p. 98) assertion that social capital is defined by its function, i.e., "it is not a single entity, but a variety of different entities, having two characteristics in common: they all consist of some aspect of a social structure, and they facilitate certain actions of individuals who are within the structure." In contrast, Bourdieu (1986, p. 248) emphasizes that it is "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition." Putnam (2000, p. 19) focuses on the mutually beneficial characteristics of the connection, by stating "social capital refers to connections among individuals – social networks and the norms of reciprocity and trustworthiness that arise from them."

In spite of alternative perspectives, a common thread is the notion of member interaction that facilitates the creation and maintenance of embedded "social" assets. In the context of network knowledge exchange and transfer, this paper adopts the definition proposed by Nahapiet and Ghoshal (1998), which contend that social capital is the aggregate product of embedded resources, derived from a network of relationships. This notion is supported by Adler and Kwon (2002), who assert that knowledge acquisition is a direct benefit of social capital. To better understand the flow of knowledge within networks, as well as the role of social capital in this knowledge movement, Nahapiet and Ghoshal (1998), distinguish between three social capital dimensions: structural, cognitive, and relational. Building on the authors' seminal work, Inkpen and Tsang (2005) and others (Manning, 2010; Riege, 2005; von Krogh et al., 2001) have identified conditions that would facilitate knowledge transfer across this social capital typology. The following section provides more detail on these different dimensions.

2.2.1. Structural dimension

The structural dimension of social capital reflects the "pattern of relationships between the network actors" (Inkpen & Tsang, 2005, p. 152) and concerns the network ties, network configuration, and the network stability. Network ties refer to the specific ways in which actors are related. These ties are a principal aspect of social capital as they influence resource combinations and resource exchange, which concomitantly affects innovation (Tsai & Ghoshal, 1998). Strong ties have shown to be fundamental for the knowledge transfer of complex, high-quality and tacit knowledge (Uzzi & Lancaster, 2003), whereas weak ties are more conducive to the transfer of explicit knowledge (Hansen, 2002). The strengthening of ties may also reach a threshold, where extra time and effort ploughed into a relationship only leads to marginal or declining returns (Reagans & McEvily, 2003).

The pattern of links among network members is determined by the configuration of a network structure (Filieri & Alguezai, 2014). Configuration elements include hierarchy, density, and connectivity. As a consequence of its impact on access to and contact among the members of the network, these elements have a bearing on the agility and ease with which knowledge can be exchanged. Network density varies between dense to sparse, where McFadyen, Semadeni, and Cannella (2009) argue that sparse networks provide diverse knowledge and is the optimal configuration for the creation of knowledge. Lazer and Friedman (2007) provide evidence that network density, over time, reduces the diversity of information available in a network, which reduces long-run innovation.

According to Inkpen and Tsang (2005), the overall corporate structure has the potential to inhibit or facilitate the connectivity between certain members within the network. Network stability refers to any change of membership within the network, where a highly unstable network may "limit opportunities for the creation of social capital because when an actor leaves the network, ties disappear" (Inkpen & Tsang, 2005, p. 153). It has been suggested that network stability has widespread implications on the transfer of knowledge within a network.

2.2.2. Relational dimension

In contrast to the structural dimension, the relational facet focuses on the direct ties and outcomes of interactions (Inkpen & Tsang, 2005). As such, this dimension is critical in building trust and confidence between partners, which, for the purpose of university-industry knowledge transfer, relies on the willingness of the partners to share their knowledge (Schofield, 2013). Trust, however, implicitly entails risk. Risk of exposing one's ignorance or lack of knowledge (Kang & Hau, 2014), risk related to cost if the other party is found to be untrustworthy (Rousseau, Sitkin, Burt, & Camerer, 1998), and risk of exploitation due to a knowledge partner's opportunistic behaviour (Holste & Fields, 2010). The transfer of knowledge is inhibited and reduced in relationships that lack relational trust, as literature asserts that knowledge sources will limit their engagement to known and trusted partners in such instances (Kang & Hau, 2014).

2.2.3. Cognitive dimension

The final social capital dimension is termed the cognitive dimension. This dimension represents those resources that provide shared representation, interpretation, understanding and meaning among parties involved (Nahapiet & Ghoshal, 1998). In their contextual focus on knowledge transfer relevance, Inkpen and Tsang (2005) focus particularly on two aspects of this dimension among network members, namely shared goals and shared culture. de Wit-de Vries et al. (2018, p. 7) assert that shared goals are needed to "reach a common understanding of the desired output" and to align for a shared interpretation of the results (Tsai & Ghoshal, 1998). The absence of shared goals creates ambiguity and hampers the cause and effect differentiation of the knowledge exchange (Davenport et al., 1998; Partha & David, 1994). Robinson and Malhotra (2005) state that successful inter-organizational partnerships are governed by shared goals and Riege (2005) argue that the strategies and goals that underlie university-industry knowledge transfer are often inadequately communicated upfront, which negatively impacts the objective measurement of goals.

Shared culture represents the degree to which behavioural norms determine relationships. Gulati et al. (2000) closely relate this to tie modality, which is defined as the "set of institutionalized rules and norms that govern appropriate behaviour in a network" (p. 205). At times these rules are clearly stipulated in formal contractual format, but most often, they are informally agreed upon and mutually understood. Shared culture may create "excessive expectations of obligatory behaviour", which could result in either a fixed mindset and an unwillingness to explore beyond the borders of the network, or free riding on the opposite side of the spectrum. Where cultural compromises need to be made, conflict often follows. Similarly, if one of the parties are inflexible in relation to their way of doing things, cultural conflict and stifled knowledge transfer are often the by-products.

Being too heavily weighted in one dimension, while having too little of another social capital dimensions may however also lead to bad performance. Yang, Alejandro, and Boles (2011) advise that one should consider all the social capital resources as a whole in order to gauge the level of social capital present in a network. The next section sets out to do this by means of assigning a social capital score to each of the three regional university-industry knowledge transfer partnerships. The methodology employed is explained in the following section.

3. A social capital university-industry knowledge transfer framework

In this study, we explore the presence of social capital as well as the strategic imperative of the knowledge transfer activity, within university-industry knowledge transfer partnerships across three different regions. In order to do this, the study utilises the principles of secondary data analysis. The researchers analysed existing studies on university-industry knowledge transfer from each identified region, and iteratively analysed these studies to explore whether it

contained the variables needed to address the current research question. Nine applicable studies were found (three studies from each respective region), which were used as secondary data sources for the analysis. The studies consist of both peer-reviewed academic research articles as well as publicly available data collected by the Science-to-Business Marketing Research Centre of Germany as part of a 2011 European Commission project and a research report on Canadian university-industry collaboration, by The Board of Trade of Metropolitan Montreal (2011). Operational definitions of the variables in each of the studies were first established to ensure that these were aligned with the objectives of this study. Table 2 provides an overview of the various studies that were used for the analysis.

The three different countries were chosen as they are representative of regions that are currently at different stages of development (OECD, 2017) and are thus faced with different challenges relating to knowledge absorption capacity, capabilities, market stability, and cultural values (Geuna & Muscio, 2009; Schofield, 2013). These are all aspects that would influence both social capital dimensions as well as knowledge transfer collaborations. These three countries, however, also have some commonalities. All three are ranked in the top 30% of most innovative countries on the 2018 Global Innovation Index (GII) (Canada 18th; Malta 26th; South Africa 58th), and 18th (Canada), 45th (South Africa) and 65th (Malta) in the world in the rankings of the 2016 Competitive Industrial Performance Index (CIP).

To address the first objective of the study, the researchers assessed the level of social capital dimensions present in each of the various country-specific university-industry knowledge transfer partnerships. A score of one was assigned to each social capital dimension which positively impacts knowledge transfer. This was then coded to denote a high level of social capital in that particular dimension. If a particular social capital dimension negatively impacted the transfer of knowledge, no score was assigned to that dimension, which was then coded as a low level of social capital in that particular dimension. Table 3 provides an overview of the results, which will be discussed in more detail in the results section to follow. In addition to distinguishing between the various levels of social capital dimensions present, the study secondly set out to assess the strategic intent of the knowledge transfer activity, based on the knowledge transfer strategy typology by von Krogh et al. (2001). To do this a differentiation was made between creating new knowledge, i.e. disruptive innovation – a knowledge appropriating strategy; or using existing knowledge for the purpose of incremental innovation or development – a knowledge leveraging strategy. This formed the basis of the social capital university-industry knowledge transfer framework, which is elaborated on in the results section.

Table 2. Overview of the data used for the analysis.

Author	Objective of Study	Method and Sample	Predominant Knowledge Transfer Strategy
Developed Region (Canada)			
The Board of Trade of Metropolitan Montreal (2011)	A research report on Canadian university-industry collaboration.	Online survey with a sample size of 402 respondents.	Appropriating and Leveraging
Kneller, Mongeon, Cope, Garner, and Ternouth (2014)	To assess industry-university collaborations to understand how companies benefit from these collaborations, and to gauge how academic discoveries benefit all stakeholders: companies, universities and the public.	Case study analysis of interviews with 20 Canadian companies.	Appropriating
Roshani, Lehoux, and Frayret (2015)	To propose a framework for establishing mutually beneficial open-innovation collaborations between universities and industry.	Case study analysis and interviews with academics and industries.	Appropriating
Transition Region (Malta)			
Davey, Baaken, Muros, and Meerman (2011)	Best case studies of good practice in the area of University-Business cooperation within Europe.	Case study analysis.	Leveraging
Cunningham and Link (2015)	To explore the cross-country differences in the extent to which universities collaborate with business in R&D in Europe.	Quantitative analysis of secondary data.	Leveraging
Georghiou, Uyarra, Scerri, Castillo, and Harper (2014)	An assessment of the smart specialisation strategy which was developed for Malta.	Case study approach to evaluate the strategy that was followed.	Leveraging
Developing Region (South Africa)			
Kruss and Visser (2017)	To examine the university-industry interaction practices of universities in South Africa.	Survey among 2159 academics at South African universities.	Appropriating
Petersen, Kruss, and Lorentzen (2008)	To assess how and why relationships between universities and firms differ across countries and regions at different stages of economic development, and across sectors.	Quantitative and descriptive analysis of secondary survey data.	Appropriating
Kruss, Adeoti, and Nabudere (2012)	To assess the contribution of university-firm interaction for knowledge development in South Africa.	Quantitative and descriptive analysis of secondary survey data.	Appropriating and Leveraging

Table 3. An overview of social capital dimensions present.

Social Capital Dimensions	Developed Region (Canada)	Transition Region (Malta)	Developing Region (South Africa)
Structural			
Network ties	Strong network ties, both formal and informal.	Strong and closely-knit network ties, due to interconnectivity of network members to formal University Research Parks.	Inter-member ties are weak and interaction is relatively low and disconnected.
Network configuration	Systems- and structure focused.	Hierarchical and bureaucratic, runs the risk of high density, which may inhibit the ease of knowledge transfer.	Bureaucratic, impedes and restricts knowledge transfer.
Network stability	High rate of network stability.	High rate of network stability.	High rate of network instability, due to high level of political uncertainty.
Relational			
Trust	Trust relationship managed through clearly defined roles with accompanying accountabilities.	Strong trust relationships.	High level of trust in established relationships, but reluctant to form new trust-based relationships based on perceived threat of opportunism.
Cognitive			
Shared goals	Goals are clearly defined and aligned, but often not enforced.	Goals are wide-ranging and runs the risk of incompatibility.	Goals are both compatible and mostly mutually shared.
Shared culture	Culture of compatibility.	High level of cultural compatibility.	Mostly cultural tolerance, but declining research culture.
Overall Social Capital Score	High	Medium to High	Medium to Low

The social capital university-industry knowledge transfer framework, as presented in Figure 2, plots the respective regional countries' knowledge transfer strategies, as indicated per Table 2, as well as their social capital dimension score on a two by two matrix. The plot positioning on the horizontal line represents the predominant knowledge transfer strategy employed, while the vertical positioning denotes the level of social capital present within the university-industry knowledge transfer partnerships.

From a social capital dimension perspective, as can be seen in Table 3, university-industry knowledge transfer partnerships in Canada and Malta consist of strong and close-knit network ties, with Canada showing evidence of a systems and structure focus in their network configuration. Both Malta and South Africa shows hierarchical and bureaucratic network configurations, which may restrict the and inhibit the ease of knowledge transfer. Canada and Malta possess a high rate of network stability, with South Africa, in contrast, exhibiting a high rate of network instability, ascribed to the uncertain political climate. The relational dimension was found to mostly be built on strong trust relationships for all three countries, with university-industry knowledge transfer partnerships in South Africa at times being under threat due to the perception of potential opportunism from one of the partners in the relationship.

The cognitive sub-dimensions of shared goals and culture show varying results, with university-industry partnerships in Canada displaying alignment, yet the goals are not always accomplished or realized. university-industry knowledge transfer partnerships in Malta have wide-ranging and at times incompatible goals, with South Africa having mostly compatible and mutually shared goals. Cultural compatibility is shared in both Canada and Malta, with South Africa exhibiting a tolerant culture, yet weakening research culture.

The results as illustrated in Figure 2, indicate that university-industry partnerships in Canada, situated in a developed region, predominantly employ an appropriating knowledge transfer strategy for the purpose of creating and sharing new knowledge. In terms of the level of social capital present within the university-industry knowledge transfer activities, Canada shows to utilize a high level of social capital within these processes of exchange. Canada is thus situated in the first quadrant of the matrix. As a country situated in a region in transition, Malta is plotted in the second quadrant of the matrix,

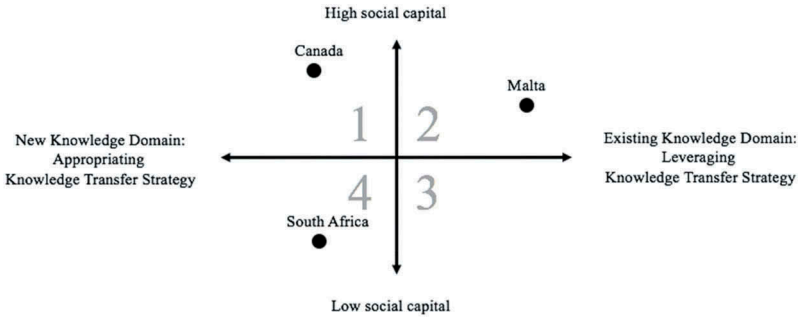

Figure 2. Social capital U-I knowledge transfer framework.

with the results indicating that university-industry knowledge transfer partnerships in Malta most often rely on a leveraging strategy. With relatively low levels of social capital displayed in university-industry knowledge transfer activities in South Africa, the results show that the partnerships most often centre around the appropriation of new knowledge, with the country being plotted in the fourth quadrant.

4. Discussion

The results of this paper indicate that there are clear differences between the social capital dimensions present and the university-industry knowledge transfer strategies employed in the different regions. By focusing on the potential implications of one's strategic positioning on the social capital university-industry knowledge transfer framework, a comparative approach is used to contrast the implications. university-industry knowledge transfer partnerships situated in the first quadrant are characterized by new domains of knowledge transfer. As such, it would involve a timeous approach to master a new and potentially complex knowledge base and way of thinking. When novel innovation or as of yet unexplored territories of competitive advantage are being sought and explored, it is most likely to be accompanied by high cost and a high level of risk. For example, reputational risk, the risk of market rejection, the risk of failure, risk related to resources – both human and financial. Conversely, university-industry knowledge transfer partnerships that are strategically positioned in the first quadrant, also have the biggest competitive advantage to others, as they may claim first-mover advantage and should be able to capitalize on strong network ties to deliver high impact goals in a stable network.

The second quadrant in the social capital university-industry knowledge transfer framework is characterized by the leveraging of a high level of social capital and existing domains of knowledge. Partnerships in this quadrant could utilize the high level of social capital present in the inter-organisational relationship, i.e. high levels of trust and a shared culture, to achieve incremental innovation goals quickly. By building on existing knowledge, this strategic positioning involves less risk and requires fewer resources to achieve results. Potential threats that this strategic positioning could possibly pose include a myopic and fixed mindset, due to the cognitive density of the network actors involved. The main differences in the comparative knowledge transfer strategies positioned in quadrants three and four are that university-industry partnerships situated here would most likely require more resources to accomplish their objectives and would take longer to achieve them. Limited structural, relational and cognitive alignment between the knowledge partners would impede the transfer of knowledge – regardless of the strategic imperative.

It would stand to argue that university-industry knowledge transfer partnerships that possess low social capital and mostly leverage existing knowledge, as per quadrant three, would not be regarded as innovative or highly competitive in their ability to exploit or facilitate the transfer of knowledge. Although highly-dependent on relational factors and the partnership, countries with limited access to external partners, with sparse networks and where the respective university-industry partners are not in close proximity to each other, might fall within the third quadrant. Quadrant four university-industry knowledge transfer partnerships should focus on maintaining and nurturing their human and structural capital over time to facilitate an increase in social capital. This may lead to a strengthening in particularly the structural and cognitive dimensions of social capital.

5. Conclusion

This paper set out to present a framework to better understand the role that social capital plays in the strategic positioning of university-industry knowledge transfer partnerships. The paper proposes a link between social capital and knowledge transfer strategy, by using a cross-regional comparison of university-industry partnerships spanning three countries, each at a different stage of development. By exploring their contrasting settings on the knowledge transfer strategy framework, a clearer picture is provided regarding the competitive advantages – or lack thereof – that this positioning offers. Future research could conduct longitudinal studies to track the change in positioning over a period of time or to compare how heightened social capital over a period of time impacts the output of the university-industry partnership. An exploration of the products of university-industry knowledge transfer can also be strategically mapped and compared. In addition, a more detailed description of the respective intellectual capital dimensions present in university-industry partnerships and its impact on knowledge transfer, present fertile ground for future exploration.

Finally, the study is not without limitations, and the authors are aware that it only offers a snapshot representation of the university-industry partnerships present in the three regions identified. As such, findings relate to a particular context at a particular point in time and the researcher do not deny the influence of additional macro-contextual factors on the interpretation of the results.

Disclosure statement

No potential conflict of interest was reported by the authors.

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