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The role of culture-moderated social capital in technology transfer – insights from Asia and America

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ABSTRACT

This study examines the impact of cultural differences on the creation of social capital in technology transfer processes. The aim is to understand the influence of culture on relationships, particularly the structural, relational and cognitive dimensions of social capital created in relationships associated with university-industry links, specifically technology transfer (TT). The research builds on a culture-moderated social capital perspective; observing that the characteristics and usefulness of social capital are determined by cultural practices prevailing in social structures. The influence of culture on social capital in case studies of six American and ten Asian technology transfer offices and organizations involved in technology transfer has been investigated. Using university research technology transfer and commercialization as the centerpiece of the empirical work, we examine basic Hofstede's cultural characteristics and the way they influence TT practices in two different culture types. Our findings suggest cultures can influence creation and utilization of social capital in university-industry links. Culture can influence not only relationships with external stakeholders in technology transfer (industry, governmental bodies) but also internal relationships and management styles in TT offices (influences on organizational culture). We propose that the awareness of cultural characteristics and influences is important not only in cross-cultural technology transfer but also domestic operations. Using this awareness to build trust lies at the heart of interactions with internal and external stakeholders. The research results should be useful for entrepreneurs, universities and technology transfer officers in order to better understand the nature, and role, of culture-moderated social capital in technology transfer and to support effective processes for scientific research commercialization.

1. Introduction

A very competitive environment and dynamic changes in the global economy have led private and public sector institutions to unite their efforts to foster the diffusion of knowledge within innovation systems. Scholarly interest in university–industry relationships for technology development and commercialization arose from a belief that collaborative research by academia with industry can be a powerful source of innovation (Mansfield, 1998). Some researchers have argued that the importance of linkages between universities and industry bodies helps ensure the survival of both parties in the competitive marketplace and that it acts as an engine of economic growth (Siegel et al., 2004). Morlacchi and Martin (2009) argue that the innovative capacity of a nation is dependant not only on individual actors of the innovation system (companies, universities, government), but more importantly on the links between such players. Carlsson and Fridh (2002) argue that technology transfer from universities to industry needs to be understood in its broader context. The success in disseminating research results for the public good depends not only on the nature of the interface between the university and the business community, but also on the receptivity in the surrounding community as well as the culture, organization, and incentives within the universities themselves. Particularly the national culture system can be more, or less, contributory to the development of social capital (Lin, 2007; Nakhaie, 2005; Sanders and Nee, 1996) and culture variations may affect the characteristics of social capital (Portes, 1998). For example norms, are considered as one of major sources of social capital (Coleman, 1988; Portes, 1998). Norms are culturally constructed (Hofstede, 1980). Also networks have been perceived as 'primarily cultural phenomena' (Curran et al., 1993: 77).

This study supports a culture-moderated social capital perspective, i.e. that the characteristics and usefulness of social capital are determined by cultural practice prevailing in social structures (Lin, 2007). We investigate social capital in a cultural context via two extreme cultural types. On the basis of Hofstede's (1997) cultural dimensions model, Griffith et al. (2000) identified two extreme cultural types: Type I (individualistic, low uncertainty avoidance, and low long-term orientation) and Type II (collectivistic, strong uncertainty avoidance, and high long-term orientation). In our study, these two contrasting culture types are chosen to investigate the effect of national cultures on the creation of social capital in technology transfer processes from

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Table 1
Hofstede's cultural dimensions for chosen countries.

	USA	Singapore	Taiwan	Hong Kong
Individualism	91	20	17	25
Long term orientation	26	72	93	61
Power distance	40	74	58	68

Source: www.hofstede-insights.com

universities to business. Technology transfer offices (TTOs) from United States were selected as representatives of Type I culture and TTOs from three Asian *tiger economies*: Singapore, Hong Kong and Taiwan as representatives of Type II cultures. The research presented here spanned a range of East Asian territories. While the territories selected have Chinese cultural links, generally there is a high level of cultural diversity between these Asian locations. Table 1 reveals however that for the three key Hofstede cultural dimensions invoked in this research, there is significant similarity across the three Asian territories and a clear difference with the results seen in the USA. This observation provides confidence in the expectation that only two cultural types need be considered for the comparative research presented here.

Three TTOs in Hong Kong, four TTOs in Singapore, and three TTOs in Taiwan have been researched via field-work, all representing cultural type II; and similarly six TTOs in Texas representing cultural type I. We explore this extreme culture types not only to illustrate our culture-moderated social capital argument, but also, noting the vast literature on US technology transfer, to inform academia and TT managers about benefits and pitfalls of social capital in Asian cultures concerning technology transfer and university-industry links. We theorize about how cultures shape TT practices. We further posit that the cultural context, which to our knowledge has not been widely applied to the study of relationships and social capital in TT, can provide new and valuable insights in the study of technology transfer. One notable exception is the research by Yoon et al. (2015) analyzing the role of social capital in entrepreneurial Regional Innovation Systems.

While the literature in the areas of innovation management, technology transfer and commercialization provides insight into various organizational, contextual and relational success factors, significant gaps remain. Some studies have captured and defined different types of university-industry links, but they do not characterize relationships in depth nor do they provide assessments of either impacts or consequences. As such, there are already generic, perhaps global, indications that existing approaches are insufficient for us to analyze social capital in technology transfer and the influence of national cultures on creation of social capital in technology transfer processes. Noting the rapid economic and technological progress of East Asia in recent decades it is becoming essential to test the emerging ideas and conclusions against the East Asian experience.

This study draws on practice-based studies of technology transfer to create a novel conceptualization of relationships management and the influence of culture on social capital in university-industry links. The paper relates to the first theme of this themed special issue, especially as regards National and Regional Innovation Systems and Development. The title of the special issue is *Global Shifts in Technological Power* which relates closely to the comparative approach taken and to the nature of university-industry links in different parts of the world. The findings of the paper also contribute to the practice of TT and the special issue subtheme: *Asian socio-technical trends, and their regional and worldwide impacts*.

The research referred to in this paper addresses a gap in the literature. Despite the recent increase of interest in the concept of social capital, the role of cultures in Technology Transfer remains largely overlooked. Furthermore, previous investigations of social capital have tended to be focussed on western (Type I) cultural contexts, i.e. open markets, free competition and societies with an individualistic orientation (Burt et al., 2000). In contract little attention has been given to contexts with different cultural contexts and market structures. In this paper we seek to explore the cultural dimension further.

This paper makes a conceptual and empirical contribution to the literature on university-industry links, namely TT. It introduces a novel conceptualization of how national cultures shape relationships, namely social capital created in university-industry relationships. It further shows some practical insights from Type I and Type II cultures.

The organization of the text is as follows: Section 2 covers some theoretical background on social capital, culture and technology transfer. Section 3 presents the methodology for the research. Section 4 presents the key emerging findings from the research and evidences those findings. Section 5 concludes the paper and seeks to link to subsequent outputs from this extended research project.

2. Context and theoretical background

This paper is concerned with the relationship between social capital and national culture and the ways in which such considerations enhance, or diminish, possibilities for technology transfer from university laboratories.

2.1. Social capital

Social capital relates to the resources developed through participation in social networks and activation of these resources for social benefit (Bourdieu, 1977a, 1977b, Bourdieu, 1986, Portes and Landolt, 1996). Bourdieu (1986) explained social capital as 'the aggregate of the actual or potential resources which are linked to membership in a group' (p.248). Coleman (1988) posited that social capital inheres the structure of relations of authority, trust and norms between and among persons. According to Putnam (1993: 35–6) social capital refers to 'features of social organization, such as networks, norms, and trust, that facilitate coordination and cooperation for mutual benefit'. Some researchers agree that social capital is composed of three elements: form, norms of obligation and reciprocity, and resources (McNeal Jr., 1999). Form refers to the breadth of the network of relations, the depth or intensity of relationships and the existence of structural holes. Shared norms and values (which refers to culture) can result in development of trust, obligation, and actions of reciprocity. Resources include access to information, language, financial resources, physical goods, but also additional networks and relations. Adler and Kwon (2002) have provided a systematic literature review of social capital and have identified reasons for differences in definitions. One reason according to the authors is different researchers' focus on the substance, sources or consequences of social capital. They also note differences coming from the researchers' focus on relations, the structure of relations, or both.

Nahapiet and Ghosal underline that social capital is a relational or network-mediated resource that enables individuals and organizations to gain access to conventionally defined resources and opportunities (Nahapiet and Ghoshal, 1998). In the technology transfer context we can look at social capital at individual, organizational and inter-organizational levels. At the individual level social capital helps enhance access to information, opportunities, support and economic resources (Bourdieu, 1986; Coleman, 1988). At the organizational level social capital creates power and influence, shapes relationships and serves as a source of social control (Cook et al., 1983; Portes, 1998; Schiff, 1992).

Within the social capital concept, relationships can be characterized by two dimensions: 1) the strength of ties (strong ties and weak ties) and 2) the shape or direction of relations (horizontal and vertical). Weak or strong ties are defined by the degree of intimacy between persons (Granovetter, 1973, 1985; Portes, 1998). Granovetter (1985) explained that social relations underline the transfer, accumulation, or diminishment of other capitals (e.g. cultural capital, human capital) and introduced the concept of 'embeddedness'.

Adler and Kwon (2002) describe social capital as a resource that

inheres in a focal actor's external network to give the actor advantages in his or her competitive rivalries. By contrast, network closure, or what Adler and Kwon called the "bonding" view of social capital (Coleman, 1988), underlines the linkages between individuals or groups within a collective, or as they term it: "the collectivity" that "give the collectivity cohesiveness and thereby facilitate the pursuit of collective goals." (Adler and Kwon, 2002: 21).

Regarding innovation management: researchers emphasize the importance of external actors and social interactions as important drivers of the better innovation performance of organizations. Landry et al. (2002) noticed that increases in social capital contribute more than any other explanatory variable to increase the likelihood of firm innovation. They also found that different forms of social capital, in addition to the number of advanced technologies adopted by companies for production, determine the radicalness of innovation, particularly if the social capital is in the form of a research network asset. According to Faccin et al. (2017) social capital has influence on competitiveness and as a result some types of innovation. Ahuja (2000) described the benefits of social networks within the framework of R&D alliances to improve firms' innovative abilities. The benefits of direct and indirect ties included: complementary competences among partners, knowledge sharing and economies of scale in R&D programmes. Maskell (2000) identified the following contributions of social capital to innovation: reduced transaction costs between a company and other actor (e.g. HEI).

2.2. Culture

Culture is defined as shared symbols, norms, and values in a social collective, such as a country. Hofstede (1980) has defined culture as "the collective programming of the mind which distinguishes the members of one human group from another." (Hofstede, 1980, 1989, 1997, 2001) has proposed four widely utilized dimensions of culture: power distance, individualism-collectiveness, masculinity-femininity, and uncertainty avoidance. Two more dimensions have been added later to this framework: long-term orientation and indulgence. Hofstede's framework has been examined empirically by many researchers in different cross-cultural studies.

Two dimensions in particular have been examined for this work, especially in terms of their influence on entrepreneurship: individualism and collectivism. One characteristic of collectivism is a strong identification with an 'in-group', and an aversion to 'out-groups'. Collectivists are motivated by the implicit norm of the group – 'the clan' (Ouchi, 1980). Inside such a group it is trust and commitment, rather than contracts, that are perceived to serve the group interest. Collectivists tend to act cooperatively seeking to maximise their group's interests and they perceive themselves as interdependent members of an 'in-group'.

It is not the purpose of this paper to explore which of the two cultural extremes investigated might be more effective, rather the interest is in understanding the nature of the difference between the two differing cultural environments. With that said we can note that researchers have found that too much of either individualism or collectivism tends to slow down economic growth at both: national level (Hofstede, 1997) and company level (Morris et al., 1993). Furthermore Morris et al. (1993) suggest that 'balanced' amounts of individualism and collectivism, at the firm level, are associated with greater entrepreneurial activity.

The technology transfer performance of higher educational institutions depends partly on the abilities of their technology transfer units, in most cases technology transfer offices (TTOs), to bring academic research results and inventions into commercial applications (Siegel et al., 2004). The experience of TTOs is specifically indicated as one of the key performance drivers (Carlsson and Fridh, 2002; Hsu et al., 2015). Some studies, however, show that TTOs can create barriers to efficient and effective technology transfer (Siegel et al., 2003). That is why there is a need to understand all elements that influence technology transfer practice. Resende et al. (2013) refer to the huge collection of variables conditioning the TT relationships and wonder if it is possible to identify ideal implementation.

A small number of scholars have studied institutional (as opposed to national) culture and its role in technology transfer. For example, Clarke (1998) argues that entrepreneurial culture of the institution is a key driver of successful university-industry technology transfer. O'Shea et al. (2007) have considered the Massachusetts Institute of Technology (MIT) and its organizational culture and they observe a result of very successful university-industry cooperation. Hsu et al. (2015) report that institutional cultural resources are among the two most emphasized resources for the improvement of university technology transfer in Taiwan.

Some authors, such as Plewa et al. (2005) and Grzegorczyk (2017) have researched relationship marketing as applied to university-industry links. Schartinger et al. (2002) further suggest that university-industry links vary according to what can be called "relational involvement", such as might exist between universities and industrial organizations. In this spirit "relationships" are defined as links with high relational involvement. It includes situations where individuals and teams from academic and industrial contexts work together on specific projects and produce common outputs. These links are to be contrasted with mobility and transfer links, and those of lower relational involvement, limited to transferring generic skills or formal IP transfer activities (Perkmann and Walsh, 2007). Interesting questions arise: How does national culture shape complex relationships between diverse actors in technology transfer processes? How does national culture shape the accumulation and exchange of social capital relevant to technology transfer? How specifically, does culture affect structural, relational and cognitive dimensions of social capital embedded in relationships among players in the context of technology transfer?

3. Methodology

The research project took a qualitative approach as qualitative research methods are particularly valuable for the exploration of new concepts and their interrelationships, and to gain an in-depth understanding of situations, behaviours or activities. Primary data was collected through sixteen Individual Depth Interviews (IDI) with technology transfer experts from different technology transfer offices or other units dealing with the technology transfer of scientific research results and academic innovation.

Table 2 provides details of participants and the affiliations of the technology transfer experts interviewed for the research programme. Purposive sampling was employed for the choice of participants for interviews to fit the criteria of being an experienced technology transfer expert (e.g. high level TT Manager or Director of TTO) working for a higher education technology transfer unit.

The research started with the Hong Kong interviews in 2015. The interviews in the USA followed in the first half of 2016. The Taiwanese interviews were conducted in the autumn of 2017 and the Singapore interviews in the spring of 2018. All interviews followed an interview protocol developed after a thorough literature review. This allowed a systematic approach without limiting the opportunity to uncover and explore new issues. While notes were taken during the interviews on emerging issues and ideas, the interview protocol remained the same in each case, so as to allow the identification of similarities, or differences, of view.

The research has been framed with reference to Nahapiet and Ghosal's view of social capital (Nahapiet and Ghoshal, 1998). They have identified the structural, the relational and the cognitive dimensions of social capital. Interview questions were asked with regard to the study's focus areas: 1) structural social capital: number and scope of social interactions, types of partners, the role of long-term relationships, internal and external relationships 2) relational social capital: quality of

Table 2
Affiliations of the technology transfer experts interviewed for the research programme.

Asia
Technology Transfer Office, The University of Hong Kong
Knowledge Transfer Office, City University of Hong Kong (City U's)
Office of Research and Knowledge Transfer Services (ORKTS), The Chinese University of Hong Kong (CUHK)
NTUitive Pte. Ltd., Nanyang Technological University, Singapore
Office of Technology and Enterprise Management, Singapore University of Technology and Design
Industry Liaison Office, NUS Enterprise, National University of Singapore
Exploit Technologies Pte Ltd., Agency for Science, Technology and Research (A*STAR), Singapore
Technology Transfer Office, Academia Sinica, Taipei, Taiwan
Technology Transfer Center, National Taiwan University of Science and Technology (Taiwan Tech)
Innovation and Incubation Center, Ming-Chi University of Technology, Taipei, Taiwan
USA
The Office of Technology Transfer and Innovation, University of Houston
Office of Technology Transfer, Rice University
Office of Commercialization and Innovation, University of Texas at San Antonio
Office of Technology Commercialization, UTSA Health Science Center
Office of Technology Commercialization and Industry Engagement, Bayrol University
Office of Technology Commercialization, Texas A&M University

relationships, trust creation, commitment, and 3) cognitive social capital: norms, values, standards and practices, problems and barriers. According to Nahapiet and Ghosal, the structural dimension of social capital includes social interaction which refers to the extent of social relationships between a TTO and the commercializing company/companies (Ring and Van de Ven, 1994). Relationship quality refers to the extent that this interaction is marked by the development of trust and expectations of reciprocity (Dyer and Singh, 1998). A shared vision embodies the collective goals and aspirations of the partners of a co-operation. When partners have the same perceptions about how to interact with one another, they can avoid possible misunderstandings in their communications and have more opportunities to exchange their ideas or resources freely.

As regards the selection of the specific territories investigated for this research – Texas, USA was selected as arguably a particularly strong exemplar of Type I culture seen in terms of Hofstede dimensions. The Asian Tigers were chosen as examples from a Type-II cultural context, chosen specifically for their strong links to Chinese culture. It would seem reasonable to infer that such influences might impact on the issues of technology transfer as part of national culture in these particular territories.

The emergence of China as the leading global competitor to the United States – especially in areas of technology, further motivated the comparative aspects of the research. Thus far Mainland China has not been researched, so as to protect the research from the role of political collectivism in the issues under investigation. To include the People's Republic of China would bring in issues concerning politically-mandated collectivism and, for example, the need for joint ventures in international inward investment. Specifically, the political dimension of Communist ideology would present a potentially important set of influences that, even if only a minor factor, would have risked complicating the national-cultural issues at this stage. To be specific, in this paper we draw a distinction between the collectivism expressed in Communist political thought and cultural norms in favour of community definition and support, as seen in the selected Asian Tiger economies and which we posit are a consequence of national culture. We regard these latter issues as being key to our study.

NVivo 11 qualitative data analysis software was used to conduct data analysis. Interviews were recorded and transcribed in the English language. Taiwanese interviews were conducted with real-time interpretation and recorded. All the interviews were transcribed in English. Interviews were conducted in-depth and lasted between 55 min and 90 min.

4. Overview findings and discussion

In this paper we take an overview of the main issues and points of contrast between the American and East Asian perspectives. Overarching observations are evidenced by reference to individual quotes from the transcribed interviews. Because of the exploratory nature of the research we stop short of seeking formal validation of our findings. Rather, at this stage we seek to assist understanding the practices of TT in two distinct cultural settings.

The overview of the collected dataset reveals some overarching findings, including that national culture, as a social capital asset, can influence the ways technology transfer managers build and maintain relationships, trust, and how practitioners use social capital embedded in relationships. By studying two extremely different cultures we identify, or confirm, some clear differences in TT practices. Culture can influence an individual's perception of the value of relationships and shape the behavior of actors involved in TT processes. It is important to stress that our focus in this paper is on differences and, as noted previously, we do not here unpack the diversity of culture and approach seen within each global region. Singapore and Hong Kong are notably multicultural with, for instance, very widespread use of English language and a long history of global trade and commerce. Taiwan also has a global and pro-western outlook, but it is noticeably less multicultural than, for example, Singapore. In addition this paper does not dwell on the fact that in practice there are many cross-cultural influences on TT processes e.g. most TTOs around the world use western concepts and models of TT and commercialization, some TT managers in Asia were trained in USA or in western Europe, indeed some of them grew up in such countries some U.S. TT managers and entrepreneurs in the USA might be of Chinese origin or deal frequently with Chinese investors.

The key overview findings may be summarized as follows:

4.1. Structural social capital

In our study probably the most important consideration to emerge is that the cultural dimension of collectivism and individualism shapes the way structural social capital is built in the technology transfer context. National cultures shape the characteristics and dynamics of social capital in technology transfer through the way that actors build, and manage, relationships at both: individual and orgnisational level. Technology transfer relationship networks are arguably complex, certainly complicated, and include relationships between: 1) inventors (researchers, students), 2) investors (corporates), 3) potential licensees, 4) patent agents, and 5) university administration and management.

Relationships clearly matter in technology transfer for both Asian and American TTOs. All the interviewees agreed that relationships are very important in TT. However, it is noticed that for TT in Asian cultures, value was rather assigned to building long-term relationships based on trust and social networks between groups of people sharing deep sense of solidarity and belonging. We also noticed that building deep relationships with fewer people was seen as the preferred way to do things in TT. Thus bonding social capital based on strong ties was extremely important. One TT expert working in Asia commented that:

> "Everybody networks here, but that's the first step. You have to build that relationship over a period of time. I've been coming to Asia since 2012, mostly in China, mostly dealing with people in Singapore, Taiwan, China, and the like. And building deep relationships with a few people, because that's the only way you could do it. And that's what I understood from the research that I've done about how to effectively de-risk the prospect of doing transactions in Asia. Because here (…) it's almost completely about who you know. Which is good and bad. There is not the notion of quid pro quo as a

Table 3
Structural social capital affecting technology transfer in different cultures.

	Asian TTOs	American TTOs	Supporting evidence from the interviews
Networks	Intense networking in order to establish *guanxi* and maintain m*ianzi*. [These terms are introduced in Section 4.2] Building deep relationships with a few people. Typically closed. More bonding social capital.	Intense networking. Searching for relationships with many actors in the network and connections with other networks. Typically open. More bridging social capital.	**Asia**: "Building deep relationships with a few people – that's the only way you could do it"; "I do business with people I know" **America**: "I can do contract with anybody". "I don't need to know these people I just need to do my job."
Weak and strong ties	Building social capital through informal social ties: kinship, hometown, common schooling, or work experiences. Strong ties and long-term relationships very important. Existing in-groups.	Weak ties very important based on delivered results, value and benefits.	**Asia**: "It's always easier to develop a relationship when you're in a close net, relatively small community." "Relationships are very important, and we do treasure the relationships at the personal level, we do value that a lot." "We are very small, interconnected society (…) So, chances are there would always be interpersonal relationships within 1 or 2 degrees to connect one end of the spectrum to the other end of the spectrum. I think that's particularly useful." "It is all about investing in relationships. You will do sth for me today and I will do sth for you in the future." **America**: "You have to be constantly interacting with people in order to understand how you can either get benefit from them or give benefit to them, in the event that you got a potential future relationship."
Orientation	Relationship centric	Value centric	**Asia**: "You can be perfectly competent and absolutely not successful, if you don't know how to work the relationship angle." "Here it's all about relationships… that might lead to contract. It's almost completely about who you know." **America**: "In America if you and I don't know each other from Adam, but if we want to buy and sell something, we can have a contract, that allows us to do that with a relative certainty that it's going to get done. So the law of that is straightforward. The logic of why we would do that, might be because I've got something that you want or you've got something that I want, but the relationship really doesn't factor into it."

Source: own research.

negative. So, I can do something for you, there isn't necessarily personal gain for me, but I've got something that you'll do for me later on."

"Relationship building and information sharing are the two things that people thrive off of here."

In contrast in American TTOs "bridging" social capital was seen as being more important. It was particularly focused on wide networking between socially heterogeneous groups, and not on deepening the relationships in tight groups, as seen in Asia. The general perception in Texas was: the wider the social networks (including business network assets, research network assets and information network assets) - the better the opportunities for creating additional value in technology transfer process. In essence value was assigned to the extent, rather than the depth, of social relationships (see evidence in Table 3).

Our interviewees expressed opinions that in Asian cultures people "do business with people they know" whereas in American culture "you can sign contract with anybody as long as you can see benefits for both sides". Therefore, in western culture pre-existing relationships are seen as being not so crucial for TT. However in all cultures we studied we met TTOs that were relationship-oriented or transaction-oriented largely as a consequence of a specific organizational culture.

An American interviewee comments:

"We are seeking fewer deeper relationships with companies to try to accomplish what we are trying to do because I'm hearing it, and seeing it, that companies are spending the same amount of money at the universities to do research to do the things we are doing at the universities but they are spending the money at fewer universities, more money at fewer universities. So this idea that technology commercialization, the value of technology commercialization is building relationship rather than creating transactions, I couldn't agree more."

Above all we should stress that in both studied territories networking was perceived as a crucial step for finding potential partners, licensees or investors. However, in Asian cultures there was more focus on building trust and long-term engagement in order to strengthen a bargaining position for potential future cooperation.

One concept that sheds light on the nature of social exchanges in Asian, especially Chinese, cultures is the notion of the "in-group" (Redding and Wong, 1986). In collectivistic cultures people form in-groups based, for example on such characteristics as kinship, hometown, common schooling, or work experiences. In-groups are usually enduring or permanent, in contrast to the temporary and flexible groups based on the common beliefs or shared interests that are seen in more individualistic societies (Triandis and Gelfand, 1998). In-groups are more than social communities they are economically important. Resources, including both financial and social capital flow through the in-group network. A central aspect of in-group action takes the form of favours and the return of favours (Yang, 1994). People who are on the margins of, or who are excluded from, the in-group may be seriously disadvantaged. The boundary of an in-group is not sharp. Indeed there is a distinction in terms of personal advantage between those on the margins of the in-group and those at its center. As noted earlier, it is not the purpose of this paper to address the wider question of whether collectivised societies and those with a culture of in-groups at an overall (i.e. national) level have an advantage over more individualistic societies. Our frame of reference is more local to the in-group itself and whether its members and its potential members can receive benefit, or perhaps simply that they perceive that they can obtain benefit, by joining the in-group. What is important for TT managers is to be aware that it is difficult to get into the in-group if you are an outsider.

One western TT manager working in Asia commented:

Table 4
Relational social capital relevant to technology transfer in different cultures.

	Asian TTOs	American TTOs	Supporting evidence from the interviews
Trust	*Guanxi and Mianzi*. Investing in relationships. The role of favours. Benefit extended by one person to another should be returned in kind in the future. Mutual benefits.	Doing things together. Delivering promises and results. Shared beliefs. Mutual benefits. Financial commitment.	**Asia**: 'It is all about favours.' 'It's favours. And it's for a place that thrives on the notion that it's merit-based. It really is relationship-based.' "There's an element that both sides are benefiting, there's the element of trust, that has been established as a consequence of both – either joint successes or mutual successes on both sides of the fence, and I think that's what really propels the relationships forward." "So, they didn't win the money and they were upset but they did know that we acted with transparency. Trust is there, even though there will be feelings of disappointment." **America**: "What created the trust is actually doing things together." "Trust is about delivering results." "(…) it was a 1,5 million dollar operation and before I ever heard about it they already have committed half the money." "You have to know what you are selling, what you are offering to somebody else in that potential relationship." "So we just started talking and we feel like I can finish his sentences he can finish my sentences we are exactly on the same page on what he is wanting to do with his company and what we are trying to accomplish. We are pretty similar."
Sequence of the TT process	Rather relationship-logic-law	Rather law-logic-relationship	**Asia**: "In the relationship-centric model (…) you tend to get this – you get this that is: I will introduce someone to the technology, I will do them a favour, because I know them. Have you ever heard the phrase: 'How can I help you?/What can I do for you?' It's a very common thing here, where what they basically say is 'I want to do something for you, so you have to do something for me later on'. And that's at the heart of the relationship. If you don't know that person, you don't trust them, you just say nothing. But if you know them, you've got a relationship with them, you say: what I really need is I need for this technology to get in front of that guy who's an investor. And I don't know him, but you know him, maybe you could introduce? Happy to do it. That's how it works." "There's a formal relationship and I think we're very good at establishing those. But between them you'll also find that there are many interpersonal relationships. Relationships that have been established for many individuals at an individual level, that have seen… progress the formal institutional relationships. So what I'm basically trying to say is, at the heart of it, there are individuals with relationships that drive our formal engagements. If there's one thing that the place is particularly good at, it is making informal relationships formal." **America**: "In America if you and I don't know each other from Adam, but if we wanna buy and sell something, we can have a contract, that allows us to do that with a relative certainty that it's gonna get done. So the law of that is straightforward. The logic of why we would do that, might be because I've got something that you want or you've got something that I want, but the relationship really doesn't factor into it." "In the Western context we have the contract, now we're working together. So we negotiated, we hard fought, tooth and nail, we get to the deal and now we're partners. So we're working, working, working, and you come back to me and say ok, well, we're partners, we're gonna do all these kind of stuff, and now here's the reality, we need to change the deal or whatever the case might be. So the relationship builds after the contract."

> "Rule number one: know you can never get into the club. First of all, you gotta start with that … That you can't. I will always be an alien. So that's never going to change. I could run down to [the] Ministry of Manpower, put in my permanent residency application, I could go through the process, get approved for PR, become a citizen, do all these kinds of stuff, but I will always be an alien. What I can do is bring a different perspective. I came here as the international expert in this space. That was my entrée into things."

Some of our Asian respondents pointed that it can also be difficult even for indigenously local TT officers to get 'into the club' regarding some relationships between important figures. Our interviewees in Asia, especially those in Taiwan, returned to this theme frequently. The Taiwan interviews, in particular, prompted an interesting observation. While no direct comment on the observation was made by any interviewee, nevertheless an important issue became clear through the fieldwork. While technology transfer as an activity relies on, or is seen to benefit from, in-group links and memberships, the officers of the TTO are typically not members of the relevant in-group. That is a result of closed in-groups but also consequence of hierarchy and formality. This sense of exclusion, and the reality of exclusion, for the TTO staff can make the role of the TTO difficult in strongly type II cultures.

4.2. Relational social capital

The relational dimension of social capital concerns the nature of connections between individuals. Key considerations include the level of trust of others, the depth of cooperation and the position and perceived role that an individual has within the network (Xiao and Tsui, 2007). The concept most closely related to social capital in Chinese culture is "guanxi", which points to the importance of trust, obligations, and reciprocity in Chinese people's social interactions. Guanxi includes, however, aspects that would be acknowledged by all to be problematic and unethical. As one commentator puts it: "Guanxi refers to

instrumental-personal ties that range from strong personal loyalty to ceremonial bribery" (Walder, 1986: 19). Guanxi is also defined as a condition that "involves the exchange of gifts, favors and banquets; the cultivation of personal relationships and networks of mutual dependence; and the manufacturing of obligation and indebtedness" Yang (1994: 6).

In a technology transfer context TTO managers, and even more so directors, in Chinese cultures will rely on aspects of their guanxi to reach potential business partners but even more frequently to link with patrons, and potential patrons, in the government in order to get access to market information, scarce resources, and protection when needed (linking social capital). As a consequence of the emergence of, and the growing importance of, a rational-legal system to govern and guide business transactions, guanxi practices (i.e. using guanxi to get things done) can be expected to be in decline, however, our interviewees confirmed that the importance of guanxi relations has remained high:

> "If you think about this idea of relationships – the Chinese have a word for this – it's called guanxi. It literally means – I'm tempted to say relationships – but I think it's a little bit intimate than that".

Guanxi (personal connections) together with *mianzi* (face, as in face-saving) are the key concepts in Type-II cultures that have strong implications for interpersonal and inter-organizational dynamics in Asian cultures. *Mianzi* is defined as the recognition of an individual's social standing and position (Lockett, 1998). In Type-II cultures it is important, not only to maintain good relationships, but also it is vital to protect a person's *mianzi* or dignity and prestige. In terms of doing business, or technology transfer, mianzi can mean that all actors of the process should show respect to, and save *mianzi* for, each other.

One expert working in technology transfer in Asia commented thus:

> "It runs completely counterintuitive, to what we're used to in the West, where the things that people appear to be asking for, seem almost inappropriate. It's not like in China, where they're asking you for money, right? Here that doesn't fly, because of the prohibitions against that kind of graft. But no, it's favours."

Additionally in Asian cultures government support can be secured when mutual trust is established. Thus one needs to be aware that the concepts of *guanxi* and *mianzi* refer not only to ties at personal level but also to relationships with governmental bodies. For more evidence see Table 4.

All Asian cultures that we studied are heavily influenced by Taoist principles. As such guanxi and mianzi are regarded to have both Yin(g) and Yang (Durlabhji, 2004). In order to build trust and establish productive relationships, the Yang of eagerness, aggressiveness and outcome orientation need to be balanced by the Yin(g) of a long-term perspective, strong co-ordination and people orientation. When the Yang is not balanced. i.e. if partners ruthlessly pursue their goals without regard to what others think then they can be accused of having a 'thick face' and a 'black heart' (Pheng, 1997). In our interviews we encountered similar opinions:

> "Here it is all about investing into the relationship. Trust is very important. People do not tend to screw each other over here, just in order to make a deal. And people are very deferential to a common code of conduct. No pointing and everything like that, because nobody wants to run the risk of losing face or losing their relationship, which is important."

The benefits of creating trust were also underlined by the American interviewees:

> "If you have a trusted personal relationship you can take risk that you can do things outside the contract and things will work out, and if everybody is moving in the same direction everybody believes in each other".

> "We've been doing these things for a lot of years. That is totally build on a handshake and trust."

> "We created a trusted technology commercialization partner if I send a company to Belgium I say you call Fillip and he will take care of everything. I don't even worry about it I don't think about trying to follow Fillip and how to help this guy. I trust Fillip and he trusts me and this organization what we say what we are going to do but that took time."

In both cultures we encountered the opinion that it takes time to build trust. However the perception of trust was a bit different in each case. In the Asian cultures managers placed more importance on the reputation and trust of their partners than on legally or contractually-defined sets of rules. In the US environment we noticed that TT managers were more focused on future opportunities and on the possibilities of creating added value for the mutual benefit of both sides.

4.3. Cognitive social capital

The cognitive dimension of social capital incorporates shared stories, language and culture. Arguably it is this dimension of social capital that is most readily identified with national culture. In that spirit it has been argued that the transfer of technology is easier between two organizations if they are similar in terms of national culture (Khedia and Bhagat, 1988). The findings of this work show that national culture can influence not only interactions with external stakeholders of a TTO, but also internal relationships through the behavior of TT managers and employees. In the research presented here we observe differences in both management styles and communication styles (see the evidence in Table 5).

In Asian cultures we have observed a very strong influence of Confucian values, such as respect for age and hierarchy, avoidance of conflict and the need for harmony, including in Technology Transfer practices. The relationship between employees and the boss is full of respect and even admiration. Collectivism and risk aversion results in a context in which it is more difficult for TT officers to make their own decisions and to act in a creative way.

4.4. Benefits and risks of social capital in TT

Social capital provides both benefits for, and obstacles to, the successful technology transfer of academic innovations. We build on Sandefur and Laumann's (1998) approach that identifies the information, influence and solidarity benefits of social capital. They focused on the benefits provided by social capital to key actors. In this paper we adopt that framework in order to understand benefits of social capital for TT managers. However, we further bring in Adler and Kwon's (2002) idea to use the distinction of the three benefits to frame a discussion of benefits not just for the focal actors, but also for the broader aggregates of which they are a part. We particularly use it to understand the benefits for TT offices. We later use the same structure to discuss social capital risks.

Camps and Marques explored how social capital shapes innovation enablers (2014). We have observed that social capital supports such diverse technology transfer tasks as:

- finding potential licensees, investors and other partners
- new product development and market strategies
- new product targeting and positioning through access to wider networks via strong and weak ties
- information flow - knowledge sharing and resource sharing
- knowledge sharing and resource sharing
- building a stronger position for the TTO within the HEI structure

We observed all three of social capital's direct benefits being present in technology transfer activities in both culture types, namely: 1) information, 2) power, control and influence and 3) solidarity benefits.

Table 5
Cognitive social capital relevant to technology transfer in different cultures.

	Asian TTOs	American TTOs	Exemplary supporting evidence from Asia
Management style	Dominating authoritative and directive management styles. Hierarchy.	Dominating participative management style	"I must force people to make their own decisions, which is hard. It's terrifying for some people when I say - as the person who has to ultimately approve any deal that gets done - that you can go out and try to create and find and do any type of deal that you want." "You must tell people exactly what you need done. Singaporeans are going to give you exactly what you told them to do. Not one step less, not one step more. And it would be perfect. As precise as Swiss clocks." "There's going to be a greater degree of understanding and admiration and respect. Here it's essential."
Communication	Formal. Indirect.	Informal. Direct.	"The other thing about this, and this is rather regimented nature of the way things get done very formally here. The amount of follow up that gets done in most meetings, where a senior guy will come in with two or three people, there's somebody taking notes, they're doing action under following up. "So I think the quality of follow-up is better. Because there's resources to it. If you don't follow-up with the relationship and demonstrate that you can build that, if you don't bring somebody value relatively quickly…that is not good." "People would rather falsify reports, as oppose to bring forward and speak the truth to power. So, inside this bubble, nobody likes to speak the truth to power. Because it's also very polite, because that would seem to be insulting and very culturally insensitive."
Networking style	Food	Drinks	"There are probably a thousand entrepreneurship-related events a year here, which is a staggering amount of networking. One of the things that's different is that in the US and Canada you might have a cocktail reception – you might have reception with wine and beer, here's food. So you can do it in the morning, mingle till lunch, because if you put out food, people will come. If you don't have food – nobody will come. The better the food – the more people will come." "All the western experts go to the bar and wait and all the locals go to get food and talk to each other. So everybody is talking, talking: 'what's going on?', and they might be talking – how's the family, and then they might be talking – how's your son doing in military service, they might be talking about hopes and dreams, and aspirations of jobs…"

However, we argue that cultural dimensions influence the ways that technology transfer offices benefit from social capital.

Strong social norms and beliefs, associated with a high degree of closure of the social network, encourage solidarity, loyalty and compliance with local rules (Adler and Kwon, 2002). We further posit that in collectivist types of cultures TTOs benefit from higher commitment, loyalty (solidarity benefits) and lower control costs (control benefits). Dominant strong ties in these cultures also bring information benefit. According to Uzzi (1997) the stronger the ties the higher probability that the focal actor (TT manager), or the organization (TTO), will receive access to important and sensitive information or access to other resources including governmental funds. For example, as strong ties are a major source of trust, a TTO without strong ties with governmental bodies might have lower chances when seeking to access governmental resources supporting the commercialisation of academic innovation. Those with strong ties can use the associated advantage to the benefit of their careers and the success of their TTO.

We also observed that some TTO managers and their offices are more powerful than others because they have strong ties with important actors from the network. However in type II (e.g. Asian) cultures social capital has deep historical roots and is rather treated as "endowment" (Putnam, 2000). Thus the associated benefits can be difficult to obtain. In type I culture TT managers benefit more from dominant weak ties that give access to nonredundant information. Thus, one can argue that cultural issues shape the ways that TT officers benefit from social capital via different structures of relationships (structural social capital) and ways of building trust (relationship social capital).

We argue that culture also influences social capital as an inhibiting factor. E.g. Culture influences the economic importance of in-groups in TT. People who are excluded from the in-group may be seriously disadvantaged (e.g. concerning access to governmental money/hierarchy and awareness of expected norms and formalities). On the other hand, in more collectivistic cultures the TTO may be over-embedded within a network of strong ties risking that emerging opportunities are missed or are inaccessible. We notice that for TTOs in culture type II (Asia) dominant strong ties had information benefits, but they were also costlier to obtain and retain and could inhibit flow of information. In culture type I TTOs the dominant ties were weak. They were more effective than strong ties as they provided access to nonredundant information and were less costly to maintain.

Our work confirms Adler's and Kwon's findings (2002) that risks can be derived from three possible flows: 1) actors may over-invest in specific relationships, 2) the strong and localized ties of particular actors may result in negative effects, 3) solidarity benefits may inhibit the flow of information and resources, including financial resources. We contribute to the literature by emphasizing the role of national cultures in such processes.

5. Conclusions and next steps

This paper provides a presentation of findings from a wide-ranging qualitative interview-based research study of technology transfer processes in the USA and East Asia. The inter-related roles of relationships, social capital and national culture are considered.

The study observes cultural differences between TTO relationship practices in two extreme culture types: in Asia and America. Most of the TTOs encountered report that they mostly work within their cultural boundary and in such cases the research findings are clearest. The case of research internationalization generally involves the international dimension being handled by local businesses. In such cases typically the TTO interacts with the local business which in turn engages with the international partners. The TTO experience lies within the cultural boundary and the research findings apply. Cross-cultural technology transfer does of course occur and would represent an excellent, but somewhat separate domain for future investigation. This paper does not

concentrate on the cross-cultural dimension.

It is found that, as others have posited previously, both relationships and social capital are important to technology transfer. This paper adds insights concerning the specific role played by culture.

Cultures can influence both the creation and the utilization of social capital in university-industry links. We suggest that national culture plays very important role, not only in international and inter-cultural technology transfer, but also in domestic TT and commercialization. This paper tends to focus on the latter domestic consideration. Technology transfer managers should be aware of how national cultures shape TT practices, especially when seeking to draw upon observed experiences and advice emerging from territories with different cultural norms.

Through this research it has become clear that the notion of the research university is common across all the territories studied for this research. As such the differences are not arising from differences in *what a university is* or *what it is perceived to be*, rather the differences lie elsewhere. Also, in our study we have observed that the fundamental TT processes, and the agreed measures of TT effectiveness, are similar in both culture types. We suggest that an awareness of the role culture plays (including especially self-awareness) is very important for TT strategy and tactics. There is the real risk that process and metrics developed with reference to the Silicon Valley, and other US experiences, are being applied without significant adjustment to Asian contexts. As the balance of innovation shifts there is also the growing risk of misunderstanding in the reverse direction. The key culture-moderated differences lie not in the definition of success, nor in what technology transfer is perceived to be, but rather in the best path to that success. We suggest that the best path is highly culturally determined and the key aspects of cultural difference are most easily seen through the lens of social capital.

We have observed some cultural influences in the ways that practitioners build and manage relationships in TT. In both the USA and East Asia networking was perceived as a crucial step for finding potential partners, licensees or investors. However, in Asian cultures there was more focus on the building of trust and in long-term engagement to strengthen a bargaining position for potential future cooperation.

In Asian culture TTOs managers were rather focused on building bonding social capital, whereas in US, managers were rather focused on building bridging social capital. Thus, created structural capital was relationship oriented and in US – value oriented. Alguezaui and Filieri (2010) argue that as social capital consists of three dimensions we should also consider interrelations between them. They found that the structural dimension influences both the relational and cognitive social capital, however in this study we didn't analyze these interrelations.

We suggest it is also worth being aware of cultural dimensions/characteristics that might apply to the *way in which we do things around here*. We also noticed that cultures are increasingly mixing, not only between the US and East Asia but also bringing in the influence of other cultures and other issues. For structural simplicity this paper takes a bilateral view (USA-East Asia). It is hoped that subsequent research might be able to generalise better to the multilateral global realities.

This paper makes four major contributions. It: (1) uncovers the approaches that enable technology transfer officers to better create and utilize social capital in technology transfer practices within their cultural boundaries, advancing the understanding of cultural influences particularly on domestic relationships; 2) develops new insights as to how cultural dimensions influence structural, relational and cognitive dimensions of social capital created in relationships associated with university-industry links; 3) develops new insights into how cultural dimensions shape the way technology transfer officers benefit from social capital as well as encounter risks arising from social capital; 4) addresses a gap in the literature concerning technology transfer and university-industry links by looking at social capital in technology transfer from a cultural perspective. The work augments the previous literature on technology transfer and university-industry links. The work also contributes to studies of social capital in university–industry links. Specifically, it is argued that culture determines the way social capital is created and utilized in university-industry links.

It is clear however that technology transfer managers should recognize the role of national culture in the process of building and managing ties in university-industry links. In particular we have observed cultural influences on the structures of networks (structural social capital), the way trust is gained (relational social capital) and the extent to which shared mindsets are important to TT processes (cognitive social capital).

This paper has a deliberately limited scope. Clearly national culture is only one of many elements influencing technology transfer practices and technology transfer effectiveness. A more holistic assessment is needed to fully understand how technology transfer practices differ between the territories considered here. In terms of culture there is a need to get beyond regional generalizations and investigate further specific regional subcultures and organizational cultures. We noted that, for example, Yoon et al. (2015) analyze the role of social capital in entrepreneurial Regional Innovation Systems. They argue that there is a need to approach social capital from a 'micro' perspective by analyzing the network which incentivizes potential entrepreneurs within a region. They notice that emerging, still evolving Regional Innovation Systems focus more on structural and relational social capital. In our study we observe different approaches to creating and utilizing social capital within each 'national' culture. For example, in the USA we see that some TTOs are more transaction-oriented and some are more relationship-oriented which might be a result of organizational culture. We shall return to such issues further in future publications.

All the Asian examples studied are strongly influenced by Chinese culture however they are all, in different ways, historically and politically pro-western and to varying degrees multicultural. The next step would be to explore these differences around the diversity and interplay of Asian cultures (e.g. Chinese, Japanese, Korean and South East Asian). Is national culture associated with a HEI and TTO organizational culture, and therefore, might national culture influence the TT effectiveness through its connection with organizational culture?

Finally the Chinese concept of *guanxi* with its focus on long-term personal relationships is in some ways close to the western *relationship marketing* concept, which stresses long-term inter-organizational relationships. It would be valuable to understand better the linkages, and similarities between these concepts.

We close with the observation that national cultures matter when seeking to commercialise university originated innovations and that the social capital lens can reveal features of reality that might otherwise remain invisible. As other have already observed, social capital plays a key role in successful operation of all economies.

Notes

In this paper we refer to 'national culture', but this is not intended to be any form of comment on the statehood or sovereignty of any territory or region considered.

The quotes presented do not necessarily represent the opinions of the author – they are the opinion of the interviewee in question and these interviewee views are presented so as facilitate a scholarly understanding of the issues.

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