Shifting Wealth II in Chinese economy. The effect of the horizontal technology spillover for SMEs for international growth

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Abstract

The convergence of technology upgrading such as virtual reality, augmented reality, and digital and social networking platforms provides new directions and solutions for companies. The proposed research seeks to capitalise on and critically interrogate such convergence, how it works and the challenges connectivity brings for internal local life and external global markets of small to medium enterprises (SMEs). SMEs have been considered the most innovative oriented businesses in developed countries even in emerging markets acting as pioneer in the digital transformational word.

It has been widely recognised that local SMEs can get advantages from multinational enterprises spillover. However, studies on the horizontal technology spillover between SMEs are scarce. Yet, there is a need to explore the effect of horizontal technology spillover on SMEs for international growth. Therefore, the research offers quantitative metrics such as technology upgrading, knowledge spillover, and technology transfer to explore this effect in the Chinese market. Especially the empirical research is conducted on a sample of 80 SMEs in Beijing from technology – intensive industry. It critically interrogates how digital, social and transformational technologies impacts SMEs' competitiveness to produce points of digital convergence that connect, co-create and drive local to international growth via structural equation modelling.

Keywords

Small to medium-sized enterprises; Emerging countries; Beijing; Horizontal Technology Spillover; Knowledge Spillover; Technology Upgrading.

Introduction

Small and medium-sized enterprises (SMEs) constitute the engine of global economic growth, contributing the economy and employment of any country by generating new jobs, disruptive innovation and output growth. In emerging economies, where countries experience rapid economic growth with rising income and buying power, SMEs play a vital role in enhancing employment levels, and economic and social development (Senik et al., 2011; Bruton et al., 2008).
In an environment heavily influenced by the emergence and rapid change of new technologies which act both as a driving force and an enabling factor to globalisation, SMEs are forced to constantly seek strategies to successfully enter and remain in the global economy (Audretsch et al. 2012).
In particular for emerging economies which different from developed countries, do not enjoy a stable domestic institutional entrepreneurial environment (Volchek et al., 2014), coping with challenges such as shortened product life cycles and the underlying processes determined by current technological developments, and raising technology costs requires from SMEs an ability to innovate in effectively marketing response, meeting performance and producing goods that could meet international standards (Gomez and Simpson, 2007). In fact, emerging markets which can achieve significance if innovation themes evolve successfully (Weber and Schaper-Rinkel, 2017), can be heavily influenced by proactive and innovative SMEs (Kocak et al., 2017). That is, innovation and competitiveness are precondition for SMEs to effectively contribute to growth in emerging economies when dealing with dynamic conditions in the current business environment (Ale Ebrahim et al. 2010). However, despite the increasing important role of SMEs in emerging economies, research attention for SMEs and technology developments in relation to emerging markets is still limited (Chatzoglou and Chatzoudes, 2016; Mbuyisa and Leonard, 2017; Ongori and Migiro, 2010; Fisher & Pry, 1971).

SMEs are one of the sectors that have a strong potential to benefit from current developments in the information and communication technologies arena and to adapt new business. Such technology developments, from mobile technologies to social media to virtual, augmented and mixed reality, combined with the inexpensive access to information that they facilitate, offer a wide range of opportunities for SMEs to innovate (Miles et al., 2000; Redoli et al., 2008). Given the wide range of applications of those technologies in different fields by SMEs, the sector has been considered the most innovative oriented businesses in both developed countries (Brunswicker and Vanhaverbeke, 2015; Bougrain & Haudeville, 2002) and in emerging markets (Jingtao et al., 2017; Wu et al., 2016; Yi et al., 2013; Zhang and Tao, 2012), acting as pioneer in the digital transformational word.

In the current knowledge-based environment, the main driving forces for SMEs are digitisation, the internet and high-speed data networks that are keys to addressing many operational issues (Noori and Lee, 2006). These factors allow SMEs to collaborate or compete with suitable firms within a network in new product development (Chen et al., 2008). This situation evokes the technology spillover which occurs between firms operating in the same industry and most often located in the same territory. Indeed, cultural and geographical proximity play a significant role in this process. However there are also cases where SMEs developed effective and efficient horizontal technology spillovers with SMEs based in a different country (Sun and Fan, 2017).
In a nutshell, an effective technology spillover would be driven by the capability to absorb knowledge from the recipient firm. Notwithstanding studies on the technology spillover have widely showed the difference between a vertical and horizontal technology spillover (Marcin, 2008; Lin et al., 2009; Havranek & Irsova, 2011; Du et al., 2012) other studies on the horizontal technology spillover between multinational enterprises and SMEs (Kokko, 1994; Xu, 2000; Motohashi, & Yuan, 2010), none has argued the increasing growth, importance of this spillover between SMEs.
Therefore, there is a need to explore the effect of horizontal technology spillover on SMEs for international growth. Thus, the research offers quantitative metrics such as technology upgrading, knowledge spillover, and technology transfer to explore this aspect in Beijing, the capital of People's Republic of China where the digital evolution has changed the way to do business. With this in mind a sample of 80 SMEs from technology – intensive industry in Beijing was investigated to critically interrogates how digital, social and transformational technologies impacts SMEs' competitiveness to produce points of digital convergence that connect, co-create and drive local to international growth.

Via Structural Equation Modelling, the paper is measure if actually the horizontal spillover technology is positively impacting local SMEs' international growth driven by technology upgrading, knowledge spillover, and technology transfer. A multilinear factor relationship model is offered. Enhancing the dilemma of SMEs' international growth by technology spillover, the study offers the aforementioned metrics to evaluate this phenomenon and build new national and international collaborations.

Literature Review and development of hypotheses

SMEs and international growth

Entrepreneurs and their decisions are influenced by the information they receive from the external environment. Volchek et al. (2014) argue that such information and the knowledge within the SMEs shapes entrepreneurial schemas, which lead to strategic decisions to pursue a certain firm-level action such as innovation- or internationalisation-based growth (Kiss et al., 2012; Hekkert et al., 2007). SMEs operating in an unfavourable home-country institutional environment such as those of emerging economies could be especially prone to venturing abroad to look for better conditions for doing business (Boisot and Meyer, 2008). As noted by Volchek et al. (2014), internationalisation -or international growth, as a strategy of a firm has its theoretical underpinnings in the growth theories of the firm developed by Penrose (1959) and Ansoff (1965). Penrose (1959) emphasised that unused knowledge and other resources in the firm create the potential to achieve economies-of-scope, in contrast with economies-of-scale, by means of diversification. Ansoff (1957), in turn, suggested that diversification is highly affected by the external aspects of the business environment, such as long-term economic and political trends, and various types of contingencies, such as technological breakthroughs, economic recession, industry competition, changes of political regime and institutional framework, most of which resonate with the dynamics of the global business context and the characteristics of emerging economies.

Although SMEs' internationalisation theory still lacks the research related to growth theory, the literature shows that a combination of the firm's excess resources and capabilities and favourable external environment conditions makes diversification a desirable growth strategy, which in turn, under the contemporary conditions of economic globalisation, relates new product development to foreign market expansion (Volchek et al., 2014). Despite the current active interest in international entrepreneurship and an associated interest in the entrepreneurial activities in emerging economies, contemporary research has not yet grasped a clear understanding of how small- and medium-sized enterprises (SMEs) from emerging economies grow internationally.
Given the growing impact of the SMEs on the global economy, there is a vital need to understand the dilemma of SMEs' international growth by technology spillover and how this phenomenon may be evaluated. This is likely to lead to the formulation of new theoretical propositions to be applied in contemporary research in international business and entrepreneurship in the context of emerging economies.

Technology spillover in emerging economies

In the digital era, enterprises tend to internationalise to exploit new markets and increase their revenue streams by collaborating with local enterprise (Del Giudice et al., 2016). SMEs share their knowledge and technology which often occurs involuntarily. This process is called technology spillover, and it happens when the activities of one firm lead to improvements in the technology or productivity of another firm such that the first firm cannot capture all the quasi-rents created by its productive activities (Eden et al., 1997).
One aspect that defines the nature of technology spillovers is the role of tacit knowledge in the collaboration between enterprises. Tacit resources often reside in the shared norms or routines of employees (Nelson and Winter, 1982) and their ability to reconfigure those routines to produce new knowledge (Kogut and Zander, 1992). Furthermore, the development of tacit knowledge in the

context of internationalisation of operations is viewed as a function of the evolutionary development of the enterprise as it travels through economic space (Nelson and Winter, 1982; Kogut and Zander, 1995; Teece, 1988).

SMEs have a generally limited availability of resources such as human or financial capital, which makes them more likely to have the need to combine resources and efforts with other firms to remain competitive (Teece, 1992). Those combination efforts take the form of equity ventures, non-equity's, terms of licensing arrangements and other types of alliances (Gomes-Casseres,1995). Although better resourced than SMEs, multinational enterprises (MNEs) are under higher pressure to increase technology knowledge and innovate in order to enlarge their international market share in the current competitive global environment (Feng, 2007). Thus, the advanced technological know-how of MNEs would spill over to other countries during processes such as foreign direct investment (FDI).

Horizontal technology spillover effect

Wang (2008) describes the process whereby transnational corporations promote technological developments into the domestic firms in the same industry of other economies as the *horizontal* technology spillover effect. Several authors ~~(e.g. Eden et al.,1997; Hongyu et al., 2011)~~ have studied the ways that technology can spill over horizontally from internationalising MNEs (e.g. Eden et al.,1997; Hongyu et al., 2011) and from international SMEs (e.g. Wright et al., 2007; Hottenrott and Lopes-Bento, 2014) to host country firms including SMEs. These have been grouped into the following categories: (i) the *demonstration-imitation effect* (Blomström and Kokko, 1998; Wu et al., 2009), whereby local firms attempt to copy ~~multinational enterprise~~ product or process technologies from the international enterprises which~~. MNEs~~ often set up a new section of the business in the new country, ~~which~~ serv~~inges~~ as a good example for local companies. While the domestic companies that struggle to maintain the market share would observe and learn the advanced technology, efficient managerial skill, operating model and marketing skills from the foreign funded companies (Bin et al., 2009). Therefore, the technological level and competitiveness of local companies are improved during this demonstration and imitation process (Hartungi, 2006); (ii) *internalisation of research and development/learning-by-doing/information effect* (Young, 1991; Young and LAN, 1997) by the local firms as a result of the backward and forward linkages between the ~~multinational~~ international enterprise and its suppliers and buyers. As ~~MNEs~~ international enterprises transfer their R&D departments from their home countries to the host countries as a result of economic globalisation, more local knowledge is created, particularly in relation to the core technology; (iii) *human capital flows spillover* or *training of local employees* (Blomström and Kokko, 2001; Jiang et al., 2001) by ~~multinational~~ international enterprises, providing a more highly skilled labour pool for local firms. In an attempt to reduce the operating costs and better understand the local culture in the host country, the international ~~MNEs~~ enterprise usually employ a ~~large~~ number of local employees (Yu and Zhang, 2006). The ~~MNE~~ international enterprise then provides different types of professional training initiatives to their employees to improve their working capabilities. As the skilled workers and senior managers who are trained by foreign companies move on to work for local companies, their competitiveness is enhanced (Chen and Chen, 2009); and (iv) the *competition effect* (Kokko, 1992; Wang and Shi, 2007), whereby entry of an international enterprise ~~MNE~~ into the local market generates more competition within an industry so local firms -often at disadvantage, are forced to use existing technology more efficiently or to upgrade their technology in order to remain competitive. Thereby, under this competitive pressure, the domestic firms are forced to accelerate the speed of technology innovation and increase productivity to maintain their market share (Chen and Chen, 2009).

Vertical technology spillover effect

Markusen and Venable (1999) describe the vertical technology spillover effect as the result of foreign MNEs promoting the technological capability of other, related industries in the host country. This effect is derived from the technology and information advantage of foreign companies over local firms, so the advanced technology will inevitably spill from the oversea subsidiaries to the related upstream and downstream industries in the host country, which is described by Jiangang and Deqing (2016) as a 'free-rider' effect for the local firms.

As MNEs need the raw materials, semi-productions and components produced by the local companies -often SMEs, there is a backward linkage relationship between the subsidiaries of MNEs and their supply chain in the upstream industries of the host country (Li et al., 2005). Often, in order to satisfy the quality requirements of the MNEs local companies would strive to improve their technical level. With that purpose, the foreign companies may also seek to provide training programs to the local suppliers. In the process, technology would spill to local companies.
In addition to the development of upstream industries in the host country to respond to the demands brought to MNEs to local suppliers, local companies in the downstream industries would benefit from providing many services for the products made by the subsidiaries of MNEs, such as packaging, sales and maintenance, as in the case of the automobile industry (Motohashi and Yuan, 2009).
Finally, the extent to which technology spill overs from foreign-funded MNEs to domestic SMEs in emerging economies is determined by factors such as the strength of the relation between the MNEs and local upstream and downstream industries, the technology gap between foreign and local firms, and the absorptive capacity of the local firms in relation to the advanced technology.

Technology spillover effect between SMEs

As SMEs in less developed economies try to reduce the gap between their knowledge base and technology and that of developed countries, technology spillover takes a new dimension consisting of the transfer of technological know-how between local SMEs. This new process is favoured by the notion of innovation interactions and the current regional clustering of industries and concepts such as regional network and industrial districts (Markusen, 2003). Zeng et al. (2010) have studied the context of the People's Republic of China and found that the development of regional cluster, much innovation cooperation for SMEs is produced in regional networks and industrial districts, as many SMEs are clustering in Science Parks and Economic Development Zones which can provide them an interactive network leading to cooperation and sharing of the knowledge derived in some cases from interactions with MNEs but also from their own innovation efforts. More recently, Lasagni (2012) found that innovation performance is higher in SMEs that are proactive in strengthening their relationships with other SMEs as innovative suppliers, and with their users and customers.
Lechner and Dowling (2003) argued that external relationships between local firms are founded to serve diverse objectives and that each firm has a unique relational mix that changes along the development path of the firm. Rammer et al. (2009) has gone further to describe the ability of an SME to efficiently use external knowledge as a source of innovation and integrate this into their internal innovation processes has been recognised as "network competence". Authors such as Freel 2000; Nieto and Santamaria 2007; Rogers 2004. Have argued that SMEs can gain by "opening" their innovation strategies and investing in external network development, with research on the Korean context supporting the potential of open innovation for SMEs and suggesting that various networking models can facilitate SME's innovation (Lee et al. (2010).
The analysis suggests that the technology spillover effect -and in particular horizontal spillover, can be measured as a combination of the following key elements:

- International R&D collaborations
- International SMEs collaborations
- National SMEs collaborations

~~Therefore~~On these basis~~,~~ we ~~stated~~ hypothesise that:

H1. The horizontal technology spillover between SMEs enhances their international growth ~~leaded~~ led by knowledge spillover

SMEs and knowledge spillover

The occurrence of a horizontal technology spillover evokes knowledge spillover, which is described as the process whereby recipient firms exploit knowledge that was originally developed by another firm. As stated by Audretsch and Belitski (2013), the knowledge spillover theory of entrepreneurship (KSTE) was developed as a response to the missing points in the knowledge production function and new growth theory (Audretsch and Lehmann 2005; Acs and Armington 2006; Audretsch et al. 2006; Acs et al. 2009). On the basis that new knowledge and ideas are a source of entrepreneurial opportunities for individuals and organisations, a direct relationship has been established between entrepreneurship and the returns of knowledge (Michelacci, 2002; Audretsch and Lehmann, 2005) and between entrepreneurship and growth (Fritsch 2008). Furthermore, scholars have found a positive impact of knowledge spillover on economic performance when accounting for the role of R&D activity (Audretsch and Belitski, 2013; Michelacci, 2002; Braunerhjelm et al. 2010). As it will be discussed in other sections, globalisation of R&D has led to the establishment of new overseas R&D institutions, technology outsourcing, and building the strategic technology alliances with local firms.

Based on the work of scholars who have studied KSTE (Audretsch and Lehmann, 2005; Audretsch and Keilbach, 2007; Agarwal et al., 2007; Florida, 2004; Lee et al., 2004; and Boschma and Fritsch 2009), Audretsch and Belitski (2013) argue that while KSTE implies that new knowledge leads to entrepreneurship and entrepreneur's decisions that spill over, new progress in knowledge and creativity research, it is both human capital and creativity embodied in well-educated or skilled people as well as an environment rich in creativity and diversity that triggers entrepreneurial opportunities at both the regional and country levels. Other factors such as the clustering of innovative foreign firms in an emerging economy have been found to be relevant for local firms to benefit from knowledge spillover and become more likely to introduce product innovations (Chen et al., 2008). All of these favours the theory that SMEs in emerging markets may benefit from knowledge spillover.

With this in mind, a critical factor becomes the capacity of an enterprise to absorb knowledge. Yet, Qin and Acs's (2013) absorptive capacity theory of knowledge spillover entrepreneurship argues that the level of knowledge spillover entrepreneurship depends not only on the speed of knowledge creation, or the level of new knowledge, but also on entrepreneurial absorptive capacity. Their theory is based on the seminal work of Cohen and Levinthal (1990), who define absorptive capacity as 'an ability to recognise the value of new information, assimilate it, and apply it to commercial ends' (p. 128). Zahra and George (2002) identified four dimensions of absorptive capacity: acquisition, assimilation, transformation and exploitation of external knowledge. Their work depicts an innovation process in which a firm develops its own new products relying on external knowledge it absorbs.

Three key elements emerge from the analysis of knowledge spillover:

- Absorptive Capacity
- Knowledge Transfer
- R&D Spillover

However, the source of new knowledge and creation of entrepreneurial opportunities that drive growth remains ambiguous. Audretsch and Belitski (2013) have found that while scholars such as Armington and Acs (2002), Acs and Armington (2006) and Audretsch et al. (2006) point to human capital as the driver for the exchange of ideas and knowledge creation, other authors suggest that skills, inspiration, talent or creativity embodied in people are the main issues promoting knowledge creation and transfer (Lucas 2009), source of new entrepreneurial opportunities and regional growth (Florida 2002, 2004; Fritsch 2008; Piergiovanni et al. 2012). The extant literature therefore shows that further research in this area is required.

Therefore, -we declare that:

H2. An effective horizontal technology spillover is driven by absorptive capability of the receiving SME.

Technology upgrading in emerging markets

Previous sections highlight the importance of knowledge and technology, and the challenges SMEs face in benefitting from new technologies to develop innovative products and services. The ability to both innovate and acquire and exploit new technology is costly, risky and path-dependent, and therefore less developed countries such as emerging economies may have a rationale to rely on foreign technology acquisition to achieve these. In fact, foreign sources of technology account for a large part of productivity growth in most countries (Fu et al., 2011; An & Ahn, 2016).

Fu and Gong (2011) explored the sources and drivers of technology upgrading in China's recent wave of science and technology development. They examined the change drivers by decomposing total factor productivity growth into technical change and efficiency improvement. Their results suggest that factors such as foreign direct investment (FDI) have served as a vehicle transferring advanced foreign technology from global reservoirs of knowledge to less developed economies. This improves static technological capabilities through imported machines and equipment (Fu et al., 2011).

Other potentially enabling factors for developing economies to acquire advanced technology and enhance competitiveness include imports of foreign technology (Coe and Helpman, 1995; Fagerberg, 1994; Freeman and Soete, 1997); in-house R&D and purchasing of domestic technology (Li, 2011); internationalisation of R&D activities by multinational enterprises (Fu and Gong, 2011); skilled human resources' mobility (Pogue, 2007); and international knowledge and innovation exchange and collaboration, through for example inter and intra-enterprise networks and global value chain (Pietrobelli and Rabellotti, 2010, Scuotto et al., 2017a; 2017b).

On these basis, technology upgrading can be defined by a combination of the following:

- Foreign Technology Used
- Catching-Up Activities
- Skilled Human Resources' Mobility

Hence, we deem that:

H3. Technology upgrading enhances an effective horizontal technology spillover by inter and intrae-enterprise networks

Technology transfer in emerging markets

Growth and success in the global economy requires a technology transition in countries across the development spectrum. This is particularly valid for emerging economies as they have quickly established significant capabilities and a dramatic growth of production capacity in several key areas of economic development.

Technology can be diffused between firms and across regions and countries through various transmission mechanisms, which are classified by Fu (2015) as: (i) licensing; (ii) movement of goods through international trade; (iii) movement of capital through inward and outward foreign direct investment (FDI and OFDI); (iv) movement of people through migration, travel, and foreign education of students and workers; (v) international research collaboration; (vi) diffusion through media and internet of disembodied knowledge; (vii) integration into global value chains to benefit from the foreign technology transferred within the supply chain (Fu, et al., 2008).

Ockwell et al. (2009) argued that the diffusion and adoption of technology is costly, requires certain pre-conditions and is sometimes difficult, given reasons including its complexity (Teece, 1986).

Technology producers have an interest in the transfer of equipment through trade, but they may be reluctant or unwilling to share the underlying capabilities because these capabilities are core competences that are central to their own competitiveness, and this adds to the indigenous challenges of technology transfer (Fu, 2015). Moreover, there is also an implicit uncertainty with regard to whether technologies designed and created in developed countries are appropriate for the context of developing countries, as technological change is a 'localised learning by doing' process (Atkinson and Stiglitz, 1969).

Three types of technologies have been examined by Buckley (1995) as the most likely to be transferred by SMEs. These include small-scale technologies, labour-intensive technologies, and specialised high-technology know-how. Eden et al. (1997) noted that that small-scale technologies

and labour-intensive technologies are likely to be internalised through parent-to-affiliate transfers, whereas alliances may allow SMEs to take advantage of high-technology know-how. Alliances, enables SMEs to reduce the cost of know-how exploitation by allowing partners to perform non-core, yet capital intensive, functions such as marketing, distribution, and production (Buckley, 1997; Gomes-Casseres, 1995).

Technology spillovers to SMEs often benefit from reduced bureaucratic costs and lower costs of transmitting the knowledge within the enterprise, and are in a position to benefit significant from technology consumption due to limited resources, thus attenuating the effects of internal knowledge deficiencies due to limitations in size of resources. However, SMEs face higher transaction costs than multinational enterprises when it comes to technology adoption, as SMEs have fewer resources (e.g. human and financial capital) to devote to knowledge search, negotiation, monitoring and enforcement efforts and therefore success is largely dependent on university; they are often more subject to opportunistic behaviour on the part of suppliers and buyers; may be less likely to have a tight appropriability regime protecting their knowledge-based firm-specific advantage (Eden et al., 1997)

The above challenges of technology transfer point to the importance of knowledge exploitation and indigenous innovation efforts for technology upgrading in emerging economies. Fu (2015) concludes that in recent years making good use of external resources such as technology knowledge has become more important for innovation in emerging economies. The flow and exploitation of international technological knowledge exploitation and diffusion can therefore benefit an emerging economy and its SMEs at every stage of the innovation process.

Technology transfer between SMEs can then be defined by a combination of the following factors:

- Transaction costs
- Knowledge flow
- Knowledge exploitation

We therefore propose the following hypothesis:

H4: Spurred by knowledge spillover, technlogy transfer enhances a successful horizontal technology spillover.

Methodology

Research Context

Based on the above literature review, the present study offers an empirical research on a sample of 80 small to medium enterprises (SMEs) from a technology-intensive industry operating in Beijing. This city, the capital of the People's Republic of China, has widely adopted new technologies in the last five years to catch up with advanced markets (Thornhill, 2017). Beijing is a fast moving city where SMEs are extensively contributing to economic growth, generating jobs and prosperity (Wang et al., 2015; Wang and Gu, 2005; Hussain et al., 2006). However, to overcome challenges and guarantee the sustainability of such contributions, Chinese SMEs tend to create strategic alliances with external stakeholders, transferring technology and knowledge into the local economy (Wang and Scuotto, 2012). These forms of collaborations support SMEs in generating innovation and developing new products and services, which raises the importance of risk mitigation strategies (Clay, Strauss 2002), market success (Spicer, Pyle 2002) and legitimisation of new industry entrants (Rao 2002). Yet, SMEs are considered the most innovative oriented businesses in emerging markets (Jingtao et al., 2017; Wu et al., 2016; Yi et al., 2013; Zhang and Tao, 2012) and are also ready to make external collaborations to compensate the lack of resources such as human skilled resources, capital, technology, etc. (Matlay et al, 2006; Ruzzier et al., 2007; Huxham and Vangen, 2013; Brunswicker & van de Vrande, 2014). The management literature points out that SMEs can get advantages from a technology spillover with multinational enterprises (Markusen, 2002; Fu et al., 2011) but there is still a lack of knowledge if such spillover can be made between SMEs and provide benefits. Therefore this study critically interrogates if the horizontal technology spillover enhances international.

Sample and Data Collection

As of 2015, there were approximately 252,000 SMEs in Beijing, representing the 82.92% of all companies in the city (Wang et al., 2015). From this wide number, 300 SMEs were selected as belonging to the technology – intensive industry, adopter of new technologies, and developer of horizontal technology spillover between SMEs. We were successful in collecting data from 80 of those SMEs in a process described as follows.

A first contact was made by email by two professional bilingual researchers who invited owners and managers to answer an online questionnaire. The online questionnaire was composed of 20 closed – ended questions, structured in line with Bryman's (1988) study. Yet, ancillary questions were posed first, followed by more specific questions. This structure allows to obtain the general information about the participant and then to interrogate the phenomenon of the horizontal technology spillover deeply.

Between July and December 2015, we received a response from individuals from 80 SMEs, who could be classified as owners (63 of them) and managers (37 of them), with some of them having a dual responsibility as owners and managers for their firms. In order to to measure the reliability of the questionnaire, 5 owners and 5 managers of SMEs in Beijing were interviewed on completion survey.

On conclusion of the data collection, the authors measured the data by applying a quantitative methodology id est structure equation modelling (SEM) using IBM® SPSS® Amos 20.0.

Measures

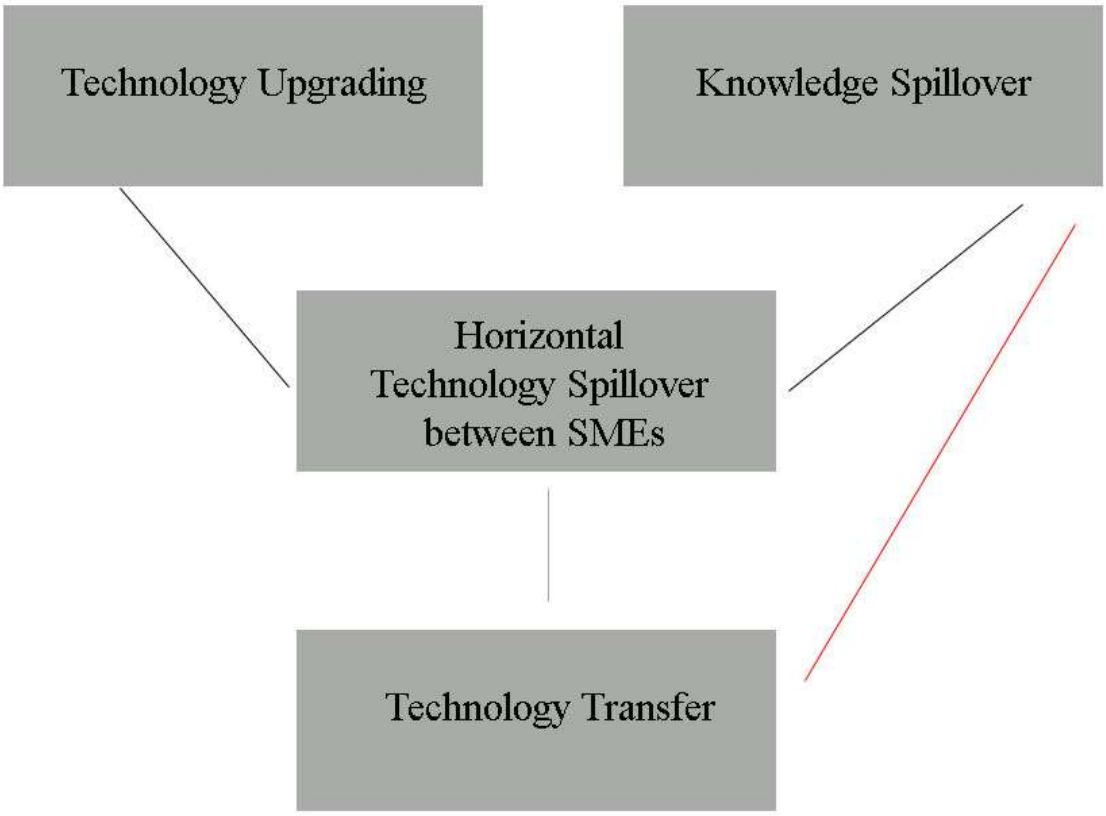
The empirical research tested the relationships of three measures such as technology upgrading, knowledge spillover, and technology transfer in relation to the horizontal technology spillover between SMEs (table 1; figure 1)

Table 1. Measures and Items

Measures	Items	References
Horizontal Technology Spillover between SMEs	• International R&D collaborations • International SMEs collaborations • National SMEs collaborations	Eden et al.,1997; Hongyu et al., 2011
Knowledge Spillover	• Absorptive Capacity • Knowledge Transfer • R&D Spillover	Audretsch and Lehmann, 2005; Audretsch and Keilbach, 2007; Agarwal et al., 2007; Florida, 2004; Lee et al., 2004; and Boschma and Fritsch 2009; Audretsch and Belitski, 2013
Technology Upgrading	• Foreign Technology Used • Catching-Up Activities • Skilled Human Resources' Mobility	Coe and Helpman, 1995; Fagerberg, 1994; Freeman and Soete, 1997; Li, 201; Fu and Gong, 2011;Pogue, 2007; Pietrobelli and Rabellotti, 2010, Scuotto et al., 2017a; 2017b, 2017c.
Technology Transfer	• Transaction costs	Fu, et al., 2008;

	• Knowledge flow • Knowledge exploitation	Ockwell et al., 2009; Fu, 2015

Research Design Model



As stated before the online questionnaire was structured in line with Bryman's study (1988) which introduced the funneling technique and based on seven - point scales (Likert, 1932).Participants provided information about gender, age, job position, number of employees, annual turnover etc. And then their opinion on the horizontal technology spillover, including its drivers such as technology upgrading, technology transfer, and knowledge spillover.
The online questionnaire was made in Chinese and translated into english by professional bilingual researchers (Brislin, 1970).

Analysis of results

From the online questionnaire emerged that participants were more male (98%) than female (2%) with age from 28-35, with more than 10 employees and with an annual turnover not exceeding 50 million euro. This results reflects the Chinese tradition where male are more dedicated to provide economic resources; whereas women are responsible for the family. Again, the young age of owners even managers represents the 'golden age' of budding entrepreneurs in china (CNBC, 2015). Owners and managers confirmed the relevance of the horizontal technology spillover to introduce their business into a new market. Yet, they are very keen to develop an internationalization strategy and compete with different markets. The 75% of the participants strongly agreed that technology and knowledge are the main resources shared with other SMEs. They also firmly agreed that the collaborations with peers enhance their capacity to collaborate with other companies and easily adjust their organizational environment to the partner because they have frequently the same structure and needs. However they also stated that these collaborations can be challengeable due to different organizational culture.

Data Analysis via SEM

To measure the data collected from the online questionnaire and confirm the hypotheses, SEM was adopted because it enables to estimate data from a large sample (Sánchez, et al., 2009); to develop an empirical research (Hair et al., 2011); and to validate theory (Hooper et al., 2008). This method is divided in two models: 1. Measurement model and 2. Structural model which respectively the first one is used to evaluate the internal relationships of the model and the second one for the external relationships. Especially, the measurement of internal relationships stands for the analysis of correlations between a latent variable and its manifest ones, whereas the measurement of external relationships means the analysis of correlations between latent variables (Chin & Newsted, 1999).

Therefore, the internal correlations was measured by Cronbach's alpha, showing significant correlations – with the value over 0.76.
In this model, manifest and observed variables were selected from the literature review (see table 1), and they resulted to be significantly associated with their latent variables as showed in the table 2.

Table 2: Internal consistence coefficients and correlations between measures and items

		Cronbach's Alpha	*(1)*	*(2)*	*(3)*	*(4)*
(1)	Technology upgrading	0.76	1			
(2)	Knowledge spillover	0.82	0.542**	1		
(3)	Technology Transfer	0.79	0.621**	0.755**	1	
(4)	Horizontal technology spillover between SMEs	0.81	0.710**	0.745**	0.822**	1

** Significant at 0.01.

Table 3. Reliability

Reliability test		
Cronbach's Alpha	Cronbach's Alpha (Standardized Items)	Items

.79	.78	80

Assessment and Structural Model

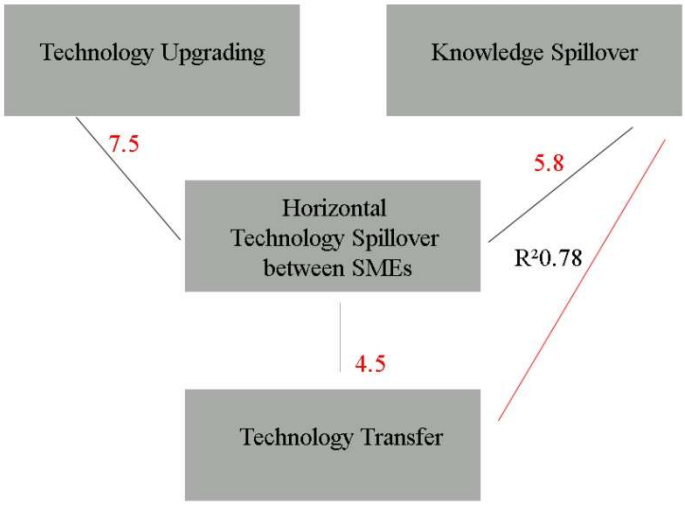
According to Chin and Newsted (1999), external relationships were tested calculating the R-squared of endogenous latent variables which were horizontal technology spillover between SMEs and technology transfer. Both variables resulted to be significant with a value over 0.70 (see table 4).

Table 4. R^2

	Technology Transfer	**HorizTechSpillover**
R^2	.75	.78

Finally the relationship between the latent variables was measured by path analysis and bootstrap (Anderson & Gerbing, 1988).
H1, The horizontal technology spillover between SMEs enhances their international growth by leaded knowledge spillover is confirmed. Yet, the result shows a positive relationship between knowledge spillover and horizontal technology spillover between SMEs ($T=5.8$, $p<0.001$). H2. An effective horizontal technology spillover is driven by absorptive capability of the receiving SME is also confirmed. In fact the relationship between absorptive capacity and horizontal technology spillover is confirmed by the measurement model (0.7). H2 is thus supported. H3. A successful horizontal technology spillover is driven by Ttechnology upgrading enhances an effective horizontal technology spillover by inter and intre-enterprise networks is supported by a significant relationship emerged from the path analysis ($T= 7.5$ $p<0.001$). Finally H4, Spurred by knowledge spillover, technlogy transfer enhances asuccessful horizontal technology spillover is confirmed. Yet, the path analysis shows that there is significant relationship between technology transfer and horizontal technology spillover ($T= 4.5$ $p<0.001$) as well as between knowledge spillover and technology transfer which was measured by R^2 (0.78).
A summary of the above results will be displayed below (figure 2).

Figure 2. Path Analysis



Discussion and Conclusion

This Chinese market is considered one of the most digitally advanced economies due to their continued relationship building with external partners (Thornhill, 2017). The focus of this research has been the relationships generated between local and foreign SMEs operating in Beijing.
The empirical research based on the analysis of data collected from 80 of such SMEs supported the research scope to critically interrogate how digital, social and transformational technologies impacts SMEs' international growth. Based on the positive relationship identified between those factors and the need to explore the effect of horizontal technology spillover on SMEs for international growth, the main contribution of this research consists of proposing three quantitative metrics, namely technology upgrading, technology transfer, and knowledge spillover, considered as the main drivers of horizontal knowledge spillover in the Chinese market.

The extant literature describes horizontal technology spillover as the process whereby the technological improvement of one firm can bring advantages to another firm, usually characterised by cultural and geographic proximity (Eden et al., 1997; Sun and Fan, 2017). The main advantage derived from the knowledge spillover involves an informal, nonmarket transfer of knowledge that often occur involuntarily (Nelson and Winter, 1982; Kogut and Zander, 1995; Teece, 1988). This process tends to fill up the lack of SMEs' resources such as knowledge, technology, skilled human resources, etc. (Buckley, 1997; Gomes-Casseres, 1995). Costs of know-how exploitation and international growth would, thus, be reduced although SMEs face higher transaction costs than multinational enterprises when it comes to technology adoption (Eden et al., 1997; Scuotto et al., 2017c).
Despite that SMEs are considered the engine of the economic growth either in advanced market or emerging one. Yet, in Beijing SMEs account for approximately 82.92% of all companies (CBNC, 2015). SMEs has a relevant role in the economy, increasing employability and economic and social

growth (Senik et al., 2011; Bruton et al., 2008). SMEs are prone to innovate and absorb knowledge to meet international standards (Gomez and Simpson, 2007; Ale Ebrahim et al. 2010; Kocak et al., 2017; Weber and Schaper-Rinkel, 2017).

With this in mind, this research described how technology upgrading becomes a driver of the horizontal technology spillover. This evokes the convergence of new advanced technologies such as virtual reality, augmented reality, mobile technologies, and social media networking, among others (Miles et al., 2000; Redoli et al., 2008). The technology upgrading process provokes the mobility of skilled human resources which results in the creation of new technological knowledge making research and business more competitive (Ale Ebrahim et al., 2010) in a context heavily influenced by digitisation, connectivity and high-speed data networks that are key to addressing many operational issues (Noori and Lee, 2006).

This research was successful in describing how technology transfer to and between SMEs supports the rapid technological changes of both emerging and advanced markets (Audretsch et al. 2012), thus becoming a key driver of economic growth. As Ockwell et al. (2009) pointed out the diffusion and adoption of technology is costly, requires certain pre-conditions. Yet, we found that technology transfer works better if it is linked with knowledge spillover. This relationship may be considered a solution the uncertainty of the adaptability of new technologies to developing countries, as technological change is a 'localised learning by doing' process (Atkinson and Stiglitz, 1969). In fact, a knowledge spillover occurs when there is a knowledge exploitation process as the same for the technology transfer (Audretsch and Belitski, 2013). As stated by Philips and Linstone (2016, p.162), "these characteristics allow regions with diverse environments but common interests in, say, a technology, to share assessments with one another, helping each to learn what works in what circumstances".

In line with Kiss et al. (2012) our research shows that these three drivers can lead firm-level action such as innovation- or internationalisation-based growth.

Although we have been able to confirm the relevance of knowledge in the process of horizontal technology spillover and how it can be shared to benefit SMEs at every stage of the innovation process, our research has a number of limitations. There is still the need to refine our findings by comparing, for example, the Chinese market with other emerging markets or to examine the difference between an advanced and emerging country. This would support the understanding of the generalisability of our findings. There is also a space for a qualitative research which can deeply explore the micro-action level of entrepreneurs in implementing a technology spillover. This topic is very avant-garde in the era of the continue, dynamic technological and social change.

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