# MNE R&D internationalization in developing Asia

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**Abstract**: In line with the recent shift of R&D internationalization towards developing Asia, this Perspective paper reviews, contextualises, and evaluates the evolving patterns of creation, transfer, and assimilation of knowledge in multinational enterprises (MNEs). A typology is proposed consisting of four stylized nodes: *West* (industrialized mature economies), *East One* (emerging industrializing economies of developing Asia), *East Two* (Asian economies at an earlier stage of industrialization), and *East Three* (Asian economies with limited visible signs of industrialization). Within these nodes, this paper applies an institution-based view to discuss their diverse national innovation environment (with particular attention paid to governments, indigenous firms, and institutional conditions), and the network perspective to propose an intra-regional knowledge hierarchy, reflecting dynamic knowledge links.

***Keywords*** R&D internationalization, Asia, knowledge hierarchy, network perspective, institution-based view.

Since the beginning of the 21st century, we have witnessed a gradual shift of global innovation locus to developing countries (Jha, Dhanaraj & Krishnan, 2018; Zhao, Tan, Papanastassiou & Harzing, 2019). This is in contrast to the earlier documentation of multinational enterprises (MNE) activities in developing countries, which dates back to the mid-20th century, where they were merely locations for low-cost manufacturing (Lall & Narula, 2004; Vernon, 1966). This production paradigm was driven by advanced innovation capabilities in developed countries and weak national institutions including absence of effective innovation systems, government policies, and innovativeness of the private sector (Archibugi & Iammarino, 2002; Lall, 2000) in the developing countries.

Recent evidence suggests the global research and development (R&D) shift is particularly significant in developing Asian countries. A survey by PriceWaterhouseCoopers (2015) identified Asia as the most attractive region for corporate R&D expenditure, ahead of North America and Europe. The fast-growing R&D spending by both governments and companies in Asia became far more promising than the rather stagnant R&D growth in North American and Europe (European Commission, 2018). For instance, AstraZeneca, a leading pharmaceutical MNE based in Sweden, established a strategic R&D center in China in 2015 (Zhao et al., 2019), whilst Germany-based specialty chemicals company Evonik recently opened its first research hub for resource efficiency topics in Singapore (Evonik, 2018). Some historical comparison of patent applications across global regions further marks this unprecedented development with Asia being responsible for over 60% of patents applications in 2016 compared to 20% coming from North America (WIPO, 2017). It is important to stress here that not only Western firms have contributed to this spectacular growth of R&D investments, but Asian firms (such as Tencent and Hindustan) are also ranked amongst the top innovative Asian firms (Forbes, 2018; Huang & Li, 2019; Kumaraswamy, Mudambi, Saranga & Tripathy, 2012). Published research investigating this phenomenon includes an *Asia Pacific*

*Journal of Management* (*APJM*) special issue titled "Knowledge Management and Innovation Strategy in the Asia Pacific" (Lu, Tsang & Peng, 2008); another *APJM* special issue titled "Innovation and Entrepreneurship in India" (Jain, Nair, & Ahlstrom, 2015); and papers by Altenburg, Schmitz and Stamm (2008), Asakawa and Som (2008), Awate, Larsen and Mudambi (2015), Chadee, Sharma and Roxas (2017), Hung and Tseng (2017), Jha et al. (2018), Lema, Quadros and Schmitz (2015), Nair, Guldiken, Fainshmidt and Pezeshkan (2015), Yang, Liu, Gao and Li (2012), and Zhao et al. (2019).

Although interest in R&D internationalization in developing Asia has grown, we remain less informed about the distinct characteristics and opportunities within the region. The past literature tells us why and how firms act is not isolated from their environment (Khoury & Peng, 2011; Lu et al., 2008; Peng, 2002; Peng, Ahlstrom, Carraher & Shi, 2017; Peng, Wang & Jiang, 2008). To this postulation, we follow the conceptual footstep of Asakawa and Som (2008) to argue that whilst the conventional wisdom views MNE R&D, with respect to Asia, as an "universal function and therefore is least affected by the regional specificity of Asia" (p.376), MNE R&D experience in developing Asia is clearly heterogenous, away from what the conventional wisdom may suggest (Wright, Filatotchev, Hoskisson & Peng, 2005). Hence, we believe that to better understand the know-how and know-why of growing corporate R&D in Asia, it is conceptually useful to examine the context-specific characteristics of the region. In this light, our Perspective paper will attempt to answer the following main question: How have Western MNEs (including those from Japan) participated in, and benefitted from, the emergence and diversification of knowledge sources in developing Asia?

To do so, we first review the literature concerning the historical development of R&D internationalization and the changing role of developing Asia. We then identify and discuss key characteristics of MNEs, local governments, indigenous firms, and institutional environment, as well as the diverse roles they play in contributing to the establishment of a

pro-innovation environment. Drawing on the national variations and recent classifications of Asian developing countries by the United Nations (2014), we propose a typology to capture the intra-regional dynamics by designating them into three conceptual groupings: *East One* represents emerging industrializing economies (exemplified by China, India, and Singapore); *East Two* represents emerging economies at an early stage of industrialization (exemplified by Malaysia, Thailand, and Vietnam); and *East Three* represents the rest of developing Asia where economic development is far behind the former two. As the paper focuses on developing Asia, we exclude more industrialized countries in the region (Taiwan and South Korea, as discussed by Dodgson, 2009) and least developed countries (Laos and Mongolia). Moreover, we find that R&D internationalization towards East One and East Two reveals distinct variations and knowledge-flow linkages within these countries. A consolidated regional analysis of the roles that these countries play on the basis of their national circumstances is provided to reflect the intra-regional dynamics. Thus, we argue that a dynamic intra-Asian division of labour is plausible whereby some Asian economies have taken on characteristics and roles earlier designated as "Western". We draw on the network perspective and institution-based view to unravel dynamic linkages among these actors in the region.

Our proposed integrated theoretical lens of network and institution avoids *the separation of analytical silos* caused by the conceptual dualism of location- and firm-centric views (Cano-Kollmann, Cantwell, Hannigan, Mudambi & Song, 2016). In light of the dual analytical lens, we offer three relevant propositions. (1) Only when factors of effective government policies, available R&D capability of indigenous firms, and pro-innovation institutional conditions are simultaneously present in the context of a developing Asian country, are Western MNEs more likely to carry out the more advanced R&D foreign direct investment (FDI) in the region. (2) MNEs can experience dynamics within the region, as a result of heterogeneous national innovation capability. (3) The varying speed of national

development in the region is indicative of multi-directional knowledge flows between MNEs and East One, Two, and Three countries.

This Perspective paper makes three contributions. First, we offer a three-dimensional typology based on the role Western MNEs play in relation to local firms, governments, and institutions. Second, we propose the concept of knowledge hierarchy and a conceptual framework of knowledge flow within developing Asia region, which can act as a springboard for future empirical research. Third, our discussion of the importance of diverse local conditions across Asian economies in explaining the knowledge hierarchy within the region can aspire future research to contribute to the institution-based view and network theory.

## Review of historical development of R&D internationalization

The review is guided by a conceptual framework consisting of three key innovation processes identifiable in extant literature (namely knowledge creation, transfer, and assimilation), and two location choices (namely West and East). Next, we review each of the processes in relation to the locations.

### The early phase of West-dominated R&D

We designate the West as the long-established mature industrial economies of North America, Western Europe, and Japan (Freeman, 1995).[1] MNEs from these economies were substantially formulated (though obviously still open to significant evolutionary forces) by the early 1960s. They began their international expansion when, purely at the firm-level, they believed they possessed specific competences that could allow them to operate effectively in overseas, institutionally-alien environments, and where certain foreign locations provided particular reasons for them to do so (Kojima, 1978; Vernon, 1966). Thus, for these Western MNEs

[1] Geographically Japan of course belongs to the East. However, international organizations such as the Group of Seven (G7) and UNCTAD (2005) have included Japan as a developed economy, and Japanese MNEs as "Western." Therefore, we follow this convention when referring to "Western MNEs," which for the purposes of this paper would include those from Japan.

*knowledge creation* was a tacit and intuitive overlap between the host country's sense of knowledge-based development and the feeding of this into the firm's competitive deepening (Pearce & Papanastassiou, 1996). The process of *knowledge creation* establishes the defining core of the wider innovation process through the generation of a new product or service that expanded the scope of the firm and thereby asserted a newly competitive position in its industry. Behind this was the institutional commitment to national innovation capability building in the West, so that knowledge and skill bases were capable of supporting this level of competence-expanding creative work (Freeman, 2013).

Knowledge *transfer* as the second process of R&D internationalization during the early phase can be found in the pioneering works of Brash (1966), Creamer (1976), Cordell (1973), Dunning (1958), Ronstadt (1978), and Safarian (1966). Knowledge *transfer* is thus considered as a discrete, intermediate phase of the wider innovation process whereby the vital new capacities created in one location were effectively passed for reapplication elsewhere in the corporate network. One aspect of this was the need to secure this intra-group knowledge transfer effectively in managerial, organizational and technical terms. Drawing on the works of Behrman and Fischer (1980), Håkanson and Nobel (1993), Hood and Young (1982), and Niosi (1999), there were two subsequent location choices available to MNEs. One was locations with local market needs that could be most effectively met through local supply. Two was locations with productive potentials that matched the product technologies so as to secure highly cost-competitive output for export markets. In choosing the former, Western MNEs were motivated by the idea of international market expansion to better supply similar markets of the West. These markets were considered *ideal* due to their close geographical proximity and similar institutional environment (Dalton & Serapio, 1995; Håkanson & Nobel, 1993; Håkanson & Zander, 1986; Niosi, 1999). Subsidiaries in these locations were ideal knowledge receivers. Here, we consider the knowledge transfer as West-West. In choosing the latter,

Western MNEs were concerned with products losing their hegemonic market position derived from their innovative originality and thus placed greater emphasis on cost-effective supply (Asakawa, 2001; Kojima, 1978; Odagiri & Yasuda, 1996; Westney, 1993). Cantwell (1992), Kuemmerle (1997; 1999), and Pearce and Papanastassiou (1996) were among the first to note that a growing number of Western MNEs were transferring existing product knowledge to developing Asia. However, this was viewed as predominantly an operational necessity, restricted to production. We consider this as the West-East knowledge transfer.

In parallel to West-West and West-East knowledge transfer, we can also identify two corresponding knowledge *assimilation* processes in the literature. In the case of West-West knowledge transfer for international market expansion, past studies showed that market conditions in the West were not identical, and that some level of product or process *adaptation* was necessary. Some facets of a product had to be adjusted by the host subsidiary to local conditions through *adaptive assimilation*. We consider this West-West knowledge assimilation. However, many studies noted that once the primal transfer was fully worked through new levels of skill were learnt and a new industrial mindset were inculcated in the East. Thus, the basis for assimilation of more ambitious procedures was in place (Odagiri & Yasuda, 1996; Westney, 1993). Subsequently, some of these subsidiaries started to have a more dynamic view of their local potentials. They started to move beyond successful knowledge transfer and build proactively on received knowledge through informed adaptation. The extent of their knowledge assimilation was more extensive in comparison to the adaptive subsidiaries in the West. This was due to the distinct market characteristics of the East. Drawing on the previous literature, we consider this as West-East *knowledge assimilation* for capturing local markets.

**Recent R&D shift towards East**

More recently, a main operational implication of continuous West-East knowledge assimilation over time was that in exploring local market and technical conditions to secure adaptive potential, subsidiaries in the East began to formulate an ambitious view of their own creative potentials (Bas & Sierra, 2002; von Zedtwitz & Gassmann, 2002). Some subsidiaries began to aspire to a more proactive role in their MNEs' competitive evolution by gradually building their innovative capability into the founding roots of their MNEs (Jha et al., 2018; Papanastassiou, Pearce & Zanfei, 2019). Subsequently, we have witnessed the emerging role that the East plays in MNE global innovation network (UNCTAD, 2005). Recent evidence shows that Western MNEs are tapping into countries like China and India for knowledge creation (Asakawa & Som, 2008; Awate et al., 2015; Jha et al., 2018; von Zedtwitz, Corsi, Søberg & Frega, 2015; Zhao et al., 2019). What makes this development unprecedently interesting is that the East is no longer viewed only as a location for knowledge assimilation, but also increasingly showing signs of being a location for innovation and creativity.

Thus, a closer examination of some of the latest developments in the East reveals that MNE R&D activities in developing Asia are associated with two innovation processes: East-East knowledge transfer for regional markets and East-West knowledge transfer for global markets. In terms of East-East knowledge transfer for regional markets, some of the recent research evidences the emergence of innovative subsidiaries in the East (Awate et al., 2015; Jha et al., 2018; Zhao et al., 2019). Building on their successfully received knowledge, these subsidiaries were able to learn new ways or create new ideas to address local market needs. An example is Suzuki's R&D center with its joint-venture partner Maruti Udyog, which localized designed new compact cars for India (Li & Kozhikode, 2009). Such subsidiaries work with local research institutions, universities, firms, and customers to identify new knowledge useful in meeting local market needs. Some of these needs are shared across the regional markets. Hence, market expansion to the region becomes possible. We consider this as the East-East

*knowledge transfer*. In terms of East-West knowledge transfer for global markets, some of these increasingly innovative subsidiaries begin to formally identify complementary or novel knowledge (at a pre-competitive stage) useful for meeting MNE global market needs (Jha et al., 2018; Zhang, Zhao, Bournakis, Pearce & Papanastassiou, 2018; Zhao et al., 2019). A truly original innovation can, through well-activated and persistent assimilation and adaption, be crucially open-ended and feed into the sustained competitive evolution of the MNE. This reflects a strong corporate vision for the East as a new-found R&D destination and the East is building its knowledge-creating capacities into the core capabilities of the MNEs. We consider this as the East-West knowledge transfer. These developments demonstrate a picture that is dramatically different from the early phase of R&D internationalization. This evolution is well-captured in the longitudinal case studies of Jha et al. (2018) and Zhao et al. (2019), which traced the historical development of subsidiaries in India and China respectively and both found subsidiary roles to evolve from being knowledge receivers to creators for the regional and global markets.

To summarize, Table 1 provides an overview of R&D internationalization from West to East, depicted by three innovation processes, two location choices, and corresponding strategic intentions, across time. For the remainder of this paper we will pay particular attention to the two recent phases 3 and 4 in the East.

[INSERT TABLE 1. HERE]

## Governments, indigenous firms, institutions, and intra-regional knowledge hierarchy

Our review unravels an evolving pattern of West-dominated MNE R&D in the early phase to the recent focus on knowledge creation in the East. Indeed, Clarke and Lee (2018) affirms that developing Asia region has been in the process of transforming from being the manufacturing center of the global economy to a center of innovation for the knowledge economy (such as the successful IPO of a Chinese MNE Alibaba in 2014). However, a closer examination of the

region by Clarke, Chelliah and Pattinson (2018) suggests contrasting national developmental paths and thus different levels of innovation performance. For example, UNCTAD (2005) survey results of foreign R&D locations in 2004 show that only China, India and Singapore made to the top of the list, way ahead of Thailand, Malaysia and Vietnam, whilst the rest of developing Asia remains at the bottom. Moreover, it also suggests the most attractive prospective R&D locations between 2005 and 2009 shows similar findings (Figure 1). Hence, to capture the intra-regional dynamics, we designate developing Asian countries into three sub-regions: (1) East One, which represents emerging industrializing economies including China, India, and Singapore; (2) East Two, which represents emerging economies at an early stage of industrialization including Malaysia, Thailand, and Vietnam; and (3) East Three, which represents the rest of developing Asia where economic development is far behind the former two. Hence, in this paper we pay particular analytical attention to East One and Two.

[INSERT FIGURE 1. HERE]

Furthermore, it has long been accepted knowledge that institutional environment of a country is an important R&D FDI determinant (Papanastassiou et al., 2019). Within this literature, the growing support of local governments, rapid innovation of indigenous firms, and pro-innovation institutions are considered important factors (Lu et al., 2008; Sigurdson, 2000). Following this line of argument, the increasing R&D shift to the region is likely to be a result of the changing institutional environment which includes more effective coordination among government policies, indigenous firms, institutions around coherent national innovation environment to sustain commitment to innovative products and processes (Clarke & Lee, 2018). However, thus far studies have somewhat neglected the innovation environment of the Asian region in relation to MNE R&D growth. This is evident from our thorough literature search. Specifically, we follow the review method suggested by Luo, Zhang and Bu (2019), whereby a systematic search for relevant articles in leading international business (IB),

innovation, and management journals (including the *Asia Pacific Journal of Management*, *Journal of International Business Studies*, *Journal of World Business*, and *Research Policy*). Since the publication of the special issue in *APJM* on innovation in the Asia Pacific in 2008, our research covers the period 2010–2019 for two reasons. (1) This period saw most significant global R&D dispersion with the highest growth of R&D FDI in Asia. (2) This period is when studies on R&D internationalization departed from reliance on theoretical dualities to integrated interdisciplinary frameworks (Papanastassiou et al., 2019). Thus, our review process is twofold: we first identified keywords linking MNE R&D and national innovation environment related to each of the countries, then we searched our target publications with those keywords using the ABI/INFORM and EBSCO databases. We identified 20 relevant articles (Table 2).

[INSERT TABLE 2 HERE]

In order to examine the innovation environment of the region (East One and Two in particular), we draw on the institution-based view (Peng et al., 2008) to explore each of them. In the next section, we will particularly pay analytical attention to East One and East Two in terms of their diverse characteristics of government, indigenous firms, and institutions).

**East One (China, India, and Singapore)**

*Governments* - In the case of China, it has a national R&D programme, which is important for the country's science and technology (S&T) development and for the structuring of a National Innovation System (NIS) (Motohashi & Yun, 2007). One of the most significant government decisions was to establish The State Science and Education Leading Group in 1998, headed by the Prime Minister. Nine ministries form the group are directly connected with S&T development. More recently, China has been working on home-grown innovation which entails enhancing original innovation, integrated innovation, and re-innovation based on assimilation and absorption of imported technology (Zhang et al., 2018).

In comparison, India's innovation strategies have been guided by the S&T policy statements, while industrial policy resolutions/statements have given direction to the development of manufacturing enterprises. These twin processes ensure that India is able to develop a sufficiently robust manufacturing base and at the same time build a sound S&T infrastructure and create a high-skilled manpower base (Dhar & Saha, 2014). The government currently accounts for nearly 70 per cent of total R&D expenditure in India. According to India S&T Report (NISTADS, 2008), six industries (pharmaceuticals, automotive, electrical, electronics, chemicals and defence) account for about two-third of the total industrial R&D.

Singapore as a comparatively smaller economy has received significant support from its government (Wonglimpiyarat, 2013). Development of human resources and infrastructure improvement attractive to S&T industries have been carried out continually over the past 50 years. In 2014, the government announced a "Smart Nation" policy (Hoe, 2016). The policy consists of government spending to attract R&D units of MNEs, human resources development to support MNE R&D centers, and promotion of business-academic collaborations.

*Indigenous firms* - R&D capabilities in China have grown significantly, and some industries are catching-up with the industrialized countries (Fu, Pietrobelli & Soete, 2011). Since 2000, China has experienced a rapid surge of home-grown patent application across industries including telecommunications (e.g. Huawei, Oppo), platform and software development (e.g. Alibaba, Tencent), to automobiles (e.g. Geely). A significant part of this rapid development is the result of fast learning from Western MNEs (Lu et al., 2008). Chinese firms imitated their Western counterparts (Hobday, 1995) through strategic alliances or original equipment manufacturing, as a means of quickly acquiring critical knowledge and technologies.

This strategy of technological catch-up is equally apparent in India (Lu et al., 2008). Through working with Western MNEs, some Indian firms have been able to initiate fast

learning of critical knowledge and developed into global players (e.g. Tata, Infosys, Maruti Suzuki, Mahindra) (Awate et al., 2015). In other cases, indigenous firms have built strong capability in frugal or inclusive innovation capability. Moreover, the number of patents applied by Indian researchers has increased about three times over the period from 2000 to 2007 (Fu et al., 2011).

Similarly, advancement of indigenous firms in Singapore has also gone through the path of being suppliers of their Western counterparts. This is evident in the rise of manufactured exports from 73.3% to 93.9% of total exports (Athukorala, 2008). By supporting MNEs, capabilities of local industries and local workforce advanced through learning from MNEs. Singapore's electronics and ICT industries (e.g., Singtel, Wilmar, Flextronics, SGAG) are two good examples whereby they yield 57% and 32% of total patents respectively (Wang, 2018).

*Institutions* – Knowledge protection is considered a crucial factor in contributing to China's innovation conditions (Khoury & Peng, 2011; Peng et al., 2017). However, intellectual property right (IPR) remains a major weakness (Hill, 2007; Yang & Jiang, 2007). Both local and foreign firms implement alternative mechanisms for protecting their intellectual properties, such as using strong internal linkages (in the case of MNEs) and social relations (in case of indigenous firms) (Zhao, 2006). Another important factor is education in China. Since the 1990s, in line with Chinese government's innovation objectives, education authorities have invested heavily in promoting science and engineering subjects in schools and universities, leading to a drastic increase in the number of relevant graduates. The same can be said about the IPR situation in India. There are significant differences in the market valuation of R&D investments of local and foreign firms (Chadha & Oriani, 2009).

In terms of education, the Indian government shows a similar view to China in that it has been active in promoting science and engineering subjects. However, there are significantly

more graduates with expertise in software development than other S&T areas, due to greater job availability as Indian firms have extensive supply contracts with MNEs.

In contrast to China and India, Singapore consistently ranks among the best in the world for its IP environment (Forbes, 2017). The government pursues very tough IP standards to attract firms to register their IP assets in the country, which brings high-paying jobs and incentivizes innovation at home. In terms of education, Singapore has developed an effective industrial and vocational training system, enabling continuous upgrade of its curriculum. However, in terms of quality of school and university education, policy makers were concerned of teaching methods being too passive to stimulate critical thinking and creativity that is required for the next stage of upgrading. Thus, reforms in curriculum design and partnering with reputable universities overseas were initiated to address these concerns. During recent years, quality of education has reached a high standard, which has become an attractive factor for inward R&D FDI (Deng & Gopinathan, 2016).

In summary, we provide an overview of the national innovation environment of the three East One countries in Table 3.

[INSERT TABLE 3. HERE]

**East Two (Malaysia, Thailand, and Vietnam)**

*Governments* – The Malaysian government has repeatedly made strong efforts to move away from a labour-intensive towards a knowledge-based economy. It articulated the innovation-driven growth and described the building of IT infrastructure toward formation and promotion of innovation eco-system, enhancement of education and trainings. However, there have been many central-planning issues, including insufficient R&D budget and research personnel, and inadequate communication infrastructure (Wonglimpiyarat, 2011). Hence, results have not been ideal.

For Thailand, the approach is different. The government has focused on institutional and international collaborations that are based on knowledgeable human capital, sufficient scientific and technological infrastructure. Moreover, several strategies have been mapped out to develop an effective innovation environment, including: (1) improving science education; (2) improving vocational skill; (3) enhancing university-industry-research institute collaboration; and (4) infrastructure development programs including science parks, technology assistance, and financing (Wonglimpiyarat, 2011). However, similar to Malaysia, results remain less ideal (Chaminade, Intarakumnerd, & Sapprasert, 2012).

For Vietnam, which experienced high economic growth through low-value-adding MNE investment, national R&D expenditures as a percentage of GDP is low at 0.21% (2011). Such R&D expenditures are made up of 60% from government research institutes and little R&D investment from both the private and education sectors. To better attract more R&D investments, legislation, planning and organizations in S&T have been developed and policies implemented. This includes introduction of national R&D institutions and high-tech human resources development institutions, incubation facilities, support function for start-ups, universities and training centers. However, achievements in S&T remain little noticeable.

*Indigenous firms* – Indigenous innovation in Malaysia has been much less effective as the government has hoped. Whilst the large majority of local innovation has been carried out by small-medium firms, private and public investments into these firms for innovation activities remain limited. These are particularly obvious in the advanced manufacturing sector. Although some degree of learning from the Western firms has been achieved (Cantwell & Iguchi, 2005), it is significantly less than East One (Giroud, 2007). Lee (2010) finds that innovating firms' size distribution reflects that 64% of them are engaged in export markets and a large majority are concerned with process innovation to improve standards and efficiency, rather than product innovation.

The lack of success continues in the case of Thailand. Intarakumnerd, Chairatana and Tangchitpiboon (2002) find that most indigenous firms have grown without deepening technological capabilities, and their technological learning has been very slow and passive. Only a small minority of indigenous firms have formally developed R&D capability. They tend to rely on off-the-shelf imported technology mostly in the forms of machinery and turn-key technology transfer from abroad or joint venture with foreign partners, due to their short-term vision and commercial orientation (Arocena & Sutz, 1999).

For Vietnam, the story is not much different until the last few years, when the country has seen the establishment of a so-called "Asian Silicon Valley" (BBC News, 2018). Before that, most indigenous firms remain in the manufacturing sector. While firms recognize benefits from innovation (Santarelli & Tran, 2017), they lack the capacity and resources to put in place technological improvements (Anwar & Nguyen, 2013). Instead, they attempt at imitating practices of MNE counterparts. However, this remains difficult as foreign firms do not easily concede their know-how and showed limited interested in R&D. For instance, only 10% of technology came from foreign firms in 2013 alone (Anwar & Nguyen, 2013).

*Institutions* – Whilst IPR protection has improved, Malaysia remains largely ineffective in providing IPR protection as it is a top producer for counterfeit products (European Commission, 2018). This widespread of available IPR-infringing goods in both physical and online markets deter firms from innovating. In terms of education policy, Malaysia has been promoting national university privatization and establishment of private education institutions. The overall direction of educational environment has been to increase student recruitment to technical colleges so that they acquire skill and accelerate building of an industrial base. Result has been positive as college-going rate in Malaysia is grown to 40% of all high school graduates.

In contrast, Thailand has been making more efforts to reinforce IPR protection, including establishment of the National Committee on Intellectual Property Policy and a subcommittee on enforcement against IP infringements (European Commission report, 2018). However, in reality problems remain. For instance, the Copyright Act provides legal protection but includes a list of exceptions that are overly broad and pre-empts the protection. In terms of education, despite the growing number of graduates, they generally lack the ability to innovate at work through applying learnt knowledge. The government concern surrounds effectively shift towards development of quality rather than quantity via better education (Phongpaichit & Baker, 2005; Pimpa, 2011).

Vietnam has one of the weakest IPR protection frameworks in place (European Commission report, 2018). Despite its effort to improve legislation, it remains an important producer of counterfeits. Vietnam's enforcement system is problematic as its high complexity makes it challenging for right holders to take effective action against IPR infringements, deterring firms to innovate. In terms of education, Vietnam is behind in producing both quantity and quality of graduates. This is not only caused by insufficient tertiary education funding to cope with any increase in technical and research students, but also supply of outdated and overly theoretical knowledge which does not meet the labour market demand.

In Table 4, we provide an overview of the three East Two countries.

[INSERT TABLE 4. HERE]

**MNEs and national R&D environments**

Applying the institution-based view (Peng et al., 2017; Peng et al., 2008) and avoiding *the separation of analytical silos* caused by the conceptual dualism of location- and firm-centric views (Cano-Kollmann et al., 2016), we will discuss the diverse qualities of national R&D environment in East One and Two and their dynamic relationships with Western MNEs.

*Government policies for R&D FDI*: Governments of East One play an active role in making their respective economies attractive to global R&D investment in recent years (UNCTAD, 2005). For example, Li and Yue (2005) note that East One requires MNEs wishing to invest in priority sectors such as infrastructure and R&D to form strategic alliances with local firms or research institutions. Although this may not be a desirable proposition for MNEs as it may mean exposing their intellectual property to reverse engineering by indigenous firms, the attractiveness of these markets and other benefits persuade them to locate R&D activities in these economies. MNE R&D ventures (cooperative or wholly-owned) in China are growing at an unprecedented rate (UNCTAD 2005; 2019). As a result, these countries have shown substantial growth in research output from both MNEs and their local partners (Li & Kozhikode, 2009; Peng, et al., 2017; Shi, Sun, Pinkham & Peng, 2014). However, there is little evidence of effective or well-implemented policies in the case of East Two.

*R&D capabilities of indigenous firms*: One important factor that has contributed to the East One's success in attracting MNE R&D has been the catching up of latecomer firms from the region, being the technology leaders of their respective industries (UNCTAD, 2005). Thus, they are considered by MNEs as attractive collaborators (Li & Kozhikode, 2009). Although many initial collaborations may have been motivated by a need for local production and to gain access to the market, later collaborations have focused on developing specialized products for the local market (Chesbrough & Appleyard, 2007). In comparison to East One, East Two are frequently considered as locations with fewer compatible local partners ideal for R&D. Most of the indigenous firms remain underperformed in R&D outputs. It is found that the transfer of technology has tended to be limited to the operational level, i.e. MNEs tended to train their workers just so that they can efficiently produce goods. There has not been sufficient transfer of technology at higher levels such as designing and engineering. Little investment from MNEs has been made in R&D (Kaosa-Ard, 1991). For instance, between 1990 and 1998, only 41

R&D projects, of which 22 were foreign firms, were granted investment promotion privilege (Intarakumnerd et al., 2002). Similarly, MNEs have not been active in developing subcontractors or giving technical assistance to local suppliers due to inefficiency and backwardness of local supporting industries.

*Pro-innovation institutional conditions (IPR and education):* Apart from Singapore, IPR protection remains problematic across the two subregions though East Two is more severe. MNEs have learnt to implement alternative mechanisms for protecting their intellectual properties (Peng et al., 2017). This includes use of strong internal linkages (Zhao, 2006); aggressive filing of patents, copyrights, and trademarks in China (Liang & Xue, 2010); splitting R&D processes across multiple locations (Zhao, 2006); and setting up strategic alliances with trustworthy local partners (Ahlstrom, Levitas, Hitt, Dacin & Zhu, 2014). For education, the recent decades have witnessed substantial growth in the talent pools particularly in East One (Asakawa & Som, 2008; Mabey & Zhao, 2017). The number of PhD candidates in S&T enrolled in universities in these regions has grown significantly (Freeman, 2005). Moreover, governments also encourage PhD holders from Western universities to return to their respective home country with lucrative incentives (Saxenian, 2006). This wealth of talent is available for less than a fourth of what it would cost in a developed country (Li & Scullion, 2006). As salaries make up a significant proportion of the cost of R&D, the availability of highly skilled human resources at lower cost is a major appealing factor for MNEs to relocate their R&D not only for better local adaptation but being centers of excellence (Almeida & Phene, 2004). For instance, in 2003 the Intel subsidiary in India filed for 63 patents with a workforce of 1,500 IT professionals. For Intel, India offers the best climate and expertise, made of individuals who are technically well-educated and speak good English.

We thus conclude that innovation is more likely to succeed when the elements of the broader environment surrounding firm's activities are well fitted into a system, than in

situations where each actor or process operate in isolation. For instance, Western MNE R&D investments in India have tended to concentrate on information technology, telecommunications, automotive, pharmaceutical and biotechnology, whereas their R&D investments in China are centerd on the personal computers and telecommunications industries followed by chemical, petrochemical, pharmaceutical, biotechnology, automotive and transportation industries. Singapore is viewed most attractive for electronics and ICT industries. Whilst IPR protection varies across these three countries (with China and India being weak and Singapore being strong), education systems have performed very well in meeting industrial innovation demand for rich supply of specialized skilled workforce. Thus, MNEs are more likely to carry out strategic R&D FDI in developing Asia, when the evolutionary condition of R&D-related experiential knowledge accumulation and institutional environment upgrading for R&D is present (Cantwell, Dunning & Lundan, 2010). We hereby offer two propositions. First, we propose:

> *Proposition 1: When factors of effective government policies, available R&D capability of indigenous firms, and one or more pro-innovation institutional conditions (i.e. strong IPR protection or effective education system) are simultaneously present within a developing Asian country, Western MNEs are more likely to make R&D investments.*

Continuing this line of thinking, whilst Western MNEs may experience heterogeneous national innovation environments across the region and seek maximum benefits from the diversity in government policies, indigenous firms, and institutional conditions, they may be making important contributions (explicitly or implicitly) to development of more effective national innovation environments in respect of the three key dimensions. This is in line with Cantwell et al.'s (2010) argument that when locations are characterized by R&D-supportive policies, strong capabilities, and improved institutional conditions, MNE-institution co-development is more likely. Co-development entails a dual process of MNEs building extensive knowledge and experience over time to profit from local opportunities and resources,

whilst contributing to filling in the "missing elements of the local environment" by offering learning opportunities and resources for local counterparts (Cantwell et al., 2010: 577). Thus:

> *Proposition 2: Western MNEs in developing Asia can co-develop local pro-innovation institutions when benefiting from their previous experience, conditions of effectively integrated government policies and available R&D capability of indigenous firms.*

Finally, drawing on the evidence of dynamic national circumstances across East One and Two countries, we provide a consolidated regional analysis of the roles the six countries play that reflect dynamic intra-regional linkages. We apply the network perspective (Inkpen & Tsang, 2005) to discuss and conceptualize the dynamic and intertwining relationships *among* these countries. We argue that dynamic knowledge creation, transfer, and assimilation is happening *within* developing Asia region. We therefore identify a noticeable knowledge hierarchy within the region. Whilst it generally remains the fact that the West (including Japan) is at the top of the knowledge *pyramid* (though MNEs of the East are increasingly closely catching to Western MNEs), we argue that within developing Asia region that indigenous MNEs in East One countries with most innovative environment and thus strongest knowledge-creation capability are most convincingly placed at the top of the intra-regional knowledge hierarchy. Knowledge created in East One is ideally transferred to East Two to maximize its value for meeting regional market needs. East Three is not equally viewed as an attractive location for the transfer. Transferred knowledge is then assimilated in East Two for markets in East Two and possibly Three. In the longer term, it is anticipated that East Two is likely to become more innovative though learning from the transferred knowledge. Therefore, new knowledge from East Two will then be transferred to increasingly more attractive East Three, following a similar developmental path of East One.

Here, we further deepen our discussion on indigenous MNEs as the new player of innovation in the region by proposing two potential trajectories. First, it may be that whilst

indigenous firms in East One cannot compete with those of Western MNEs in the high-income markets that are their natural territory, it may be more appropriate for these indigenous firms of East One to expand to other lower-income countries in the region (in this case East Two and Three). Products and technologies attuned to the conditions of East One may be more applicable to effective transfer and assimilation in East Two and East Three (for market expansion) than those of Western MNEs. East Two to East Two or East One to East Three transfers may be more viable and desirable than West to East Two or West to East Three. The second trajectory is very different and directly reflects the perception of the indigenous MNEs' competences. Here knowledge-creation investments in technologically-advanced developed countries are articulated to access and learn the superior innovation-oriented potentials of these economies and feed them back not only into the technical competences of the indigenous MNEs but the wider innovation scopes of the home countries (Deng, Delios, & Peng, 2020). If secured this would imply a very different form of West-East One transfer. However, the capacity to carry out such knowledge-creation investments need the support of home-country government policies, which is another important factor to indigenous MNE development. Thus:

> *Proposition 3: There is an intra-regional knowledge hierarchy whereby knowledge created by Western and indigenous MNEs in East One is most likely to be transferred to East Two for assimilation to meet market demands of East Two and possible Three. Reversely, transferred knowledge to East Two creates valuable learning opportunities and thus technological upgrade and knowledge creation capability are likely to develop in the future.*

## Discussion

Although interest in R&D internationalization in developing Asia has grown, we remain less informed about the distinct characteristics and opportunities within the region. Our analysis shows that MNEs are not isolated from their environment (Khoury & Peng, 2011; Lu et al.,

2008; Peng, 2002; Peng et al., 2017; Peng et al., 2008), rather, MNE R&D experience in developing Asia is clearly heterogenous, away from what the conventional wisdom may suggest (Wright et al., 2005). We offer a conceptual framework (Figure 2) to depict R&D knowledge flows and intra-regional knowledge hierarchy.

[INSERT FIGURE 2. HERE]

More specifically, innovation capability has defined the spread of industrial development through developing Asia, where East One was projected as the template for a series of waves of regional expansion to East Two. Here we see East Two as emerging economies at an early stage of industrialization, lagging behind East One. These countries are sufficiently far into the industrialization process to become aware of the problems and potentials of securing its sustainability. The major difference from the East One story is that these East Two countries pursue their own progress in an Asian context that is now significantly conditioned by these antecedent pioneers of East One. One aspect of this is that in the early stages of the East Two countries' development, they have both West and East One sources of external knowledge available. East One sources may prove easier to assimilate since they reflect a state of development closer to their own than direct knowledge transfer from West sources. It may also mean the goods they produce are more in-line with regional tastes, building their growth constructively into the broader Asian context. As East Two countries try to move towards the generation of a more effective national innovation environment, the East One model can illustrate demonstratively the need and scope to pursue this route. Any newly found innovation capability of East Two needs to feed into the regional markets already penetrated by the first-mover status of East One. However thus far, East Two markets remain relatively small and national innovation environment remains weak, and the attraction to FDI is likely to be mainly cost-based efficiency and market-seeking potentials. Furthermore, the remaining possible East Three countries (such as Laos and Mongolia) will be in a predominantly

dependant status for the moment, seeking to secure the early benefits of participation in an open global (or perhaps mainly regional) economy. Our conceptual framework (Figure 2.) thus depicts how three knowledge processes (knowledge creation, transfer, assimilation), three locations (East One, Two, and Three), two specific groups of actors (Western MNEs and indigenous MNEs), and two concurrent R&D internationalization processes determine outward knowledge transfer and intra-regional knowledge hierarchy.

Our Perspective paper thus makes three contributions. First, we contribute to the literature of innovation in Asia by offering a three-dimensional typology based on the role Western MNEs play in relation to local firms, governments and institutions (with particular focus on China, India, Singapore, Malaysia, Thailand, and Vietnam). We are among the first to suggest an intra-regional typology that captures variations within developing Asia. Second, we contribute to the literature on R&D internationalization to emerging economies by proposing a conceptual framework of knowledge hierarchy within developing Asia region. This paper is one of the few that highlight the importance and usefulness of applying an intra-regional focus when examining the shift of global innovation locus. Our framework captures the dynamic intra-regional knowledge linkages in developing Asia, which can act as a springboard for future empirical research. Third, we contribute to the institution-based view and network theory by explicating their usefulness as an integrated analytical lens to investigate relational and locational characteristics of emerging economies for R&D. In particular, thus far the institution-based view has been relatively neglected in research on intra-regional innovation of developing Asia. Our discussion of the importance of diverse local conditions across Asian economies in explaining the knowledge hierarchy within the region can aspire future research to contribute to the institution-based view (Lu et al., 2008; Peng et al., 2017; Peng & Delios, 2006; Peng et al., 2008). Essentially, R&D internationalization in developing Asia raises important idiosyncratic managerial questions (Asakawa & Som, 2008; Wright et al., 2005). It

is hoped that this paper will prompt new debates and discussions, theoretical and empirical contributions from the management and international business scholars.

## Conclusion

One of the core developments in global management through the past 50 years has been the emergence of internationalized processes of R&D. In this paper, we review this development, not in terms of how it has been organized and operationalized as a practice within individual MNEs, but in terms of how the spread of innovation by MNEs diffused and expanded geographically through time. We focus particularly on increasingly diverse Asian economies as significant locations for Western MNEs R&D internationalization as well as offering unique competitive advantages to capability-building of indigenous firms. In particular, we discuss the role of Western MNEs in benefiting from and contributing to the development of R&D capability in developing Asia. Our analysis is built upon our conceptualization of a new typology and a conceptual framework for R&D internationalization in developing Asia, which reflect the dynamic intra-regional linkages and knowledge hierarchy. Future empirical research can build on this typology to examine the finer details of linkages between and within each of the categories of countries in developing Asia. There remain many managerial lessons for both Western and indigenous MNEs to learn where context should be a central consideration.

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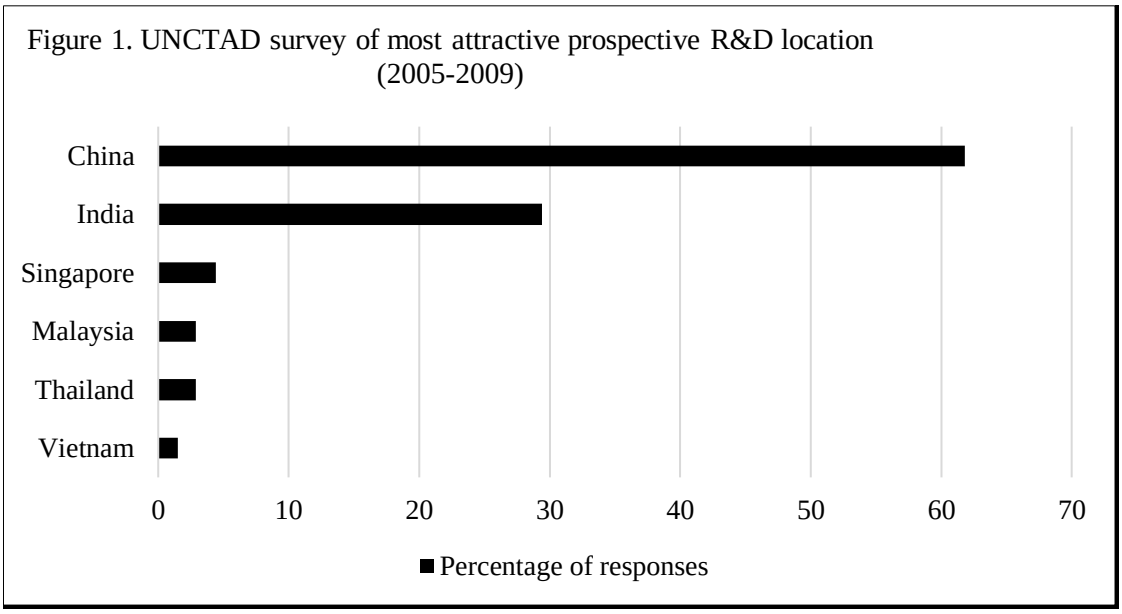
**Table 1.** An overview of evolution of R&D internationalization between West and East

| *Time* | *Space* | *Innovation processes* | *Corresponding strategic intentions* |
|---|---|---|---|
| Phase 1 (early) | West-West | • Knowledge creation in the West for the West | - To seek new knowledge locally |
| | | • Knowledge assimilation in the West | - To seek market expansion opportunities |
| Phase 2 (early) | West-East | • Knowledge transfer from West to East | - To seek low-cost production |
| | | • Knowledge assimilation from West to East | - To seek market expansion opportunities |
| Phase 3 (recent) | East-East | • Knowledge transfer from East to East | - To seek regional market expansion opportunities |
| Phase 4 (recent) | East-West | • Knowledge transfer from East to West | - To seek novel or complementary knowledge locally |




Source: UNCTAD (2005) (Responses came from UNCTAD survey of world's largest R&D investors.)

**Table 2.** A summary of recent management and IB literature on R&D internationalization to developing Asia (2010-2019)

| Country[2] | Author | Year | Sample | Data | Extent of discussion on local actors[3] |
|---|---|---|---|---|---|
| **China** | Cantwell and Zhang | 2013 | 3845 pairs of patents | Published dataset | Limited discussion |
| | D'Agostino and Santangelo | 2012 | 221 subsidiaries | Published dataset | Limited discussion |
| | Haakonsson and Ujjual | 2015 | 1 MNE | Interview | Limited discussion |
| | Liu and Chen | 2012 | 3105 R&D networks | Published database | Some level of discussion |
| | von Zedtwitz et al. | 2015 | 16 headquarter-subsidiary knowledge links | Interview | Limited discussion |
| | Zhang et al. | 2018 | 129 subsidiaries | Questionnaire | Limited discussion |
| | Zhao et al. | 2019 | 1 MNE | Archive | Limited discussion |
| **India** | Awate et al. | 2015 | 2 subsidiaries | Interview, archive | Limited discussion |
| | D'Agostino and Santangelo | 2012 | 221 subsidiaries | Published dataset | Limited discussion |
| | Haakonsson and Ujjual | 2015 | 1 MNE | Interview | Limited discussion |
| | Jha et al. | 2018 | 9 subsidiaries | Interview, archive | Limited discussion |
| | Kumaraswamy et al. | 2012 | 1271 subsidiaries | Published dataset | Limited discussion |
| | Lema et al. | 2015 | 22 subsidiaries | Interview | Limited discussion |
| | Nair et al. | 2015 | 10 subsidiaries | Questionnaire | Limited discussion |
| | von Zedtwitz et al. | 2015 | 16 subsidiaries | Interview | Limited discussion |
| **Malaysia** | von Zedtwitz et al. | 2015 | 16 subsidiaries | Interview | Limited discussion |
| **Singapore** | D'Agostino and Santangelo | 2012 | 221 subsidiaries | Published dataset | Limited discussion |
| **Thailand** | Jongwanich and Kohpaiboon | 2011 | 65,286 subsidiaries and domestic firms | Published dataset | Some level of discussion |
| | Worasinchai, and Bechina | 2010 | 5 subsidiaries | Questionnaire, archive | Limited discussion |
| **Vietnam** | von Zedtwitz et al. | 2015 | 16 subsidiaries | Interview | Limited discussion |

[2] In alphabetical order; Some of the studies have covered more countries than developing Asia. We are only concerned with those countries mentioned in this paper.
[3] Local governments, indigenous firms, or institutions

**Table 3.** Heterogeneity of governments, indigenous firms, and institutions across East One

| | *Governments* (pro-innovation environment) | *Indigenous firms* (characteristics of local innovation) | *Institutions* (IPR legal protection; innovation expertise) |
|---|---|---|---|
| **China** | - Strong policy support<br>- Effective NIS covering all key areas | - Highly concentrated in several key industries<br>- Focus on both radical and incremental innovation<br>- Extremely active learning from Western firms<br>- Indigenous MNEs with strong R&D capability | - Weak IPR protection<br>- Local-educated and repatriated expertise |
| **India** | - Strong policy support<br>- Targeted NIS for priority industries | - Highly active across a few specific industries<br>- Focus on frugal innovation<br>- Active learning from Western firms<br>- Indigenous MNEs with strong R&D capability | - Weak IPR protection<br>- Local-educated ICT expertise |
| **Singapore** | - Strong policy support<br>- Targeted NIS for priority industries | - Highly active across a few specific industries<br>- Focus on incremental innovation<br>- Extremely active learning from Western firms<br>- Indigenous MNEs with strong R&D capability | - Strong IPR protection<br>- Local-educated and immigrated expertise |

**Table 4.** Heterogeneity of governments, indigenous firms, and institutions across East Two

| | *Governments* (pro-innovation environment) | *Indigenous firms* (characteristics of local innovation) | *Institutions* (IPR legal protection; innovation expertise) |
|---|---|---|---|
| **Malaysia** | - Average policy support<br>- Partially effective NIS for priority industries | - Limited innovation across key industries<br>- Focus on incremental innovation<br>- Limited learning from Western firms<br>- No/limited indigenous MNEs | - Improving IPR protection<br>- Local-educated expertise |
| **Thailand** | - Less effective policy support<br>- Less effective NIS across all key areas | - Limited innovation across key industries<br>- Limited focus on both radical and incremental innovation<br>- Extremely limited learning from Western firms<br>- No/limited indigenous MNEs | - Weak IPR protection<br>- Local-educated expertise |
| **Vietnam** | - Less effective policy support<br>- Less effective NIS across all key areas | - Limited innovation across key industries<br>- Limited focus on both radical and incremental innovation<br>- Extremely limited learning from Western firms<br>- No/limited indigenous MNEs | - Weak IPR protection<br>- Increase in repatriated expertise |

**Figure 2.** Framework of Evolution of R&D internationalization