NTU Management Review
Vol. 33 No. 1 Apr. 2023, 39-84
DOI:10.6226/NTUMR.202304_33(1).0002

Value Creation and Capture in Developing Countries: The Driver and Mechanism of Offshore Outsourcing Innovation

在開發中國家之價值創造與攫取：境外創新外包之驅動因素與管理機制

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Received 2021/9, Final revision received 2022/5

Abstract

As firms have been increasingly outsourcing innovation activities in developing countries where the firms confront challenges of creating and capturing value due to weak protection of Intellectual Property Rights (IPR), the answers to why these firms still take the risk and how they manage it remain unclear. To bridge the knowledge gap, we adopt the Knowledge-based View (KBV) to conduct the research on offshore outsourcing innovation. We argue that the availability of human capital, in terms of low-cost and high-skilled talent, in a country with weak IPR protection increases the likelihood that a firm outsources an innovation activity to that country. In addition, we further propose that the main effect of human capital can be positively moderated by the designing of task specificity and project modularity which the firm uses to capture value and protect proprietary information from outsourcing innovation in developing countries. Using the data of Offshoring Research Network (ORN), Index of Economic Freedom (IEF), and World Economic Forum (WEF) to test these hypotheses, we find our premises supported.

【Keywords】offshore outsourcing innovation, task specificity, project modularity, human capital, developing countries

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摘 要

僅管在開發中國家，廠商面對著智慧財產權虛弱保護下價值創造與攫取之挑戰，廠商卻仍然逐漸將其創新活動外包至開發中國家。廠商為何冒著這種風險進行境外創新外包？廠商如何管理其境外創新外包？學界迄今仍未提出明確解答。為了填補此研究缺口，我們採納知識基礎觀點進行相關研究。我們主張：一個對智慧財產權虛弱保護的國家，若其具備低成本、高才能的人力資本，廠商將創新活動外包至該國的可能性增加。此外，我們更進一步主張：當廠商可提高創新外包活動的任務專屬性與專案模組化程度，則得以攫取境外創新外包之價值，並且保護在開發中國家執行境外創新外包所需的專有資訊。本研究透過 Offshoring Research Network (ORN)、經濟自由度指數 (Index of Economic Freedom; IEF) 與世界經濟論壇 (World Economic Forum; WEF) 的資料檢驗上述的研究主張，發現所有假說皆獲得支持。

【關鍵字】境外創新外包、任務專屬性、專案模組化、人力資本、開發中國家

1. Introduction

Offshore outsourcing innovation is one stream of research on the internationalization of innovation in the International Business (IB) literature (Contractor, Kumar, Kundu, and Pedersen, 2010, 2011). When conducting offshore outsourcing innovation, firms can choose developing countries as the locations of knowledge accessing and sourcing. In general, offshore innovation outsourcing in developing counties creates value for outsourcing firms since it helps them attain and sustain competitive advantage by saving costs (Kedia and Mukherjee, 2009), obtaining resources (Massini, Perm-Ajchariyawong, and Lewin, 2010), entering markets (Larsen, Manning, and Pedersen, 2013), and enhancing innovativeness (Belderbos, Park, and Carree, 2021). Nonetheless, developing countries are often characterized by high legal risk and weak Intellectual Property Right (IPR) protection (Holmes, Li, Hitt, DeGhetto, and Sutton, 2016; Hoskisson, Eden, Lau, and Wright, 2000; Keupp, Beckenbauer, and Gassmann, 2009; Peng and Heath, 1996; Xie, Peng, and Zhao, 2013). Given that, offshore outsourcing innovation might incur the risk of knowledge leakage to other companies and even to competitors in developing countries (Buss and Peukert, 2015; Martínez-Noya and García-Canal, 2018). More importantly, such a risk could challenge outsourcing firms to capture the value created through offshore innovation outsourcing (Brander, Cui, and Vertinsky, 2017; Bruno, Crescenzi, Estrin, and Petralia, 2021).

However, the answers to why firms take the risk on outsourcing innovation in developing countries and how they manage it remain unclear. We find that the extant research mainly focuses on examining the value creation of offshore outsourcing innovation from the theories of Transaction-cost Economics (TCE) and Resource-based View (RBV) but pays scant attention to the value capture of offshore outsourcing innovation. For example, the TCE school often asserts that firms conduct outsourcing at the lowest-cost level to gain cost advantages (Murray and Kotabe, 1999). Although lowering cost is sufficient for firms to outsource innovation offshore, it is not necessary for them to do so in developing countries. More than that, the TCE school hypothesizes that firms will not outsource high-value activities, such as R&D and innovation, to locations characterized by a high potential risk (Contractor et al., 2010). Since we have already witnessed that firms have been increasingly outsourcing innovation to developing

countries (Bertrand and Mol, 2013; Howells, Gagliardi, and Malik, 2008; Martínez-Noya and García-Canal, 2018; Sartor and Beamish, 2014), we believe the TCE school might overlook the way that firms capture value from outsourcing innovation in developing countries characterized by both high legal risk and weak IPR protection.

On the other hand, the RBV scholars have indicated that offshore outsourcing can give a firm the opportunity to access rare resources (Bunyaratavej, Doh, Hahn, Lewin, and Massini, 2011). Indeed, offshore innovation outsourcing can provide access to the rare resources owned by offshore contractor providers; however, the value created through this access is no longer entirely unique, rare, or inimitable for outsourcing firms to capture and appropriate (Doh, 2005). Besides, RBV is limited in cases featuring higher levels of disaggregation, which reduces firm-specific competencies and resources (Rodgers, Khan, Tarba, Nurgabdeshov, and Ahammad, 2019). In these cases, RBV might underexplore the possible mechanisms that outsourcing firms could use to capture value from outsourcing innovation in developing countries.

Therefore, this study adopts the perspective of Knowledge-based View (KBV) as the theoretical lens to explore the abovementioned research issues and aims to fill the research gap. Specifically, the KBV perspective proposes that the performance of a firm depends on its creation, management and use of knowledge from, within, and outside its boundaries (Grant, 1996; Kogut and Zander, 1992; Nonaka and Takeuchi, 1995). Since knowledge is embedded in human capital within a firm and cannot be easily transferred (Grant, 1996), leveraging and utilizing human capital enable firms to create value and sustain competitive advantage (Chen and Huang, 2009).

Extending from this perspective, we argue that an outsourcing firm plays the role as an organizer of knowledge to access and manage human capital when conducting offshore innovation outsourcing in developing countries. Firstly, firms have a strong need of human capital for conducting innovation activities such as R&D, product design, and engineering services (Demirbag and Glaister, 2010; Graf and Mudambi, 2005; Musteen and Ahsan, 2013). As human capital is critical for firms to succeed in conducting innovation activities, developing countries can be excellent sources of human capital, in terms of the availability of human capital including low-cost and high-skilled technicians, scientists, and engineers (Holmes et al., 2016; Jensen, Larsen, and Pedersen, 2013; Li and Scullion, 2006). The availability of human capital in developing countries thus encourages outsourcing firms

to relocate their innovation activities offshore (Chen and Hsiao, 2013; Kumar, 2001). Secondly, outsourcing innovation activities also involves the firm's need to acquire tacit inputs such as skilled workers, advanced technology, and new knowledge from offshore contractor providers. That is, offshore innovation outsourcing is needed for knowledge unavailable in-house or for finding the best knowledge around the world (Mukherjee, Gaur, and Datta, 2013; Musteen, Ahsan, and Park, 2017). When developing countries can fulfill such a need particularly with cost advantages, firms surely will consider outsource innovation activities to access human capital in the developing countries to create value.

Furthermore, we argue that firms conduct offshore innovation outsourcing in developing countries not only to create value by accessing human capital, but also to capture value by managing the knowledge embedded in the human capital within, between, and among offshore partners. According to KBV (e.g., Kogut and Zander, 1992; Takeishi, 2002), outsourcing implies partitioning activities based on knowledge between the firm and its providers. While some partition activities are independent, others are interdependent (Sanchez and Mahoney, 1996). Extending from this perspective, we propose two mechanisms–task specificity and project modularity–for firms to manage innovation activities outsourced in developing countries with weak IPR protection.

On the one hand, we define task specificity as disaggregating an innovation activity into independent specific tasks. Specifically, task specificity enables firms to allocate tasks efficiently and to manage the global configuration of tacit knowledge that resides in the human capital of offshore partners across locations. It also provides limited access to the knowledge of a specific task, exposes a little value of each task, and increases the cost of coordinating a whole innovation activity. As such, task specificity can be a mechanism that firms use to manage outsourcing in developing countries with weak IPR protection. On the other hand, we define project modularity as modularizing interdependent tasks in a project. Specifically, project modularity enables firms to access the specific knowledge embedded in the human capital of offshore partners and to integrate knowledge across offshore partners quickly and efficiently. It also creates the complexity of interdependent tasks, hides the information of each project, and minimizes the need for communication between projects. Accordingly, project modularity can be another mechanism that firms use to capture value from outsourcing innovation in developing countries with weak IPR protection.

Using the survey data of Offshoring Research Network (ORN), World Economic Forum (WEF), and Index of Economic Freedom (IEF), we find our premises supported and offering several contributions. First of all, we respond to the recent call regarding the KBV research on global strategy and IB literature (e.g., Grant and Phene, 2022), as we complement the extant research based on the TCE and RBV perspectives by adopting the KBV lens to explain value creation and capture of offshore innovation outsourcing in developing countries. Moreover, we broaden the research on internationalization of innovation by examining various innovation activities outsourced to developing countries which can provide abundant human capital for those outsourcing firms to create value. We further explore the moderator and contingency on the relationship between the driver and the choice of offshore locations, which has been downplayed in the IB literature (e.g., Chen and Hsiao, 2013), as we propose two mechanisms–task specificity and project modularity–which moderate the driver of offshore innovation outsourcing and the decision on outsourcing to developing countries. Lastly, we add to the literature regarding the impact of global outsourcing and offshoring on IPR protection (e.g., Belderbos et al., 2021). As we examine the two possible mechanisms which firms use to mitigate the risk of ineffectual institutions in developing countries, particularly those with weak IPR protection, we then provide further theoretical grounding and empirical support to the works on the IPR protection and shed some light on the recent research of global outsourcing and offshoring.

The rest of this paper is structured as follows. We review the literature regarding internationalization of innovation, offshore outsourcing innovation, and the KBV perspective; we then extend the discussions to firms' value creation and capture of offshore outsourcing innovation. Next, we elaborate the empirical setting of this paper and discuss the research methodology. Thirdly, we outline the analytical results, present the research findings, and finally offer discussions and conclusions at the end.

2. Theoretical Background and Hypothesis Development

2.1 Internationalization of Innovation and Offshore Outsourcing Innovation

The internationalization of innovation is a core research theme in the IB literature (Dunning, 1988). Continuing this core theme, scholars have explored related subjects, such

as global innovation (e.g., Mudambi, 2008; Nandkumar and Srikanth, 2016), offshoring innovation (e.g., Contractor et al., 2010; Kedia and Mukherjee, 2009; Lewin, Massini, and Peeters, 2009), R&D internationalization (e.g., Belderbos, Lokshin, and Sadowski, 2015; Chang, Lee, Chieng, and Chin, 2013; Chen and Hsiao, 2013; Chen, Huang, and Lin, 2012; Hsu, Lien, and Chen, 2015; Liu and Chen, 2007), and offshore outsourcing innovation (e.g., Rodríguez and Nieto, 2016; Santangelo, Meyer, and Jindra, 2016).

Offshore outsourcing innovation is an increasingly important industrial activity and academic topic. It emphasizes that firms cannot and should not conduct all innovation activities such as R&D, product design, analytical service, software development, and engineering activities internally, but can and should capitalize on external knowledge which can be licensed or bought in offshore countries (Contractor et al., 2010; Gassmann, 2006; Kedia and Mukherjee, 2009). Offshore outsourcing innovation is also one of the most desirable strategies for firms to operate in foreign countries. For one thing, offshore innovation outsourcing is realistic when firms scout for specific knowledge or capabilities that are owned by offshore contract providers in foreign countries (Alcácer, Cantwell, and Piscitello, 2016; Chung and Alcácer, 2002; Massini et al., 2010). For another thing, offshore innovation outsourcing is feasible and efficient when firms are unable to make the high upfront investment or when internalizing innovation activities in foreign countries involves huge sunk costs (Gooris and Peeters, 2016; Sartor and Beamish, 2014). In these cases, offshore innovation outsourcing becomes a desirable strategy for firms to conduct innovation activities in foreign countries.

As the research summary of offshore outsourcing innovation shown in Table 1, four major streams found in recent literature are: cost advantages, innovation outcomes, institutional contexts, and knowledge management. At first, the early research stream of offshore innovation outsourcing mainly focuses on its cost advantages. For example, Kapler and Puhala (2011) find that offshore outsourcing clinical trials in India offered an additional opportunity for the pharmaceutical companies to reduce costs by 50 percent. In addition, Teirlinck and Spithoven (2013) indicate that offshore innovation outsourcing is also able to examine new areas with relatively low capital involvement in case of failure in foreign countries. By contrast, Cozza, Franco, Perani, and Zanfei (2021) argue that firms face higher costs when internalizing innovation and developing formal and informal relations with knowledge suppliers involved in the host location's system of innovation.

The second stream is related to innovation outcomes and points out the benefits of offshore innovation outsourcing to the outsourcing firms. Since a critical element of offshore innovation outsourcing is the reverse transfer of knowledge from overseas actors to a focal firm (Govindarajan and Ramamurti, 2011; Kotabe, Dunlap-Hinkler, Parente, and Mishra, 2007), it can intensify a firm's innovation outputs and benefits (Grimpe and Kaiser, 2010). On the one hand, offshore innovation outsourcing creates the conditions for a more extensive division of labor within a firm's global network involved in the generation and use of knowledge. That is, offshore innovation outsourcing enables firms to tap into specialized knowledge and skills in foreign geographic knowledge clusters with comparative advantages in certain industries (Cassiman and Veugelers, 2006; Lewin et al., 2009). On the other hand, firms rely upon external knowledge providers to create new knowledge and to innovate products, processes, and services. Since outsourcing innovation is undertaken where doing so is cost-effective and does not threaten the competitive advantage of a company (Narula, 2001), it can help firms to increase innovation output and stay ahead of competition (Bertrand and Mol, 2013; Nieto and Rodríguez, 2011).

The third stream proposes that offshore innovation outsourcing depends on institutional contexts such as the host-country environments where a focal firm is outsourcing (Kshetri, 2007; Lam, 2003; Lu, Tsang, and Peng, 2008). As the host-country environment plays an important role in a firm's decision on choosing offshore outsourcing locations (Sartor and Beamish, 2014), it can either facilitate or hinder knowledge transfer from foreign sources to the focal firm. Among the host-country characteristics, the system of IPR protection is the most important, because it can either strengthen or weaken firms' ability to appropriate value created by their innovation activities (Brander et al., 2017; Martínez-Noya and García-Canal, 2018). A strong IPR protection system is critical for offshore innovation outsourcing because it enables firms to capture the innovation outcomes and value. Without an effective system of IPR protection, firms confront the extra cost of implementing offshore outsourcing. Nonetheless, the relationship between the geographic location of outsourced innovation and the institutional context, in particular the strength of IPR protection, remains unanalyzed (Bruno et al., 2021).

The fourth stream indicates that the success of offshore innovation outsourcing depends on knowledge management. For example, firms develop their learning paths to conduct offshore outsourcing from the stage of cost reduction to the stage of knowledge

seeking (Maskell, Pedersen, Petersen, and Dick-Nielsen, 2007). In addition, outsourcing firms initiate the knowledge transfer and knowledge building by absorbing particular knowledge from an external source (Chen, McQueen, and Sun, 2013) and by tapping into foreign knowledge (Berry and Kaul, 2015). Moreover, firms play the role of knowledge organizer and coordinator in offshoring (Asmussen, Larsen, and Pedersen, 2016). Taken together, this stream of research reflects the central notion of the KBV perspective (Grant and Phene, 2022).

2.2 The KBV Perspective, Human Capital, and Offshore Outsourcing Innovation

The KBV perspective assumes that the creation of knowledge (e.g., Nonaka and Takeuchi, 1995), the use of knowledge (e.g., Carlile, 2004), and the integration of knowledge (e.g., Grant, 1996; Spender, 1996) all provide unique inputs for the competitive advantages of a firm. As a firm acquires, protects, and integrates special knowledge, the knowledge is held by individuals and embedded in the human capital within the firm (Bowman and Swart, 2007). According to this view, human capital is recognized as a firm-specific, valuable asset when firms can retain it by expecting and training their employees to acquire firm-specific knowledge and skills (Chen and Huang, 2009). From the KBV perspective, we then argue that offshore innovation outsourcing can be driven by the need of human capital. Indeed, the availability of human capital in a country plays a critical role in that location being selected as an offshoring destination (Graf and Mudambi, 2005; Kedia and Mukherjee, 2009). This suggests that offshore innovation outsourcing is increasingly about sourcing human capital from everywhere (Musteen et al., 2017) and that firms with the capability to integrate knowledge are able to benefit from the available human capital across different offshore units (Belderbos et al., 2021).

2.3 Outsourcing Innovation Activities to Create Value in Developing Countries

Offshore innovation outsourcing is an important value-creation activity for outsourcing firms. In the last three decades, the scholars of global offshoring and outsourcing have witnessed a growing number of European and US firms outsourcing innovation activities to developing countries (e.g., Martínez-Noya, García-Canal, and Guillén, 2012; Sartor and Beamish, 2014; Quan and Chesbrough, 2010). Traditionally, they create value by exploiting and/or augmenting cost advantages. Such advantages

Table 1 The Research Summary of Offshore Outsourcing Innovation

Emphasis	Literature	Main Findings
Cost advantages	• Howells et al. (2008)	• Costs and time are important reasons for firms to outsource R&D.
	• Kapler and Puhala (2011)	• Offshore outsourcing offers an opportunity for the pharmaceutical industry to reduce costs in developing countries.
	• Teirlinck and Spithoven (2013)	• Research collaboration and R&D outsourcing allow firms to exploit economies of scale and scope in both research and development, thereby reducing innovation costs.
Innovation outcomes	• Grimpe and Kaiser (2010)	• There is an inverse U-shaped relationship between R&D outsourcing and innovation performance.
	• Nieto and Rodríguez (2011)	• The offshoring of knowledge services benefits firms from location-specific and specialization advantages to improve innovation performance.
	• Bertrand and Mol (2013)	• Offshore outsourcing leads to more positive innovation outcomes.
Institutional contexts	• Lu et al. (2008)	• Institutions impose rules for legitimacy, serve as a source of knowledge, and allocate incentives and resources for innovation.
	• Martínez-Noya et al. (2012)	• Technological and international expertise are required in order to outsource R&D in developing economies.
	• Sartor and Beamish (2014)	• Informal institutions influence an MNE's strategy of offshoring innovation in emerging markets.
	• Buss and Peukert (2015)	• Firms must address value appropriation hazards when conducting R&D outsourcing.
	• Martínez-Noya and García-Canal (2018)	• Sharing R&D suppliers with competitors results into the disadvantages in countries with weak IPR protection.
	• Bruno et al. (2021)	• MNE innovative performance will be enhanced when the firm's R&D activities are based in locations where IPR protection is stronger.
Knowledge management	• Maskell et al. (2007)	• Offshore outsourcing of a corporation goes through a sequence of stages towards sourcing for knowledge and innovation.
	• Chen et al. (2013)	• An offshoring model concentrates on absorbing the particular knowledge from an external source and applying it into a belief system.
	• Berry and Kaul (2015)	• High-performing firms seek to develop new capabilities by tapping into foreign knowledge.
	• Asmussen et al. (2016)	• Firms acquire and accumulate architectural knowledge to accommodate for the added coordination requirements associated with offshoring.
	• Rodgers et al. (2019)	• The offshoring of R&D activities can provide MNEs with unique competitive advantages and access to foreign knowledge resources.
	• Grant and Phene (2022)	• Fragmenting the value chain can take account of local expertise and integrate globally distributed knowledge to develop global new products that require accessing local knowledge.

include lower labor costs and high-quality infrastructures, leading firms to not only enter but also operate in the developing countries (Demirbag and Glaister, 2010). Moreover, Yang and Jiang (2007) show that some developing countries provide other cost advantages stemming from cheap access to minerals and high labor productivity. From the KBV position, we further assert that the reasons why firms outsource innovation to developing countries, even in those with weak IPR protection, actually go beyond labor costs, high-quality infrastructures, and cheap minerals to pursue human capital.

On the one hand, firms have a strong need of human capital for conducting innovation activities. These activities include Information and Technology (IT) and software development, R&D, product design, and engineering services, which are knowledge-intensive and require skilled labor and human capital. For example, the IT companies' decisions on outsourcing location choices are bound by their specific needs for skilled technicians worldwide (Graf and Mudambi, 2005). Also considered is the specialized knowledge, capabilities, and skills of contract providers. For instance, the computer system manufacturers such as Dell and Lenovo have relied on their East Asia contract providers that specialize in different knowledge areas such as optics, storage, monitors, and vocal technology (Saxenian, 2002); some pharmaceutical companies often source to and work with contract providers who specialize in biotechnology and genomic knowledge, which entails the specific training of employees to effectively run the drug development process (Howells et al., 2008). Moreover, outsourcing parts of clinical trials requires that skilled scientists perform time-consuming codifiable tasks in the drug discovery portion of pharmaceutical R&D (Kapler and Puhala, 2011). In other words, firms depend on human capital which refers to the specialized knowledge, capabilities, and skills performed by the employees of offshore contract providers.

On the other hand, developing countries provide low-cost and high-skilled human capital. For instance, MNCs make R&D investment in developing counties, such as China, in order to enjoy the abundant supply of a cheap workforce and talented labor (Li and Scullion, 2006). Lewin et al. (2009) also find that the firm's decisions about offshoring innovation in developing countries are driven by the need to access qualified engineers. Since talented labor and qualified employees can be associated with higher levels of R&D investment, education, and training, the abundant supply of human capital is crucial for firms to outsource innovation in developing countries. Compared with developed countries,

developing countries not only have cost advantages but also can provide an abundance of human capital that influences firms' innovation and value creation. This is because firms need both cost savings to generate advantages and talented labor to invent new products and processes (Holmes et al., 2016; Papanastassiou, Pearce, and Zanfei, 2020). Simply put, the low-wage and highly skilled knowledge workers in developing countries attracts the firms seeking cost advantages as well as human capital to make offshore investments. The access to local talent pools and human capital then becomes a critical driver for firms to create value when outsourcing innovation activities in developing countries even with weak IPR protection. Accordingly, we propose the baseline hypothesis:

Hypothesis 1: Developing countries have a greater likelihood to be selected for outsourcing innovation activities when they have the greater availability of low-cost, high-talented human capital.

2.4 Capture the Value of Outsourcing Innovation Activities in Developing Countries

Although developing countries might offer low-cost and high-talented human capital, firms normally confront the issue of value capture and misappropriation particularly when outsourcing innovation activities to the countries with weak IPR protection. As developing counties have been characterized by relatively weak IPR protection and ineffective legal systems, the latter can increase the cost of enforcing contracts in developing countries (Xie et al., 2013). The lack of legal protection can further cause severe problems of IPR infringement (Schotter and Teagarden, 2014). For instance, firms' proprietary information and intellectual knowledge can be easily stolen by suppliers or third parties when there is no strongly legal IPR protection (Zhao, 2006). Moreover, firms will be at risk particularly when the weak IPR protection facilitates the leakage of proprietary information and intellectual knowledge, which can be obtained and leveraged by their competitors (Holmes et al., 2016; Huang and Chiu, 2020; Nandkumar and Srikanth, 2016; Weng and Tseng, 1995). This means that firms might lose some tacit knowledge to other firms. This also poses the risk that firms might lose their competitive advantage. Therefore, the use of managing mechanisms to capture the value and protect the IPR of outsourcing innovation activities in developing countries has become an important issue (Berry, 2017; Gooris and Peeters, 2016; Papanastassiou et al., 2020).

2.4.1 Disaggregation and Task Specificity

As outsourcing implies partitioning activities based on knowledge (Takeishi, 2002), outsourcing innovation entails disaggregation insofar as firms partition, disaggregate, and allocate their activities across organizations (Contractor et al., 2010). Specifically, disaggregation means that a firm separates a certain innovation activity into many finer portions and tasks. Each task might perform independently and separately while each with specific knowledge contributes to the same innovation activity. For instance, a R&D activity can be separated into different portions and tasks ranging from blue-sky research to basic research, to applied research, to development, and to supportive work (Andersson and Pedersen, 2010). In addition, disaggregation also means that a firm identifies specific tasks which can be offshored (Jensen et al., 2013).

Take the pharmaceutical industry as an example. Some pharmaceutical companies from developed countries disaggregate and outsource their R&D tasks, including the analysis of chemical components and the process of component screening, to developing countries while they keep the genetics research and new drug development near their headquarters (Contractor et al., 2011). Some pharmaceutical companies also distribute the preparation of test batches and clinical testing tasks for the same new drug across a number of countries and contract providers (Kapler and Puhala, 2011). Since these specific tasks are assigned and distributed to each contract provider working separately from the others without communication, each task thus becomes specific to the vendor and can be termed as task specificity.

Following the above discussions, we propose that task specificity offers a mechanism for outsourcing firms to capture the value from contract providers in the developing countries with weak IPR protection. Firstly, task specificity enables firms to allocate at least some specific, safe, and discrete portions of their innovation activities across countries and to increase the productivity by taking advantage of the foreign knowledge embedded in the human capital of offshore contract providers (Kedia and Mukherjee, 2009). Secondly, task specificity enables firms to acquire tacit inputs from contractor providers when innovation activities involve high levels of tacit knowledge, creativity, and intangible assets (Buckley, Craig, and Mudambi, 2019; Kapler and Puhala, 2011). Thirdly, task specificity enables firms to utilize the global configuration of tacit knowledge and specific capabilities that resides in different organizations and companies spread

across different locations (Contractor et al., 2010; Mukherjee et al., 2013). With respect to enhancing the value from outsourcing innovation activities, task specificity helps firms obtain immediate cost-cutting benefits and manage the human capital of external contract providers.

At the same time, task specificity also lowers the risk of knowledge leakage. As firms can disaggregate their innovation activities into many finer portions and tasks, some of which being performed in offshore locations and others performed at home, the intellectual property generated in the weak IPR location is still protected because it creates value only after combining with those generated at other locations and at home. For example, firms can separate a whole R&D activity into different tasks with little stand-alone value and distribute some tasks to address their concerns about the location of weak IPR protection (Quan and Chesbrough, 2010). Firms can also lower the imitation risk by contracting out more specific tasks that have less market value than generic ones (Buss and Peukert, 2015). In this fashion, task specificity can reduce the incentive of potential defectors including contractor providers with knowledge of the focal firm's technologies to cheat in the countries with weak IPR protection. Even though an individual contract provider has access to the outsourcing a firm's technologies, the access is only limited to a small portion of the total proprietary information which is specific to the task. For one thing, the proprietary information in one contract provider is limited and constrained without the information of others (Gooris and Peeters, 2016; Quan and Chesbrough, 2010). For another thing, the proprietary information about a whole innovation activity can likewise be separated just as the activity can be separated into different tasks underlying their own specificity (Berry, 2017; Martínez-Noya and García-Canal, 2018).

Since an outsourcing firm can use task specificity to allocate specific portions of its innovation activity across countries, it can access and manage the human capital of contract providers in developing countries. At the same time, since the focal firm only allows each contract provider to access a small portion of the total proprietary information, the costs for coordinating all the information will increase. As such, firms could disaggregate and outsource different tasks of an innovation activity to the countries with weak IPR protection and still capture most of the value from outsourcing innovation by the designing of task specificity. Therefore, we propose the following hypothesis:

Hypothesis 2: The developing countries with the greater availability of low-cost,

high-talented human capital have more likelihood to be selected for outsourcing high-task-specificity innovation activities than for outsourcing low-task-specificity innovation activities.

2.4.2 Interdependence and Project Modularity

Although an outsourcing innovation activity can be disaggregated into independent, discrete, and specific tasks, there is still a possibility that some tasks within an activity cannot be specifically divided but are instead highly interdependent. First and foremost, there are difficulties of decomposing some tasks due to interdependent components (Sanchez and Mahoney, 1996) and an overlapping division of labor (Adner and Kapoor, 2010; Gulati and Singh, 1998). For instance, Thomke and Kuemmerle (2002) have elaborated two tasks–analoging and screening–which are highly interdependent in the drug discovery process. Kumar, van Fenema, and von Glinow (2009) also indicate that the globally distributed activities, tasks, and assignments are either more or less interdependent with each other. According to Thompson (1967), interdependence is related to a need for achieving concerted action. While two or more tasks are interdependent, one's performance may be affected by the change of the other or by the need of both to interact with each other (Crowston, 1997). Furthermore, the outcomes of these tasks need to be brought together or integrated to produce the intended product or service (Kumar et al., 2009), which leads to the construction of a module (e.g., Baldwin and Clark, 1997, 2000; Pil and Cohen, 2006). While a module consists of many components, a modular system is made up of many modules which are largely independent across one another. In addition, the boundaries between modules can be settled in different locations and organizations (von Hippel, 1990). Moreover, each module becomes specific to the system; making these modules non-specific will cause a loss of performance (Schilling, 2000).

In light of this perspective, we define project modularity as a module integrating interdependencies among different outsourcing tasks. We argue that besides specifying tasks, the designing of project modularity could be another alternative mechanism for firms to capture the value from outsourcing innovation activities in weak IPR protection countries. Project modularity is based on a clear division of labor between the outsourcing firm, with the architectural knowledge of a whole modular system, and the contract provider, with the specific knowledge of a module and a modularized task (Saxenian,

2002). Project modularity is also based on a unique technology or knowledge which requires investment in a significant amount of human capital. To complete the modularized project, specifically, the contract provider is responsible for the investment in human capital consisting of scientists and technicians with the proper experience, knowledge, and skill. The low-cost and high-talented human capital in the developing countries just support the offshore contract providers to provide knowledge sourcing services and activities, especially considering the high investment costs in skilled and experienced workers and also the increasing shortage of talent in developed countries (Lewin et al., 2009). As outsourcing firms delegate the responsibilities of investment to external contract providers by the designing of project modularity, they can further access the specific and distinct knowledge owned by the contract providers (Zirpoli and Becker, 2011). In addition, a modularized project could be switched quickly from one location to another. This implies that firms can take advantage of sourcing opportunities and benefits from agglomeration economies (Albertoni, Elia, Massini, and Piscitello, 2017). In addition, by outsourcing different modularized projects, the firm also increases its opportunities to interact with different contract providers who have specific knowledge and to integrate their knowledge into the whole modular system (Elia, Massini, and Narula, 2019; McDermott, Mudambi, and Parente, 2013).

By designing project modularity, outsourcing firms may also worry less about the leakage of knowledge. Firstly, since a modular system integrates independent modules, it creates a black box to hide knowledge by putting a different part of knowledge to each module (Baldwin and Henkel, 2015), which makes imitation more difficult. When a firm outsources several projects with a modular project design and to different contract providers, the contract providers are prevented from accessing, not to mention imitating the whole system (Fleming and Sorenson, 2001). Designing project modularity also involves firms employing several contract providers for different and independent modularized projects. This means that providers can all participate without the need to work as a team with any others or even without the awareness of what the other providers are doing (Kumar et al., 2009). Given that project modularity minimizes the need for communication and interdependence between contract providers, it decreases the risk of information leakage among those providers (Martínez-Noya and García-Canal, 2011) and the exposure of propriety information to third parties (Albertoni et al., 2017).

On the whole, outsourcing firms play the role in integrating different modules into a whole system. They invest in the architectural knowledge on the basis of understanding the interdependencies between modules and the activities surrounding the system so as to access to the specific and distinct knowledge owned by the contract providers (Henderson and Clark, 1990; von Hippel, 1990). Outsourcing firms can also use project modularity to hide knowledge, lower the need of communication among contract providers, and set up barriers to imitation when they outsource innovation activities offshore. As such, the design of project modularity for an outsourcing innovation activity can be another mechanism to capture value and to prevent the knowledge leakage from outsourcing innovation activities in the developing countries with weak IPR protection. Therefore, we propose the following hypothesis:

Hypothesis 3: The developing countries with the greater availability of low-cost, high-talented human capital have more likelihood to be selected for outsourcing high-project-modularity innovation activities than for outsourcing low-project-modularity innovation activities.

3. Methods

3.1 Data and Sample

To test our premises and hypotheses, we collect the primary data from the ORN survey. Having been used in many studies (e.g., Elia et al., 2019; Gooris and Peeters, 2016; Larsen et al., 2013; Lewin et al., 2009; Massini et al., 2010), the ORN survey contains the adoption of different offshoring governance modes and the location choice of different offshoring projects by firms, an important feature allowing us to observe the decisions on outsourcing innovation activities. Specifically, the ORN survey covers questions including why firms offshored, with what projects and what governance modes (e.g., offshore outsourcing or captive offshoring), in which year, and where. Based on the survey, we construct the dataset consisting of 336 firms that conducted 914 offshore innovation activities, defined as software development, product design, engineering, IT, analytical and knowledge service, and R&D, across 74 countries from 1990 to 2009. Since we focus on the firms' decisions about offshore outsourcing, we finally define 202 firms that outsourced 465 innovation activities.

In addition to the survey-based information collected from the ORN survey, we adopt two additional data sources from IEF and WEF to capture the extent of IPR protection in each country. Combining the IEF and WEF data with the ORN survey creates leeway to mitigate the potential bias due to common method variance (Chang, van Witteloostuijn, and Eden, 2010). Regarding the IEF, we use its index of Property Protection that includes five components: physical property rights, intellectual property rights, strength of investor protection, risk of expropriation, and quality of land administration. The index measures the extent to which the legal systems and institutions of a given country allow people and organizations to accumulate private property and intellectual property freely and securely (Miller and Kim, 2017). We define a country with weak IPR protection when its IEF index is below the average plus one standard deviation in an observed year.

Apart from the IEF index, we also use the WEF Executive Opinion Survey on the protection of IPR in a country as a robustness check. The WEF index measures the protection of IPR in a country by collecting executives' opinions regarding how strong the protection of intellectual property is in their countries (Schwab, 2017). Both indices have been used to provide researchers with a qualified measure of the IPR protection at the country level (Zhao, 2006).

3.2 Estimation

In this study, we investigate the probability of outsourcing an innovation activity in weak IPR countries instead of strong IPR countries. We include all outsourcing innovation activities and examine cross-activity variances when controlling for firm characteristics. Since we observe the firms of offshoring innovation activities only for those that did outsource offshore, there is the issue of sample selection in our analysis of the probability of where to outsource. Endogeneity is another potential limitation given that not all firms are completely free to engage in their outsourcing practices and location choices (Hamilton and Nickerson, 2003; Wooldridge, 2012).

Following previous studies on the internationalization of innovation (Chen and Hsiao, 2013; Lo and Hung, 2015), we use the two-stage Heckman model to correct for the potential biases of sample selection and endogeneity. Following Heckman (1979), we conduct a probit regression to estimate the probability that a focal firm adopts an offshore outsourcing mode instead of a captive offshoring mode to conduct innovation activities

offshore in the first-stage estimation. In the first-stage estimation, specifically, we adopt the following equation:

$$Z_{ij} = W_{ij}\alpha + S_{ij}\gamma + \vartheta_i, \quad (1)$$

where

Z_{ij} is the dependent variable with a binary value of 1 if firm i adopted the offshore outsourcing mode for the outsourced project j; 0 otherwise.

W_{ij} includes independent and control variables that influence firm i's choice to adopt the offshore outsourcing mode for the outsourced activity j.

S_{ij} includes the instrumental variables.

ϑ_i is the error term.

The second-stage estimation is our main model, in which we introduce the inverse Mills ratio (a selection correction term constructed by the results from the first-stage estimation) to control for the potential bias of sample selection in estimating the effects of independent variables and moderating variables on the dependent variable. In the second-stage estimation, we then estimate the following equation:

$$Y_{ij} = X_{ij}\,\beta + C_i\,\sigma + \epsilon_i, \quad (2)$$

where

Y_{ij} represents the dependent variable with a binary value of 1 if firm i chose the weak IPR protection country to outsource activity j; 0 otherwise.

X_{ij} represents independent, moderating, and control variables affecting the dependent variable (the location choice of firm i to outsource activity j).

C_i is the inverse Mills ratio, a selection correction term, denoting the probability density function over the cumulative distribution function of a distribution.

ϵ_i is the error term.

Our dataset also includes firm-activity observations. A given firm might have multiple associated observations, meaning that the analyzed data may result in a clustered structure. To overcome this potential problem, we chose a maximum likelihood estimator by controlling fixed factors and constant parameters with clustered robust standard errors (Greene, 2000). This two-stage model can also correct for the endogeneity caused by unobserved and fixed factors (Wooldridge, 2012).

3.3 Measurement

3.3.1 The First-Stage Estimation (Selection Model)

Dependent variable The dependent variable "Entry mode" is a binary variable indicating that a firm either uses the governance mode of offshore outsourcing or the captive offshoring mode to conduct its innovation activity in a host country (Lewin et al., 2009). Specifically, the value of the dependent variable equals 1 if a firm chose the offshore outsourcing mode; otherwise, 0.

Instrument variables Based on the ORN survey on the drivers of offshoring, we use three items as the instrumental variables: "Enhancing capacity for innovation," "Increasing organizational flexibility" and "Part of a larger global strategy". While these three items are good predictors of the governance mode which firms use to conduct offshore innovation activities, they do not necessarily predict the location choice (Lo and Hung, 2015).

3.3.2 The Second-Stage Estimation (Main Model)

Dependent variable The dependent variable "*Location choice*" is a binary variable indicating whether a firm outsources its innovation activity to either a host country with weak IPR protection or a host country with strong IPR protection. Following previous research (e.g., Zhao, 2006), we define a country as a weak IPR location when its value of IEF index is below the average plus one standard deviation in the observed year. Specifically, the value of the dependent variable takes 1 if a firm chose to outsource an innovation activity to a country with weak IPR protection; otherwise, 0.

Independent variables The independent variable is "*Low-cost talent*" used in estimating location advantages with respect to the stock of human capital perceived by a focal firm. We use two items of the ORN survey— "Low cost of labor" and "Talent pool available"— to capture the concept of low-cost and high-skilled talent (Lewin et al., 2009; Massini et al., 2010). According to the ORN survey, both items are measured using a Likert 5-point scale. We apply the geometric average of these two items to measure the availability of low-cost high-talented human capital in a given country as perceived by a focal firm. Simply put, the higher the value of this measure, the more human capital a focal firm could access in the offshore location.

Moderating variables Two moderating variables are "*task specificity*" and "*project*

modularity". We firstly define task specificity as a focal activity performing only a discrete, independent, and specific task at the offshore location (Contractor et al., 2010). We then define project modularity as a focal activity performing high interdependence across tasks (Baldwin and Henkel, 2015) and involving several tasks in an entire process (Gooris and Peeters, 2016). To separate task specificity from project modularity, we follow Elia et al. (2019) to use one item from the ORN survey as the conditional item: Does/did this implementation involve one or more discrete tasks or entire processes? This item offers binary results – Yes or No. If the answer to this item is "No," the value of task specificity is calculated based on the Likert 5-point scale score of the ORN item: "The implementation requires personnel with company-specific knowledge involving routines, procedures, products and services." In contrast, if the answer to the conditional item is "Yes," the value of project modularity is calculated based on the score of another ORN item: "Loss of synergy across firm activities." According to Elia et al. (2019), the low value of losing synergy across firm activities means high project modularity. For the purpose of measurement, we reverse the coding of this item.

Control variables We include the control variables reflecting location, firm, industry, and project characteristics in this study. First, we control the locational characteristics such as "*Turnover*," "*Geographic proximity*," "*Co-location* (with a manufacturing plant)," "*Access to local market*," "*Governance incentive*," "*Cultural similarity*," and "*Language similarity*" (Gooris and Peeters, 2016). These seven variables are measured by the ORN survey questions using a Likert 5-point scale. We then control firm characteristics such as "*Nationality*," "*Firm experience*," "*Firm size*;" we take a focal firm's nationality into consideration because several studies have found that firms from different nationalities presented different offshoring patterns (Massini et al., 2010). We use a dummy variable to measure the nationality of a focal firm. Specifically, the value equals 1 if a focal firm's nationality is US; otherwise 0. We control a focal firm's past experience because recent research has also found that a firm's experience could affect its choice of offshore location (Larsen et al., 2013). We measure firm experience by calculating the number of years from the time of the focal firm's first launch to the year of the focal project outsourced. Since big firms have more resources to manage offshoring activities in different countries (Massini et al., 2010), we control firm size by measuring the logarithm of the focal firm's employees in the home country. Besides, we also control "*Industry*" in this study since

the industry where a focal firm operates also influences offshoring decisions (Lewin et al., 2009). Finally, we use dummy variables to control the different types of innovation activities outsourced offshore. We also include the calendar years from 1990 to 2009 when a focal firm conducted offshore outsourcing in order to control the possible temporal effects during the observed period.

4. Results

4.1 Statistical Analysis and Hypothesis Test

Using the Heckman two-stage model with probit estimation, we test the relationships between the hypothesized effects of variables and the location choices of outsourcing innovation activities. The descriptive statistics of each variable and the bivariate correlation between any two variables are listed in Table 2. As the analysis includes an investigation of the firm's location choice between strong and weak IPR protection countries, the correlation results show a low potential of common method bias (Brannick, Chan, Conway, Lance, and Spector, 2010). Nevertheless, we further conduct the CFA analysis to detect the potential of common method bias (Brannick et al., 2010). The results of the CFA analysis show a significant difference between the one-factor model and multi-factor model ($\triangle\chi^2 = 1350$, $df = 15$, p-value < 0.01), which indicates no common method bias in this study. Table 3 includes the models predicting the firm's choice between each type of country for an outsourcing innovation activity. The estimated coefficients represent the probability of choosing weak compared to strong IPR protection countries. Statistically, a positive coefficient of a variable means an increase in the probability of choosing the weak IPR protection countries while a negative coefficient means that outsourcing an innovation activity is more likely to happen in the strong IPR protection countries.

According to Model 1 (a null model containing only the control variables) of Table 3, the results show that there is the negative coefficient of turnover ($\beta = -0.87$, p-value < 0.05). This indicates that the turnover of local employees increases the likelihood of choosing countries with strong IPR protection to outsource an innovation activity. Cultural similarity also increases the likelihood of outsourcing an innovation activity in the strong IPR protection country ($\beta = -1.96$, p-value < 0.05). Specifically, the negative coefficient of

cultural similarity means that cultural difference between home country and host country decreases the likelihood of choosing countries with weak IPR protection to outsource an innovation activity. Further, a significant negative coefficient of the inverse Mills ratio indicates that unobserved characteristics underlying a decision on offshoring influence the location choices of those firms that did use the offshore outsourcing mode relative to those that used the captive offshoring mode (β = -1.19, p-value < 0.05). In addition, the negative effect suggests that a firm's intention to use the offshore outsourcing mode based on unobserved characteristics increases the likelihood of choosing countries with weak IPR protection (Dolton and Makepeace, 1987).

According to Model 2 in Table 3, we find support for the hypotheses related to the impact of available human capital on location choices for outsourcing innovation activities. First of all, we include the variable of human capital "*Low-cost talent*" in Model 2 of Table 3. In this model, the positive coefficient of low-cost talent means that the availability of low-cost highly-talented human capital increases the likelihood of choosing countries with weak IPR protection to outsource an innovation activity (β = 3.06, p-value < 0.01). That said, if a country with weak IPR protection could provide abundant human capital, it is more likely to be selected as an outsourcing location. Therefore, Hypothesis 1 is supported.

To test Hypothesis 2, we introduce one moderating variable ("*Task specificity*") into the estimation. We use the mean centered interactions between low-cost talent and task specificity in estimating the probability of outsourcing an innovation activity to a country with weak IPR protection. The results are listed in Model 3 of Table 3. In this model, the interaction of low-cost talent with task specificity shows that the interaction between low-cost talent and task specificity is statistically significant and positive (β = 2.59, p-value < 0.05). The positive estimated coefficient indicates that the design of task specificity can enhance the effect of low-cost talent on the likelihood of choosing the country with weak IPR protection for innovation outsourcing. Accordingly, Hypothesis 2 is supported.

To test Hypothesis 3, we introduce another moderating variable "*Project modularity*" to estimate the probability of choosing a location to outsource an innovation activity. We use the mean centered interaction terms between low-cost talent and project modularity. The results are listed in Model 4 of Table 3. The results show that the interaction between low-cost talent and project modularity is statistically significant and positive (β = 2.57,

Table 2 Descriptive Statistics and Correlation Coefficients

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 *Location choice*	0.69	0.41	1.00	0.13	0.12	0.01	-0.05	-0.04	-0.04	-0.15	0.02	-0.03	-0.06	-0.08	0.28	0.17	0.01	0.14
2 *Low-cost talent*	3.15	1.23	0.13	1.00	0.11	0.02	-0.01	0.06	-0.01	-0.06	0.09	0.15	0.13	-0.02	0.15	0.16	0.04	0.17
3 *Task specificity*	2.35	1.48	0.14	0.13	1.00	-0.02	-0.04	-0.01	-0.03	-0.06	-0.07	0.01	0.05	-0.01	0.05	0.13	-0.01	-0.15
4 *Project modularity*	2.19	1.29	0.01	0.01	-0.04	1.00	-0.11	0.15	0.07	0.14	0.01	0.13	0.10	0.03	0.05	0.02	-0.05	-0.01
5 *Turnover*	3.11	1.62	-0.07	-0.02	-0.05	-0.14	1.00	-0.11	-0.04	-0.01	-0.06	-0.12	-0.07	-0.13	-0.17	-0.12	0.14	0.05
6 *Geographic proximity*	2.66	1.42	-0.06	0.05	-0.01	0.13	-0.13	1.00	0.15	0.20	0.16	0.06	0.09	0.06	0.03	0.03	-0.03	-0.07
7 *Co-location*	2.41	1.47	-0.05	-0.02	-0.04	0.06	-0.05	0.14	1.00	0.11	0.11	0.12	0.23	0.06	0.01	0.05	-0.07	0.02
8 *Access to local market*	2.65	1.41	-0.16	-0.07	-0.09	0.12	-0.02	0.18	0.09	1.00	0.17	0.15	0.19	0.11	-0.16	-0.11	-0.05	0.01
9 *Governance incentive*	2.30	1.32	0.03	0.10	-0.05	0.02	-0.04	0.05	0.13	0.16	1.00	0.16	0.15	0.06	0.11	0.06	-0.06	-0.05
10 *Cultural similarity*	2.80	1.30	-0.05	0.14	0.00	0.12	-0.14	0.07	0.10	0.10	0.15	1.00	0.21	0.04	0.03	0.06	-0.03	-0.09
11 *Language similarity*	3.03	1.34	-0.07	0.12	0.03	0.09	-0.09	0.08	0.19	0.17	0.13	0.18	1.00	-0.09	0.04	0.02	-0.11	-0.08
12 *Firm experience*	2.50	0.73	-0.10	-0.02	-0.03	0.02	-0.14	0.05	0.04	0.10	0.05	0.02	-0.07	1.00	0.21	0.16	0.01	0.03
13 *Firm size*	7.28	3.11	0.25	0.12	0.04	0.04	-0.15	0.02	0.00	-0.14	0.13	0.02	0.03	0.18	1.00	0.19	-0.13	-0.02
14 *Nationality*	0.52	0.50	0.18	0.16	0.15	0.03	-0.10	0.02	0.04	-0.11	0.06	0.07	0.01	0.14	0.17	1.00	0.04	-0.15
15 *Industry*	0.26	0.44	0.00	0.03	-0.02	-0.06	0.12	-0.04	-0.09	-0.05	-0.07	-0.03	-0.10	0.00	-0.12	0.03	1.00	-0.02
16 *Project type*	0.41	0.61	0.13	0.16	-0.16	-0.01	0.03	-0.09	0.01	0.00	-0.06	-0.11	-0.09	0.01	-0.03	-0.16	-0.02	1.00

Note: N = 465; Correlation with absolute value greater than 0.15 are significant at $p < 0.05$, and those greater than 0.19 are significant at $p < 0.01$ in the two-tailed test; The Pearson's Correlation Coefficients are shown in the lower left matrix and the Spearman's Rank Correlation Coefficients are shown in the upper right matrix.

Table 3 Parameter Estimates of Heckman Probit Model in the Second-Stage Analysis (Reference Group: Strong IPR Countries)

	Model 1	Model 2	Model 3	Model 4	Model 5 (Ordinary regression)	Model 6 (2SLS regression)
Human Capital						
Low-cost talent		3.06***	3.95***	3.58***	2.43	2.93***
		(0.79)	(0.88)	(1.11)	(1.53)	(0.90)
Task specificity			2.57**			
			(1.27)			
Low-cost talent			2.59**			
X Task specificity			(1.15)			
Project modularity				0.98**		
				(0.48)		
Low-cost talent				2.57*		
X Project modularity				(1.50)		
Turnover	-0.87**	-0.72**	-0.80**	-0.66***	-0.76**	-0.78**
	(0.33)	(0.30)	(0.34)	(0.23)	(0.32)	(0.33)
Geographic proximity	0.31	0.22	0.08	-0.08	0.23	0.20
	(0.20)	(0.47)	(0.39)	(0.37)	(0.49)	(0.50)
Co-location	0.20	0.24	0.43	-0.02	0.25	0.21
	(0.29)	(0.40)	(0.46)	(0.49)	(0.42)	(0.43)
Access to local market	-0.91	-0.90	-0.63	-0.77	-0.88	-0.95
	(0.69)	(0.67)	(0.62)	(0.85)	(0.69)	(0.72)
Governance incentive	-0.01	-0.01	-0.23	0.01	-0.01	-0.01
	(0.48)	(0.49)	(0.54)	(1.00)	(0.51)	(0.53)
Cultural similarity	-1.96**	-2.11**	-2.48***	-2.71***	-2.15**	-2.26**
	(0.93)	(0.92)	(0.88)	(0.71)	(0.90)	(0.97)
Language similarity	0.48	0.50	0.60	1.04**	0.53	0.43
	(0.52)	(0.58)	(0.62)	(0.50)	(0.59)	(0.60)
Firm experience	0.99	1.11*	1.30	-3.76***	1.28**	1.05*
	(0.65)	(0.67)	(0.89)	(0.94)	(0.65)	(0.60)
Firm size	-0.14	-0.07	0.20	0.80**	-0.08	-0.05
	(0.25)	(0.29)	(0.44)	(0.39)	(0.27)	(0.38)
Dummies						
Nationality	Included	Included	Included	Included	Included	Included
Industry	Included	Included	Included	Included	Included	Included
Project type	Included	Included	Included	Included	Included	Included
Temporal effects	Included	Included	Included	Included	Included	Included
Inverse Mills ratio	-1.19**	-1.28*	-1.52*	-0.62*		
	(0.56)	(0.68)	(0.89)	(0.36)		
Constant	1.25**	1.49**	1.69*	0.87**	2.14***	2.32***
	(0.55)	(0.07)	(0.93)	(0.43)	(0.61)	(0.68)
Pseudo R^2	0.56	0.70	0.74	0.75	0.66	0.68
Wald test	276.14	249.05	257.95	319.72	245.33	250.71
Log pseudolikelihood	-41.32	-30.08	-26.74	-25.45	-31.12	-31.69
F-Statistic		24.75***	23.62***	23.52***	23.01***	22.39***
Mean VIFs	4.032	4.315	4.906	4.918	4.422	4.478

Note: N = 465; * p < 0.1, ** p < 0.05, *** p < 0.01; Clustered robust standard errors reported in parentheses; A positive (negative) coefficient of a variable shows that it increases (decreases) the probability. *F*-Statistic for the null hypothesis of equal year or firm effects.

p-value < 0.1). The positive coefficient of the interaction term indicates that the design of project modularity can increase the effect of low-cost talent on the likelihood of choosing the country with weak IPR protection for innovation outsourcing. As such, Hypothesis 3 is supported.

4.2 Additional Robustness Checks

A long-standing conundrum in the research on internationalization of innovation is why firms differ in their decisions and subsequent actions. The issue of endogeneity arises when such decisions are associated with firms' abilities. In such situations, ordinary regression analyses and their results are likely biased (e.g., Chen and Hsiao, 2013; Lo and Hung, 2015). To check upon the estimation of Hypothesis 1, we conduct an ordinary regression to show whether bias might exist. In Model 5 of Table 3, specifically, we can see that the main effect of human capital on the entry of developing countries disappears if sample selection bias is not corrected by including the inverse Mills ratio. Thus, we believe that the two-stage modeling approach used in this study is appropriate. Furthermore, we account for the potential endogeneity of entry choices by using a two-stage least squares (2SLS) regression. To identify the first stage of our 2SLS regression in Model 6 of Table 3, we use the instrument variable of enhancing capacity for innovation (Lo and Hung, 2015). We expect firms with the motive of enhancing capacity for innovation to pursue more outsourcing activities but did not expect that enhancing capacity for innovation affects the focal firm's preference on location choices. Model 6 reports the results of the second-stage 2SLS regression (the first-stage regression is not shown but available upon request), showing that the previously estimated effects remain the same. Furthermore, we run additional multinomial logistic regressions with the analysis of marginal effects to inspect the estimation of Hypothesis 1. The estimated coefficients represent the utility of choosing very strong IPR protection countries (i.e., IPR values greater than the mean plus two standard deviations), strong IPR protection countries (i.e., IPR values greater than the mean plus one standard deviation but smaller than the mean plus two standard deviations), or weak IPR protection countries (i.e., IPR values smaller than the mean plus one standard deviation). The robustness checks support the previous findings. More specifically, the availability of low-cost talent decreases the likelihood of outsourcing innovation activities to very strong IPR protection countries (β = -0.04, *p*-value < 0.01) and strong

IPR protection countries (β = -0.08, p-value < 0.01) while increasing the likelihood of outsourcing innovation activities to the weak IPR protection countries (β = 0.12, p-value < 0.01). Overall, these robustness checks provide significant support for Hypothesis 1.

Following Aiken and West (1991), we further draw the interaction plot and conduct the Hausman test to check upon the estimation of Hypothesis 2. For this, we first define the regression of high task specificity by using the value of task specificity above the mean plus one standard deviation, and the regression of low task specificity by using the value of task specificity below the mean minus one standard deviation. Given the estimation of low-cost talent on the likelihood of location choices (in terms of odds ratios), we draw the interaction graph to illustrate two models: high-task-specificity and low-task-specificity regressions (shown in Figure 1). According to Figure 1, the slope of the high-task-specificity regression is steeper than the slope of the low-task-specificity regression. We then calculate the simple slope of the high-task-specificity regression that is significantly positive (β = 2.56, p-value < 0.01) and the slope of the low-task-specificity regression that is also significantly positive (β = 1.64, p-value < 0.01). Although both slopes are positive, we further conduct the Hausman test that shows that both regressions are significantly different (χ^2 = 4.9, p-value < 0.05). Moreover, we follow Hoetker (2007) to evaluate the joint impact of low-cost talent and task specificity for the three groups of very strong IPR protection countries, strong IPR protection countries, and weak IPR protection countries from our data (see Figure 2). Consistent with Hypothesis 2, Figure 2 shows that the marginal impact of adding task specificity on the availability of low-cost talent is positive when outsourcing an innovation activity to weak IPR protection countries. Specifically, adding task specificity on low-cost talent is associated with a 4.60% drop in the odds of outsourcing to very strong IPR protection countries, whereas there is about a 5.77% increase in the odds of outsourcing to the weak IPR protection countries. According to these robustness checks, the previous estimations and results of Hypothesis 2 are confirmed and supported.

We then plot the interaction graph, conduct simple slope analysis, run the Hausman test, and evaluate the joint impact of the independent variable and moderating variable for the robustness checks of Hypothesis 3. Firstly, we define the regression of high project modularity by using the value of project modularity above the mean plus one standard deviation and the regression of low project modularity by using the value of project

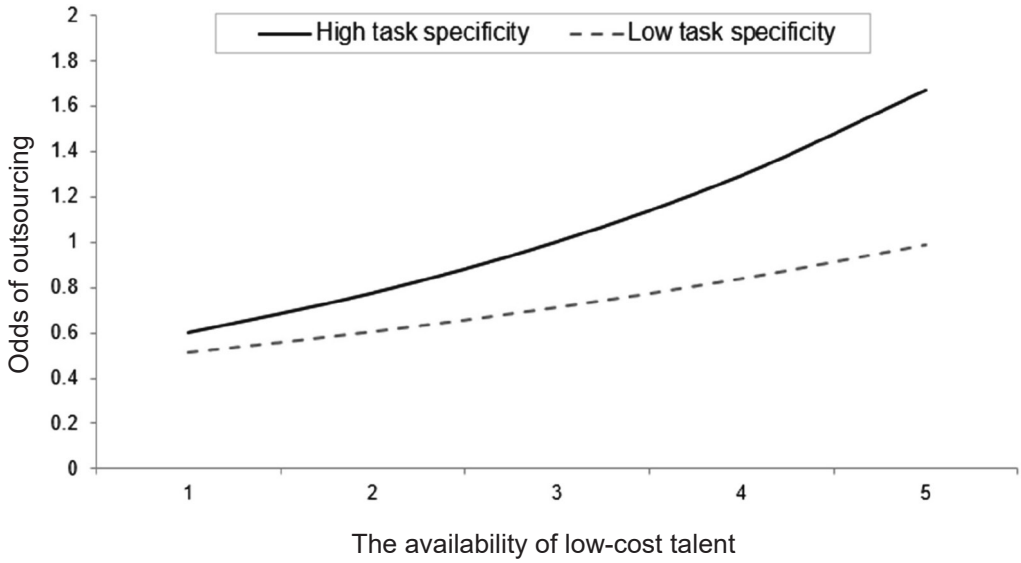

Figure 1 The Positive Moderating Effect of Task Specificity

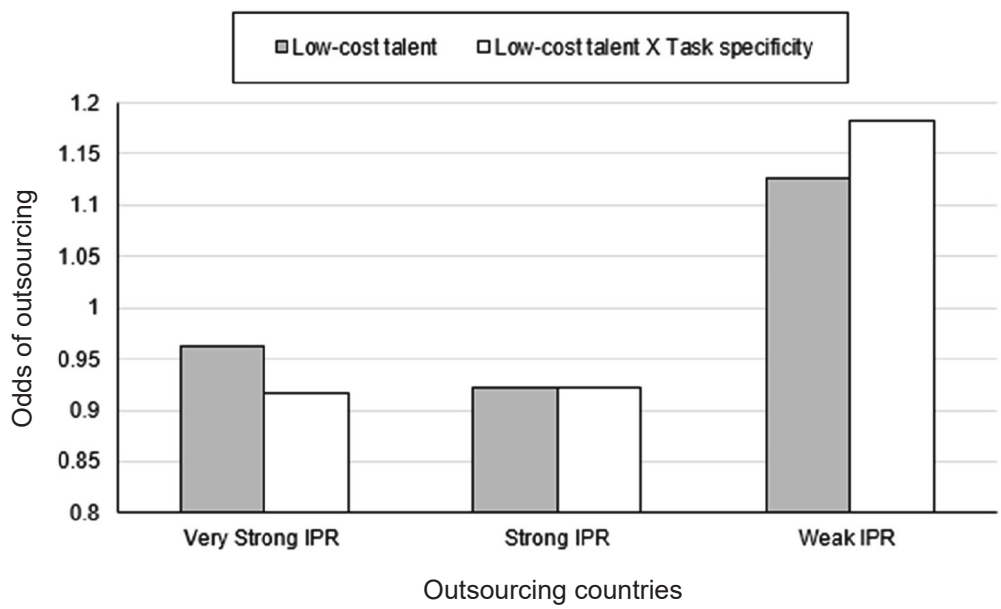

Figure 2 The Moderating Effects of Task Specificity Vary across Three Groups of Countries

modularity below the mean minus one standard deviation. Given the estimation of low-cost talent on the likelihood of location choices (in terms of odds ratio), we then draw the interaction graph to illustrate the high- project-modularity and low- project-modularity regressions (Figure 3). Figure 3 shows that the slope of the high-project-modularity regression is steeper than the slope of the low-project-modularity regression. While the slope of the high-project-modularity regression is significantly positive (β = 1.95, p-value < 0.01), the slope of the low-project-modularity regression is also significantly positive (β = 1.57, p-value < 0.01). After the Hausman test, nonetheless, the result shows that both are significantly different (χ^2 = 12.27, p-value < 0.01). We also evaluate the joint impact of low-cost talent and project modularity for the three country groups (very strong IPR protection countries, strong IPR protection countries, and weak IPR protection countries) in Figure 4. Specifically, adding project modularity to the availability of low-cost talent could lead to a 1.60% drop in the odds of outsourcing an innovation activity to the very strong IPR protection countries and a 1.8% increase in the odds of outsourcing an innovation activity to the weak IPR protection countries. These are consistent with Hypothesis 3.

Lastly, the mean of the Variance Inflation Factors (VIFs) for each model in Table 3 ranges from 4.032 to 4.918, while none of the single VIF is excessively greater than 10 (O'Brien, 2007). That is, the multicollinearity is relatively mild. Overall, these results corroborate the expectations formulated in the previous hypotheses.

5. Discussions and Conclusions

5.1 Main Findings

Conducting the empirical test on the ORN, IEF and WEF data, we validate our major premises and show several intriguing findings. As firms strategically make their decisions on outsourcing innovation activities to the countries with weak IPR protection, we observe systematic differences across different countries and their impacts on the choice of an outsourcing location. Specifically, we adopt the KBV perspective to examine human capital, in terms of low-cost and high-skilled talent, as one of location differences in developing countries. We then explore the effect of human capital on the location choice when firms decide to outsource innovation activities. As a result, we find that

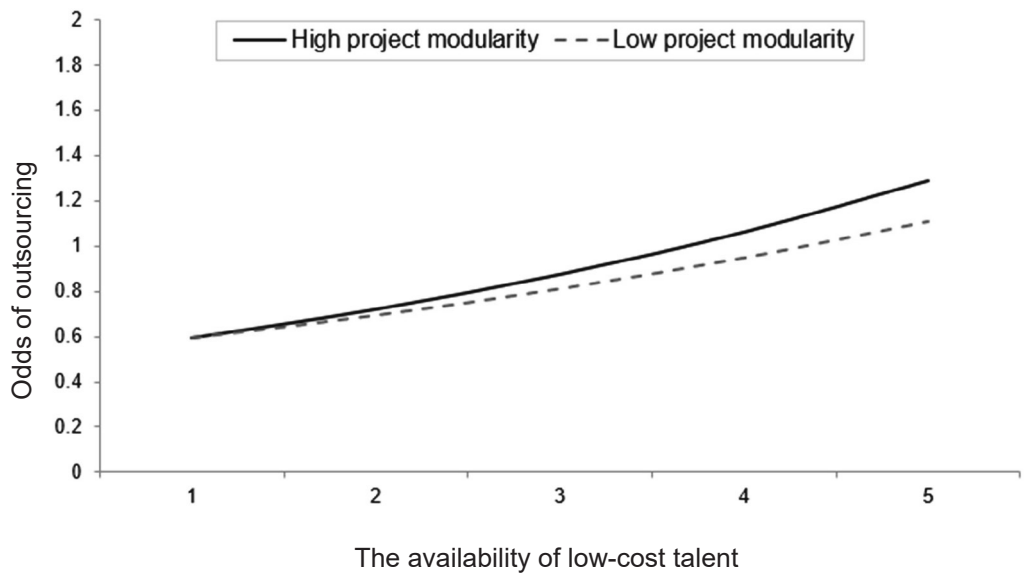

Figure 3 The Positive Moderating Effect of Project Modularity

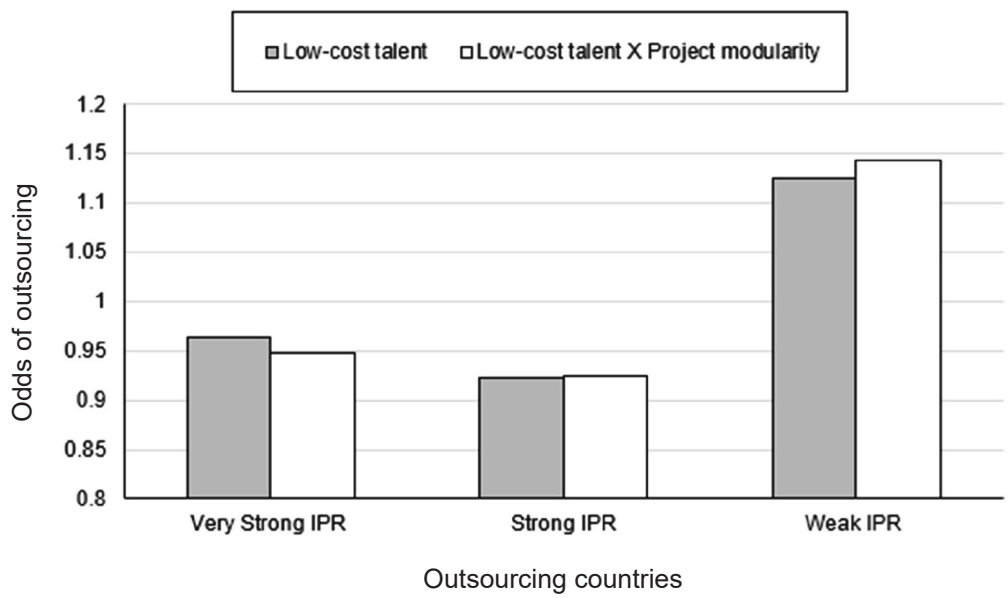

Figure 4 The Moderating Effects of Project Modularity Vary across Three Groups of Countries

the availability of low-cost and high-skilled talent is the significant factor driving firms to outsource innovation activities in developing countries. Apart from cost advantages which can be exploited in developing countries, we find that human capital's influence on innovation activities and outcomes is crucial to outsourcing innovation in those countries, even if they have weak IPR protection. In other words, the availability of abundant low-cost and high-skilled technicians, scientists, and engineers required for innovation activities at relatively low costs drives firms to create value by offshore innovation outsourcing in developing countries.

In addition, firms that outsource innovation activities in developing countries with weak IPR protection may also confront issues of value capture and appropriation. Since outsourcing implies partitioning activities based on knowledge, a firm can design task specificity or project modularity as the managing mechanism to capture the value of outsourcing innovation in weak IPR protection countries. According to the empirical results, we did find systematic differences in the design of task specificity and project modularity for the innovation activities outsourced to weak IPR protection countries compared to strong IPR protection countries. For one thing, task specificity enables firms to allocate independent tasks that require tacit knowledge that resides in human capital to offshore vendors while at the same time limiting each vendor's access to the complete knowledge of an innovation activity. Thus, task specificity can be used to manage offshore innovation outsourcing and to lower the risk of knowledge leakage. Our findings support this assertion and show that an activity of high task specificity, compared to that of low task specificity, can strengthen the effect of human capital on the likelihood of outsourcing innovation in a country with weak IPR protection. Also, project modularity enables firms to assign interdependent tasks that require specific domains of knowledge from different offshore vendors, thereby creating a complex of interdependent tasks that can hide proprietary information from one vendor to another. Therefore, project modularity can be another mechanism that firms can use to capture value from offshore innovation outsourcing. According to our empirical results, an activity of high project modularity, in contrast to an activity of low project modularity, can further enforce the positive effect of human capital on the likelihood of outsourcing innovation in a weak IPR protection country.

Taken together, an outsourcing firm acts as an organizer of knowledge to access and manage human capital when conducting offshore innovation outsourcing in developing countries. The availability of human capital in developing countries is then attractive for outsourcing firms to relocate their innovation activities offshore. An outsourcing firm can not only create value by accessing human capital, but also capture value by managing human capital within, between, and among offshore partners. That is, the positive impact of human capital on location choice is strengthened when a project is designed with a managing mechanism, either task specificity or project modularity, to capture the value of outsourcing innovation in developing countries with weak IPR protection.

5.2 Theoretical Contributions

Our study offers several contributions. First, we respond to the recent call for KBV research on global strategy in IB literature (e.g., Grant and Phene, 2022) by adopting the KBV perspective as the theoretical lens to explore the topic of offshore outsourcing innovation in the field of IB research. Drawing on the KBV perspective, we also complement previous TCE and RBV studies on offshore outsourcing innovation. Since neither TCE nor RBV can fully explain outsourcing cases featuring higher levels of disaggregation, we develop a theory of human capital and knowledge partitioning on the basis of KBV as our major argument to explain why firms take the risk of outsourcing innovation and how they manage it, particularly in developing countries.

Secondly, we extend the research on the internationalization of innovation by examining various innovation activities outsourced to developing countries that can provide abundant human capital for outsourcing firms to create and capture value. While previous studies on offshore outsourcing innovation have focused on cost advantages (e.g., Teirlinck and Spithoven, 2013), innovation outcomes (e.g., Bertrand and Mol, 2013; Nieto and Rodríguez, 2011), institutional contexts (Sartor and Beamish, 2014), and knowledge management (e.g., Chen et al., 2012), we adopt the KBV perspective to investigate the impact of human capital on the decision of offshore innovation outsourcing. With a better understanding of the way that firms are able to create value through outsourcing innovation in developing countries, we can contribute to the body of research on the internationalization of innovation as well as offshore outsourcing innovation.

Thirdly, we contribute to the knowledge on the drivers, moderators, and choices of

offshore locations, which has been downplayed in the IB literature (e.g., Chen and Hsiao, 2013) till now. As some developing countries might offer low-cost and high-talented human capital, they might also pose the risks of weak IPR protection and ineffective legal systems. Since weak IPR protection can erode the appropriable value of offshoring innovation in those countries and might deter firms from outsourcing innovation activities to those countries (e.g., Contractor et al., 2010; Gooris and Peeters, 2016), we propose two moderating mechanisms–task specificity and project modularity–on the basis of knowledge and activity partitioning (e.g., Takeishi, 2002). Using both task specificity and project modularity, we show how firms protect their proprietary information and knowledge when outsourcing innovation in countries with weak IPR protection. Although it is well established in the literature that internalization allows firms to capture value from their innovation activities in the countries with weak IPR protection (e.g., Alcácer and Zhao, 2012; Almeida and Phene, 2004; Feinberg and Gupta, 2009; Zhao, 2006), this stream of research offers only a partial explanation as internalization may not be realistic, feasible, or efficient, particularly when firms outsource innovation activities offshore. To complement this stream of research, we also provide another theoretical lens to show how firms may use alternative mechanisms to affect their offshore outsourcing strategies in countries with weak IPR protection.

Last but not least, we provide theoretical grounding and empirical supports for studies of global outsourcing and offshoring on IPR protection, which propose the use of a valid mechanism in designing tasks to mitigate possible risks of knowledge leakage (e.g., Belderbos et al., 2021; Gooris and Peeters, 2016; Jensen et al., 2013; Srikanth and Puranam, 2011). As we examine the impact of task specificity on offshore innovation outsourcing in countries with weak IPR protection, task specificity is understood as disaggregating an innovation activity into independent specific tasks. When outsourcing only a discrete task of the entire innovation activity to an individual contract provider that is unable to put the whole system together, the risk of knowledge leakage is limited (Contractor et al., 2010). This is, therefore, one type of task design that leverages specific, safe, and discrete portions of an innovation activity. Another way to minimize knowledge leakage is by project modularity when interdependent tasks cannot be specifically divided. By modularizing interdependent tasks in a project, project modularity can help outsourcing firms decrease the incentive and mitigate the risk of knowledge leakages from contract

providers (Baldwin and Henkel, 2015; Brusoni and Prencipe, 2001; Fixson and Park, 2008). This is another type of task design with interdependencies among different tasks. By introducing these two mechanisms used to manage offshore outsourcing innovation, we shed some light on the recent research into global outsourcing and offshoring strategies.

5.3 Managerial and Policy Implications

Our findings have several managerial implications. Our estimates of the offshore outsourcing locations indicate that within our sample, sourcing locations are influenced not only by cost advantages but also by human capital in host countries. This suggests that developing countries can be selected as the sourcing locations when they are able to supply low-cost and high-skilled talent. In addition, our finding about the positive impact of task specificity and the positive effect of project modularity on the relationship between human capital and location choice also make important reading for managers contemplating offshore outsourcing innovation, especially for firms that plan to outsource innovation in developing countries with weak IPR protection. Our findings should also be of interest to policy makers. Our study suggests offshore innovation outsourcing in developing countries may not only be driven by cost advantages but also by a firm's desire to obtain human capital. Thus, programs that would enhance human capital in a firm's home country might be a way of reducing its propensity to outsource innovation activities abroad. This can be particularly applicable for the knowledge-intensive industries.

5.4 Limitations and Future Directions

In addition to our contributions and implications to research on offshore innovation outsourcing activities and location choices, we need to acknowledge several inherent limitations which might affect the generalizability and validity of the empirical findings in this study. First, we use the ORN survey data to measure major variables such as low-cost talent, turnover, task specificity, and project modularity. The valid measures might be limited in this study. In addition, some potential errors of measurement in the survey data might also influence the estimated effects of the major covariates. Future research could incorporate other variables to measure latent concepts and include more control variables to improve these limitations and overcome bias. For example, future researchers may build a more comprehensive model by also considering the effect of informal institutions

on offshore location choices (e.g., Anand, McDermott, Mudambi, and Narula, 2021). Moreover, we observe only the sample companies within the ORN survey, so future studies should explore the same research issues in other contexts to test the research concept, question, and framework of this study so as to enhance generalizability.

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The authors would like to thank for the valuable comments and suggestions received from the editor and two anonymous reviewers of *NTU Management Review* and from the participants of the 2021 Management Concept and Application Conference. The authors would also like to thank Farok Contractor and Ajai Gaur for their insightful advices on the early draft of this paper. Last but not least, the authors want to acknowledge the offshoring data released by the ORN at Duke University and the research funding supported by the MOST (Project #110-2410-H-011-003-MY2) in Taiwan.