



# Managing from a distance in international purchasing and supply

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## Abstract

International purchasing and supply management (PSM) teams have long faced the visibility and understandability challenges of managing geographically dispersed and culturally distant suppliers. Problems arising from inadequate monitoring and control over suppliers can be attributed to geographical and cultural distance, capability gaps, weak institutions, and supply market dynamism. With transaction costs theory as our lens, we examine how international geographically and culturally distant purchasing and supply management (PSM) teams control emerging economy suppliers with formal management controls. We use interview survey data on 339 international customer-Chinese supplier relationships using supplier perceptions of the extent to which performance measurement and monitoring practices are used by their primary customer in the purchase reorder decision and control. The results demonstrate that the cultural and, to a lesser extent, geographical distance between the customer and the supplier is associated with more extensive use of formal management controls. Also, we find the relationship between geographical or cultural distance and the importance of performance measurement is strengthened for suppliers of complex components.

**Keywords** Supply chain management · Geographical distance · Culture distance · Formal management control mechanisms · Strategic resources · Transaction costs theory

## 1 Introduction

Since 1990, efficient management of supply chain activities across international networks has been the major aspect of globalization (König and Spinler 2016). As a result, supply chains have become more vigorous, complex, and costly (Janvier-James 2012). For international purchasing and supply management (PSM) teams, successfully managing geographically dispersed and culturally distant suppliers is critical (Beugelsdijk et al. 2018; Cao et al. 2018). Specifically, PSM teams face problems from inadequate monitoring and control

over their emerging market suppliers, attributed to geographical and cultural distance, capability gaps, weak institutions, and supply market dynamism (Kosmol et al. 2018). For example, greater geographical distance may diminish the efficacy of purchasing practices aimed at improving operational performance, while cultural distance can hide critical capability gaps because of differences in the collective norms and values held by the transacting parties. Practitioner reports similarly cite the problems associated with managing global operations with supply chain visibility and the complexity of managing from a distance frequently cited as a root cause of control and coordination difficulties ((Deloitte 2020; Akbari and Do 2021; Road 2019; Umbenhauer et al. 2019). The academic literature on the subject also describes several challenges that are associated with achieving successful international supply, such as unexpected costs, delays, and complexities, due to geographic and cultural distances, collectively referred to as location-specific complexity (Quintens et al. 2006; Holweg et al. 2011; Subramanian et al. 2015).

Yet while studies have shed light on the influence of distance on cross-border control practices, the field is hampered by both theoretical and empirical ambiguity (see Beugelsdijk et al. 2018; Wiengarten and Ambrose 2017; Lorentz et al.

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2018; Boscari et al. 2018 for recent reviews). First, while the impact of cultural distance on the efficacy of purchasing and management practices has been subject to frequent inquiry, geographical distance has been explored to a lesser extent (Wiengarten and Ambrose 2017; Gerbl et al. 2016). Second, the few studies that have examined both cultural and geographical distances have produced mixed results. For example, both Gooris and Peeters (2014) and Kaufmann and Carter (2006) found support for their cultural (but not geographical) distance arguments. In contrast, Handley and Benton (2013) find support for their impact of geographical (but not cultural) distance argument. These concerns for how PSM teams control geographically, and culturally distant emerging-market suppliers are explicitly evaluated in this study.

This study focuses on the consumer electronics supply chain in which thousands of component suppliers supply to the world's leading electronics brands (see Fig. 1). This study uses transaction costs theory to examine how geographically, and culturally distant purchasing and supply management teams control Chinese electronic component suppliers with formal management controls. We focus on how important performance measurement is in the purchase reorder decision and the extent to which monitoring routines are used to control the supplier. We use data taken from 339 face to face interviews with upstream (second-and third-tier) electronics component suppliers who supply to the world's major electronics OEMs/brands (e.g., Samsung, Apple, Foxconn, Panasonic, Philips, ZTE, Huawei, Sony, Canon, HTC, Lenovo, and TCL).<sup>1</sup>

Our analysis of the electronics component global supply chain offers several advantages. First, there is significant product variation ranging from generic components to highly customized circuit boards and mechanical modules. Second, the electronics industry is one of the few industries in which major OEM customers integrate hundreds of components sourced from many suppliers, often using multi-sourced relationships. These suppliers are already approved in their customer's selection process and receive frequent orders from their customers, which are seen as a reward for their performance. They are subject to frequent monitoring and evaluation on multiple attributes, including technology, cost, delivery, quality, and service (Wu and Chien 2008).

This study makes contributions to three areas. First, this study provides insights into the drivers of control in global supply chains, cited as a gap in the literature (Gereffi and

Lee 2012). Specifically, we add to the ongoing debate in the literature on how geographical and cultural distance influences the management control of international supply chains (e.g., Gooris and Peeters 2014; Handley and Benton 2013; Kaufmann and Carter 2006). While this literature has examined the effect of location- and task-specific complexity factors on informal management control mechanisms, its consideration of formal management control mechanisms has been limited. We contribute by empirically testing the influence of location-specific complexity on the use of formal management control mechanisms. Related, we examine the interactive effect of geographical or cultural distance and component complexity to reflect the fact that ordering and monitoring decisions are often jointly dependent on task-specific (component) complexity factors at the firm level in effectively managing distant suppliers (Dibbern et al. 2008; Johnston et al. 2012; Parente et al. 2011). We show that the use of formal management control mechanisms to manage suppliers from a distance depends on both the level of location- and task-specific complexity.

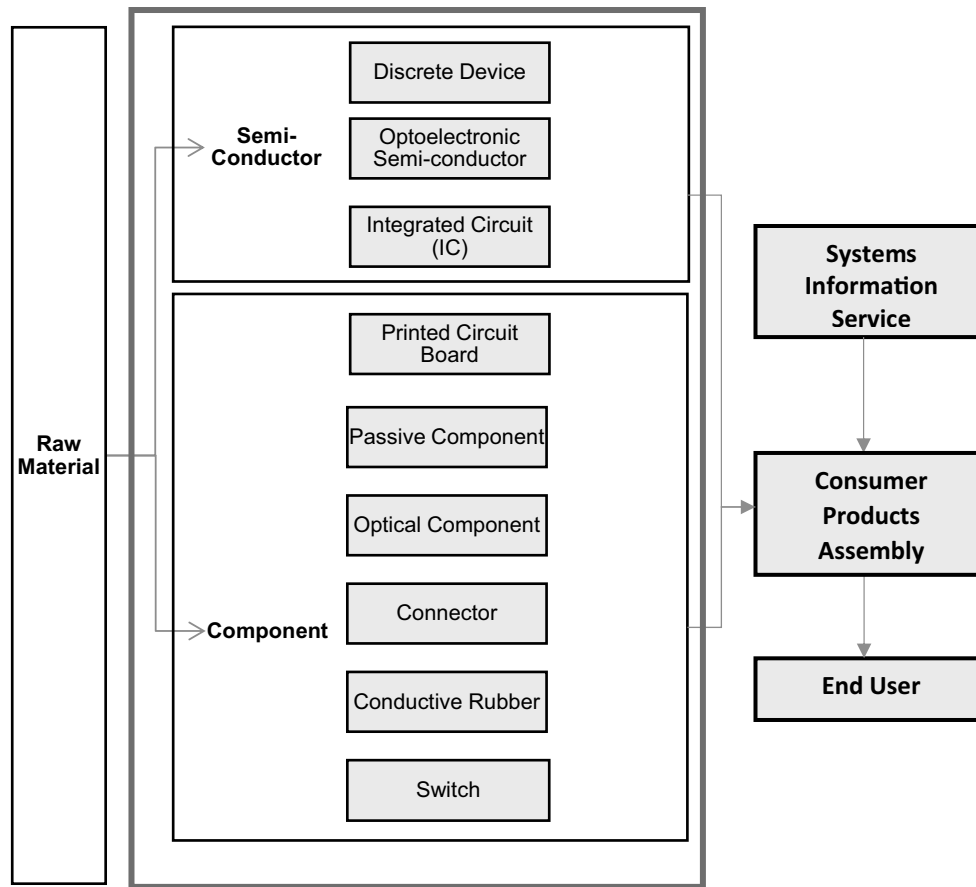
Second, this study contributes to the debate in the literature on whether transactional (i.e., contracting) and relational (i.e., trust) mechanisms act as complementary (Cao and Lumineau 2015; Poppo and Zenger 2002; Liu et al. 2009) or substitutive forces (Wuyts and Geyskens 2005). Our proxy for low levels of relational mechanisms at the country level (i.e., high cultural distance) is substituted by higher levels of transactional mechanisms (formal controls) at the firm level, suggesting a substitution type relationship in the international supply chain setting. Our findings provide a flavor for thinking about one of the origins of interfirm trust—cross-country similarities in shared norms and values—and how it is related to the use of formal controls. Finally, we add to the ongoing debate on how suppliers in weak institutional contexts such as emerging economies are managed from a distance (Dibbern et al. 2008; Johnston et al. 2012). This is especially important as emerging economies represent the dominant part of the world's global supply chains (Ghemawat 2018).

## 2 Literature review

The global supply chain and services offshoring literature have explored various variables that proxy for location-specific complexity, such as geographical distance, cultural distance, and psychic distance (see Table 1).<sup>2</sup> Following the methodology recommended for a systematic literature

<sup>1</sup> These major customers were most frequently identified during the interviews. The global electronics manufacturing market represents one of the highest-value supplier networks in the world (over 10,000 suppliers and over \$US2.4 trillion in trade in 2012) (Custer and Custer-Topai 2012). The magnitude of these figures suggests that upstream component suppliers are an important link in the manufacturer's supply chain.

<sup>2</sup> We acknowledge that other measures of distance potentially exist such as economic, financial, political, administrative, demographic, knowledge, connectedness, professional, functional, temporal, identity and organizational. However, these dimensions have been less well explored in the global supply chain literature (See Lorentz et al. 2018 for a review).



**Fig. 1** Electronics supply chain context of the manufacturing suppliers interviewed in this study

review, no timeframe restrictions were applied (Tranfield et al. 2003). We limited the literature review to empirical studies of manufacturing supply chains and offshore service providers published in quality peer-reviewed journals (Denyer and Tranfield 2009). Next, the inclusion/exclusions criteria list was developed: We included English-written articles focused on global sourcing. The main keywords were "distance," including geographical, cultural, and psychic distance. We also filtered articles based on the key word "control," including management, formal, informal, behavioral, output, clan, social, bonding, relational, trust, learning, coordination, integration, obstacles, knowledge transfer, costs, contracts, entry strategy, mechanisms, and

communication. We also reviewed recent literature reviews on the association between location complexity and various organizational practices such as service outsourcing (Handley and Benton (2013, pp. 111–112), global purchasing practices (Beugelsdijk et al. 2018; Lorentz et al. 2018; Wiengarten and Ambrose 2017), choice of international alliance structure (Lopez-Duarte et al. 2016), and operations management (Boscari et al. 2018). Out of the hundreds of papers represented, less than 20 have examined the association of geographical and/or cultural distance and controls in managing supply chain partners and offshore service providers. We include such papers in our literature summary.

**Table 1** Panel A. Studies investigating the impact of home-host country distance on control choices in the *manufacturing* supply chain setting

| Author (year)   | Research Setting   | Institutional context of the supplier | Distance construct  |                 | Management control mechanism construct |                              |   | Hypotheses   | Hypotheses supported?   |
|---|--|---------------------------------------|---------------------|-----------------|--|------------------------------|---|--|---|
|   |  |                                       | - Geographical (GD) | - Cultural (CD) | Formal controls                        | Informal controls / outcomes | Other   |  |   |
| <b>Studies proposing a positive relationship between distance and control choices</b> |  |                                       |                     |                 |  |                              |   |  |   |
| Current study   | Interview survey data from 339 Chinese suppliers who supply to international B2B customers | Emerging market                       | CD                  |                 |  | X                            |   |  |   |
| <b>Studies proposing a negative relationship between distance and control choices</b> |  |                                       |                     |                 |  |                              |   |  |   |
| Nassimbeni (2006)   | Survey data from 78 Italian enterprises belonging to various industries                    | Italian and foreign suppliers         | CD                  |                 |  |                              | Obstacles to international sourcing                             | CD → (+) obstacles to international sourcing   | Yes   |
| Kaufmann and Carter (2006)  | Survey data from supplier managers of manufacturing firms located in the U.S. and Germany  | Developed market                      | CD/GD               |                 |  |                              | Social bonding; Extendedness of the buyer-supplier relationship | CD/Geographic complexity → (+) (1) the extendedness of the buyer-supplier relationship; → (-) (2) the degree of social bonding | No for GD in both H1 and H2; No for CD in H1; Yes, for CD in H2 |
| <b>Studies proposing CD/GD as a moderator</b>   |  |                                       |                     |                 |  |                              |   |  |   |

Table 1 (continued)

| Author (year)         | Research Setting   | Institutional context of the supplier | Distance construct  |                 |  | Management control mechanism construct                   |                              |  | Hypotheses supported?  |
|-----------------------|--|---------------------------------------|---------------------|-----------------|--|--|------------------------------|--|--|
|                       |  |                                       | - Geographical (GD) | - Cultural (CD) |  | Formal controls  | Informal controls / outcomes | Other  |  |
| Cheung et al. (2010)  | Upstream supply chain. Survey data from 136 cross-border vertical dyads from emerging and developed countries.               | Emerging and developed markets        | CD                  |                 |  |  | Relationship learning        | CD (-) moderates the effects of environmental factors and inter-organizational properties on relationship learning                           | No, CD is not a significant moderator                          |
| Omar et al. (2012)    | Upstream supply chain. Survey data from 103 manufacturing firms based in the United States that source from global suppliers | Emerging and developed markets        | CD                  |                 |  | Collaboration, coordination, global supplier integration |                              | CD (-) moderates the effects of supply chain orientation on (1) collaboration, (2) operational coordination, (3) global supplier integration | No, CD is not a significant moderator for all three hypotheses |
| Parente et al. (2011) | Upstream supply chain. Survey data from 111 automobile suppliers in Brazil   | Emerging market                       | CD                  |                 |  | Supplier integration                                     |                              | CD (-) moderates the effects of (1) supplier integration; (2) product modularization on dynamic capability creation                          | Yes  |

**Table 1** Panel B. Studies investigating the impact of home-host country distance on control choices in the *service* outsourcing setting

| Author (year)   | Research Setting  | Institutional context of the service provider | Distance construct  |                 |  | Management control mechanism construct   |                           |  | Hypotheses supported?                            |
|---|---|---|---------------------|-----------------|--|--|---------------------------|--|--|
|   |   |   | - Geographical (GD) | - Cultural (CD) |  | Formal controls  | Informal control/outcomes | Other  |  |
| <b>Studies proposing a positive relationship between distance and control choices</b> |   |   |                     |                 |  |  |                           |  |  |
| Dibbern et al. (2008)   | Case studies of six software projects that are offshored to Indian vendors in a large German financial service institution                              | Emerging market                               | CD/GD               |                 |  | Client extra costs (control, coordination costs; knowledge transfer, design costs) |                           | Offshore-specific client-vendor CD/GD → (+) extra costs for the client             | Yes, for CD/GD                                   |
| Gooris and Peeters (2014)   | Secondary data of 949 implementations launched between 1995 and 2009 by firms located in the U.S., the Netherlands, Germany, Belgium, Spain, and the UK | Emerging and developed markets                | CD/GD               |                 |  | Probability of using Captive Mode – Vertical integration                           |                           | CD/GD → (+) the choice of a captive offshore control mode over an out-sourced mode | Yes, for CD; Marginal for Time zone distance     |
| Handley and Benton (2013)   | Survey data from 102 partnerships between U.S. customer and their domestic/foreign service provider   | Emerging and developed markets                | CD/GD               |                 |  | Control and coordination costs   |                           | CD/GD → (+) control and coordination costs   | Yes, for GD; No for CD                           |
| Zhang et al. (2003)   | Downstream marketing channels. Survey data from 142 U.S. exporting manufacturers  | Unknown                                       | CD                  |                 |  | Reliance on relational norms and trust   |                           | CD → (+) the level of relational norms/trust held by the manufacturer              | No, but reliance on relational norms → (+) trust |

Table 1 (continued)

| Author (year)   | Research Setting  | Institutional context of the service provider | Distance construct | Management control mechanism construct |   |       | Hypotheses   | Hypotheses supported?   |
|---|---|---|--------------------|--|---|-------|--|-------------------------|
|   |   |   |                    | Formal controls                        | Informal control/outcomes                     | Other |  |                         |
| <b>Studies proposing a negative relationship between distance and control choices</b> |   |   |                    |  |   |       |  |                         |
| Ellram et al. (2008)  | Service outsourcing. Case studies based on interviews with ten supply management executives                                 |   | CD/GD              |  | Offshore service provider selection contracts |       | CD/GD proxies for high degree of management risk → reluctance to offshore  | Yes, for CD/GD          |
| Nes et al. (2007)   | Downstream marketing channels Survey data from 161 exporting companies in Norway  | Unknown                                       | CD                 |  | Trust, Communication                          |       | CD → (-) (1) the exporter's trust in its local foreign middleman; → (-) (2) communication between the exporter and its local foreign middleman | Yes, for both H1 and H2 |
| Bönte (2008)  | Partnerships—Survey of a sample of aeronautical firms based in Germany  | Unknown                                       | GD                 |  | Interfirm trust                               |       | GD → (-) inter-firm trust between business partners  | Yes                     |
| Choudhury and Sabherwal (2003)  | Project Outsourcing. Five cases on outsourced information system development projects based in the U.S., Colombia and India | Emerging and developed markets                | GD                 | Behavior control                       | Clan control                                  |       | Co-location needed to develop clan control   | Yes                     |
| Bello and Gilliland (1997)  | Downstream marketing Channels Survey data from 160 U.S. manufacturing firms that export via foreign distributors            | Unknown                                       | PD                 | Output control                         | Process control                               |       | PD → (-) the use of output controls over foreign distributors  | Yes                     |

Table 1 (continued)

| Author (year)                                 | Research Setting   | Institutional context of the service provider | Distance construct | Management control mechanism construct |  |                | Hypotheses  | Hypotheses supported?   |
|---|--|---|--------------------|--|--|----------------|---|-------------------------|
|   |  |   |                    | Formal controls                        | Informal control/outcomes                          | Other          |   |                         |
| Evans et al. (2008)                           | Downstream marketing channels. Survey data from 204 international retail operations based in the U.S., U.K. and Germany.                               | Developed markets                             | PD                 |  |  | Entry strategy | PD → (-) (1) adoption of high-cost high-control entry strategies; → (+) (2) adaptation of the retail strategy to the foreign market | Yes, for both H1 and H2 |
| Griffith et al. (2014)                        | Downstream marketing channels Survey data from 151 export managers   | Unknown                                       | PD                 | Adaptation of detailed contracting     | Adaptation of relational behavior                  |                | PD → (-) (1) the adaptation of relational behavior; → (-) (2) the adaptation of detailed contracting                                | No for H1; Yes, for H2  |
| Katsikeas et al. (2009)                       | Downstream marketing channels Survey of 214 importing firms trading with overseas manufacturers, primarily from the EU, North America and the Far East | Emerging and developed markets                | PD                 |  | Trust in the supplier                              |                | PD → (+) (1) the level of exporter opportunism; → (-)(2) the level of importer trust in the exporter                                | Yes, for both H1 and H2 |
| <b>Studies proposing CD/PD as a moderator</b> |  |   |                    |  |  |                |   |                         |
| Johnston et al. (2012)                        | Downstream distribution channels Survey data from 150 importers based in Taiwan  | Emerging market                               | PD                 |  | Relational outcomes of bidirectional communication |                | PD (-) moderates the effects of communication frequency and bidirectional communication on trust and satisfaction                   | Yes                     |



Table 1 (continued)

| Author (year)            | Research Setting   | Institutional context of the service provider | Distance construct | Management control mechanism construct           |  |       | Hypotheses supported?   |
|--------------------------|--|---|--------------------|--|--|-------|---|
|                          |  |   |                    | Formal controls                                  | Informal control/ outcomes   | Other |   |
| Sachdev and Bello (2014) | Downstream marketing Channels Survey data from 248 export manufacturers based in the U.S. with focal intermediaries from diverse industries that exported to several countries | Unknown                                       | PD                 | Monitoring                                       |  |       | PD (-) moderates the positive effects of (1) asset specificity; (2) environment diversity on the use of monitoring/information sharing<br>Yes, for H1; monitoring; No for H1 information sharing; No for H2   |
| Solberg (2008)           | Downstream marketing Channels Survey data from 173 exporting companies based in Norway   | Emerging and developed markets                | CD                 | Relationship quality outcomes of output controls | Relationship quality outcomes of social relationship and clan control mechanisms |       | (H3) When CD is high, product complexity is low, social relationships and flexibility are (+) related to relationship quality; (H4) When both CD and product complexity are high, clan and output controls are (+) related to relationship quality; process control is (-) related to relationship quality-control is negatively related to relationship quality<br>Yes, for both H3 and H4 |

Our literature summary reveals the following: First, we identify five studies examining the relationship between CD and GD and control costs or controls. Of these, only Dibbern et al. (2008) find that both CD and GD are significantly positively related to *client extra costs* (i.e., control and coordination costs; knowledge transfer, and design costs). Gooris and Peeters (2014) find that CD (but not GD) is positively associated with the probability of using a *captive mode of entry*, such as vertical integration. In studies of service providers, Ellram et al. (2008) conclude that both CD and GD may be associated with higher *performance measurement difficulty*, while Handley and Benton (2013) find that GD (but not CD) is positively associated with *control and coordination costs*. In the only study of CD and GD in the manufacturing supply chain setting, Kaufmann and Carter (2006) found that CD is negatively associated with *social bonding* between the customer and supplier.

Second, research examining formal management controls such as performance measurement and monitoring is limited to outsourcing case studies (e.g., Choudhury and Sabherwal 2003) and downstream marketing studies. For example, we identify three downstream marketing studies which have found a direct negative association between *Psychic distance* (which has a CD element) and the use of *output controls* (Bello and Gilliland (1997), the *extensiveness of entry strategy* (Evans et al. 2008), and *detailed contracting* (Griffith et al. 2014). By contrast, most studies examined the informal dimension of control mechanisms such as interfirm trust, social bonding, and communication. The results generally reflect a negative association between geographical and cultural distance and informal management controls. For example, researchers have found that CD is negatively related to *trust* and *communication* (Nes et al. 2007) and that CD is associated with *obstacles to international sourcing* (Nassimbeni 2006). Next, of the two studies that have examined only the impact of GD, Bonte (2008) finds that GD is negatively related to *interfirm trust* in suppliers or customers and Choudhury and Sabherwal (2003) find that co-location is needed to develop *clan controls* with the outsourced vendor. Finally, Katsikeas et al. (2009) find that *Psychic distance* is negatively related to *trust* in the supplier.

Third, the institutional setting of the supplier or service provider has not been systematically accounted for. For example, Western companies source considerable portions of their purchasing spend from suppliers in emerging markets (Najafi et al. 2013), which presents heightened supply risk regardless of the cultural or geographic differences with the customer's country (Steven and Britto 2016; Zsidisin et al. 2016). Zhou and Xu (2012) suggest that detailed contracts are ineffective in containing partner

opportunism in contractually specified areas because of weak institutions in emerging economies, augmenting the need to complement contracts with relational control mechanisms. Thus, a common practice in the literature to sample both developed and developing country suppliers or service providers brings added complications in parsing the effects of geographical and cultural distance and institutional differences on control costs (Meyer and Peng 2016). As Table 1 shows, there are different institutional contexts, with a prominent distinguishing feature being the distinction between developed economy and emerging economy suppliers or distributors/markets. Indeed, only three studies focus on emerging economies (Dibbern et al. 2008; Johnston et al. 2012; Parente et al. 2011). Since prior studies (e.g., Li et al. 2010) have found that weak institutions associated with emerging economies can impact the control of the supply chain, it is worth noting for positioning our study's contribution to the literature.

Fourth, most of the studies that have found support for the geographical and cultural distance hypothesis have focused on the service sector using transaction cost theory (e.g., Handley and Benton 2013). The spirit of transaction cost theory considers the factors that make something more expensive to outsource versus making it internally. And while both services outsourcing and supply chain manufacturing sourcing have high upfront fixed costs such as selection, training, and monitoring systems, the similarity ends there (Ellram et al. 2008). Compared to services outsourcing, manufacturing outsourcing has higher backend variable costs such as ongoing product design updates, quality control inspections, logistical coordination of the physical movement of goods, inventory, and warehouse management, which is in part a function of the level of product complexity (Aitken et al. 2016; Stanczyk et al. 2017). Thus, the generalizability of transaction costs theory consistent findings to the supply chain manufacturing sourcing context may not be as straightforward.

To summarize, while trust appears to be consistently found or argued to be a driver of control arrangements, the evidence is consistent with the negative influence of cultural or geographical distance on control mechanisms in the outsourcing or the global supply chain context. Because differences across institutional and service and manufacturing settings have impacted theory/s of supplier management, further examination of the specific institutional and supply chain contexts is needed to understand the nature of the geographical and cultural distance and management control relationship. This study focuses on emerging economy suppliers, the primary source of manufacturing supply chains.

### 3 Theory and research hypotheses

#### 3.1 Geographical and cultural distance

This study focuses on two location characteristics that bring complexity to the global supply chain: geographical and cultural distances. *Geographical distance* is the number of kilometers between the supplier and the customer. Because of geographical distance, it becomes more difficult or costly for suppliers and customers to interact and communicate face-to-face (Gooris and Peters 2014; Handley and Benton 2013; Homburg et al. 2002; Li and Scullion 2006). As a result, geographically distant exchange parties tend to suffer from lower levels of familiarity and experience higher complexity (Handley and Benton 2013). Research has shown that customers struggle to deal with suppliers far away (Bönte 2008; Knobens and Oerlemans 2006; Li and Scullion 2006; Theng-Lau and Goh 2005; Wafa et al. 1996). *Cultural distance* describes how shared norms and values in one country differ from those in another (Chen and Hu 2002; Hofstede 2001; Kogut and Singh, 1988). Like geographical distance, the cultural distance between the supplier and the customer is also associated with a lower level of familiarity and greater monitoring difficulty, increasing the complexity of the global supply chain. Numerous studies have shown that cultural distance inhibits the interaction between exchange parties, creates misunderstanding, and brings difficulties in collaboration and trust-building (Cheung et al. 2010, 2011; Dyer and Chu 2000; Johnston et al. 2012; Katsikeas et al. 2009; Nes et al. 2007; Nguyen et al. 2021; Sako and Helper 1998).

#### 3.2 Formal management controls

Control strategies must be adopted to reduce supplier opportunism risks and enhance knowledge transfer (Cousins and Menguc 2006). Scholars have proposed their lists of controls in interfirm relationships divided into formal and informal management controls (Wathne and Heide 2000). Formal management controls, which comprise outcome, and behavior-based controls, are widely used in ongoing relationships (Kurtulus et al. 2012; Wathne and Heide 2000). Outcome controls refer to evaluating the supplier's performance according to formal or contracted standards to inform the purchase reorder decision (Krause et al. 2007). We refer to this as *performance measurement* for the purchase reorder decision. Studies have highlighted the importance of performance measurement in formalizing supplier integration, enhancing supplier alignment (Handfield et al. 2015), and facilitating the supplier

management process (Wu and Chien 2008). The five performance measurement dimensions used in supplier evaluation in the electronics industry (and this study) are technology, quality, service, delivery, and cost. Researchers have also referred to this construct as *communication* and *innovation-focused* measures (Cousins and Lawson 2007) and *output monitoring* (Kosmol et al. 2018; Heide et al. 2007).

*Behavior controls* refer to monitoring the supplier's behavior, such as frequent meetings, communications, and training undertaken by the customer for the supplier. They include establishing formal support groups and joint teams to analyze and discuss strategic issues (Ittner et al. 1999). We refer to this as *monitoring practices* (Ittner et al. 1999). Researchers have also referred to this construct as *formal socialization* (Cousins et al. 2006; Lawson et al. 2009), *internal coordination* (Lau 2014), the *monitoring* part of supplier base alignment (Cousins and Lawson 2007; Handfield et al. 2015) and *behavior monitoring* (Heide et al. 2007; Kosmol et al. 2018).

#### 3.3 Influence of geographical and cultural distance on the use of formal management controls

To motivate the distance hypotheses, we rely on transaction cost economics theory, which has been widely used to explain the organizational boundaries of the firm (Anderson and Dekker 2005). Drawing on transaction cost theory (Williamson 1979), location-specific complexity associated with geographical and cultural distance induces information asymmetries between exchange parties (Gooris and Peeters 2014; Handley and Benton 2013; Shenkar 2001), increasing transaction costs and the chances for suppliers' opportunistic behavior (Katsikeas et al. 2009). In general, suppliers hold asymmetric information about the quality of their products and their ability to meet the customer's demands. This information asymmetry is a concern if the distant buyer cannot perfectly observe the supplier's actions, resulting in the potential for the supplier to act opportunistically (Holmstrom 1979). Further, bounded rationality limits partners' writing contingent claim contracts, covering every possible future contingency (Anderson and Dekker 2005; Dekker 2004; Schloetzer 2012). In addition, buyers are likely to overestimate the problems associated with managing suppliers from different cultures because of bounded rationality. Further, information asymmetries and bounded rationality limit partners to write contingent claim contracts, covering every possible future contingency (Anderson and Dekker 2005). Prior research provides evidence that greater control is used in MNCs (Wilkinson et al. 2008) and in-service offshoring (Gooris and Peeters 2014) when there is a higher geographical and cultural distance.

### 3.3.1 Geographical distance

Applied to the supply chain setting, geographical distance leads to a lack of synchronous face-to-face exchange, which helps coordinate the physical flow of materials and components to assembly operations. Manufacturers located at a distance from their component suppliers are likely to lack the experiential knowledge of what, where, and how to find the relevant sources of information to monitor their suppliers' behavior (Sachdev and Bello 2014). Thus, to address the adverse selection problem, *outcome* controls such as performance measurement are likely to be more important for the purchase reorder decisions made from a distance as they are less information intensive. For example, the manufacturer can rely on third-party inspections and deliveries (e.g., incoming materials, in-assembly, and final product quality gates) to assess the supplier's performance to the contract (Kosmol et al. 2018).

Nonetheless, relying on outcome controls alone is not expected to be effective, as the risk of opportunistic behavior on the supplier's part remains. For example, while major brand name customers have contractual stipulations that suppliers must document and report separately every part or material change to their process, suppliers may combine several material changes to cover the seriousness of a change in the supplier's factory. To control against such type of behavior, we will expect that geographically distant customers will not only pay greater attention to performance measurement (outcome) controls but will work closely with the supplier in terms of involving the supplier in product development, sharing information through the use of joint teams, and frequent communication (monitoring practices). Thus, based on the preceding arguments, we propose:

**Hypothesis 1a.** *The importance of performance measurement for order allocation increases with the geographical distance between the customer and supplier locations.*

**Hypothesis 1b.** *The use of monitoring practices increases with the geographical distance between the customer and supplier locations.*

### 3.3.2 Cultural distance

Additional costs are incurred because of cultural differences, especially customer-facing offshore tasks. Similarly, prior studies have found that because of the increased chance of misunderstanding by both parties that result from differences in norms and values, cultural distance complicates the process of organizational learning, inter-partner knowledge transfer, and value creation (Barkema et al. 1996; Beamish and Kachra 2004; Lew et al. 2016; Meschi and Riccio 2008; Simonin 1999; Sirmon and Lane 2004). First,

significant barriers in language and slang usage and lack of an understanding of the organization's values may require more considerable attention by the customer in using outcome controls to ensure that the various contractual stipulations are being met (Ellram et al. 2008, p. 9). While outcome controls can address the adverse selection problem, misunderstandings can occur concerning outcomes as captured by the customer's performance measurement system. Thus, behavior monitoring to explain the meaning and intent behind supplier actions are needed to understand disputes that may arise from outcome controls alone. In this way, outcome controls are communication-intensive because, to be effective, the various targets/outcomes need to be well understood and agreed upon by both parties (Ellram et al. 2008; Bello and Gilliland 1997).

Second, manufacturers working with culturally distant suppliers are more likely to be suspicious of wrongful acts and perceive additional opportunism (Katsikeas et al. 2009). For example, while major brand name customers have contractual stipulations that suppliers must document and report separately every part or material change to their process, suppliers may combine several material changes to cover the seriousness of a change in the supplier's factory. To control against such type of behavior, we will expect that geographically distant customers will not only pay greater attention to performance measurement (outcome) controls but will work closely with the supplier in terms of involving the supplier in product development, sharing information through the use of joint teams, and frequent communication (monitoring practices). As a result, manufacturers may rely on outcome controls to communicate their strategic priorities and provide a bilateral social mechanism to resolve disagreements (Zhou and Poppo 2010). At the same time, manufacturers will increase monitoring to manage the perceived opportunism risk (Sachdev and Bello 2014). Thus, based on the preceding arguments, we propose:

**Hypothesis 2a.** *The importance of performance measurement for order allocation increases with the cultural distance between the customer and the supplier.*

**Hypothesis 2b.** *The use of monitoring practices increases with the cultural distance between the customer and the supplier.*

### 3.4 Moderating effect of component complexity on the use of formal management controls

The complexity of the component order arrangement contributes to the complexity of the sourcing arrangement in terms of a more significant information processing load (Espinosa et al. 2007; Handley and Benton 2013), switching costs (Barthélemy and Quélin 2006), and reduced information flow (Cannon and Perreault 1999). In the

manufacturing supply chain setting, complex components are typically brought into the product development process early on and possess a higher level of lock-in costs on the customer (i.e., the customer cannot easily switch to another supplier in case of failed delivery). In addition, complex components are likely to have a higher number of exceptions and require nonstandard supplier-specific coordination such that the source of supplier opportunism can be both information and non-information-related (Neumann 2010). Unlike generic components, complex components are designed early in the product development process, which creates a customer–supplier interdependency that exposes the customer to supplier opportunism because the specific nature of the supplier's behavior in the value exchange cannot be easily checked (Kim and Choi 2015). And, because component customization limits the relevant suppliers available to the customer, it can increase coordination difficulty and the potential for supply chain disruption (Ellis et al. 2010). Together, these opportunism and coordination risks help to differentiate complex component suppliers from generic component suppliers.

The case for the deployment of formal management controls is twofold. First, complexity raises non-information-related opportunistic behavior concerns, such as being locked into a supplier's delivery. In such a case, customers will want to increase the level of measurement (output) and monitoring (behavior) controls to have earlier warning of any quality problem or delay in the shipment (Barthelemy and Quelin 2006). Prior research posits that the role of contracts in knowledge sharing is limited to explicit information (Li et al. 2010). Therefore, a combination of output and behavior controls is encouraged over a wide range of behaviors to share tacit knowledge, which is more necessary in the case of complex components (Celly and Frazier 1996). Second, manufacturers are more likely to want to protect their tacit technological knowledge, associated with complex components, against threats of supplier opportunism (Harmancioglu et al. 2009). This is because the value-added contribution of complex components enhances the cost versus benefit outcome and supports manufacturers' greater involvement through performance measurement and monitoring supplier behaviors (Sachdev and Bello 2014). As such, complex components provide more significant benefits to justify the higher investment in formal management controls, such as training to properly install outcome controls and more extensive monitoring and engagement with the supplier.

Given each geographical and cultural distance context and the risks, geographically and culturally distant manufacturers will likely overestimate the perceived risk of opportunistic behavior associated with managing suppliers of complex components. Therefore, component complexity will likely strengthen the positive relationship between geographical and cultural distance and the use of outcome

and behavior controls. This supports our argument for the joint influence of distance and component complexity on the use of formal management controls. Thus, we formulate the following hypotheses:

**Hypothesis 3a.** *Component complexity positively moderates the association between distance and the importance of performance measurement for order allocation by customers.*

**Hypothesis 3b.** *Component complexity positively moderates the association between distance and the use of monitoring practices by customers.*

## 4 Research methods

### 4.1 Sample and data collection

We conducted the study in two phases using data from pilot study interviews with six large consumer electronics original equipment manufacturers (OEMs), followed by 1,075 structured survey interviews of electronics component suppliers directly supervised by the principal researcher (see Appendix A). We collected primary data from managers of Chinese OEMs' electronic component suppliers who were in a continuing relationship with their major customers. Focusing on a single industry provided depth to the study, and it allowed us to control for several industry-specific conditions that may have been relevant to the OEMs' use of controls in their overseas suppliers (Wu and Chien 2008). China provides an appropriate setting since its electronics manufacturing sector plays an integral part in the global supply chain for consumer products (Japan Electronics and Information Technology Industries Association 2017).

Data used were collected using a combination of an interview survey and archival data. We followed the interview protocol steps Bloom and Van Reenen (2007) pioneered in their large-scale interview study of over 3000 managers. In response to criticisms in the literature (Ittner and Larcker 2001) about 'who' completed the mail survey or who was interviewed, the interviewee vetting process was conducted personally by one of the professor-researchers (Dillman et al. 2011). The respondents were managers who had been with the firm for at least one year and had knowledge about how the largest customer monitors the supply chain (see Panel A, Table 2). Like Li et al. (2010), we collected the initial data using face-to-face interviews conducted by research assistants under the professor-researcher's supervision at every interview. This enabled us to minimize response-set and other survey-type biases when the respondent completed the survey.

The initial sample comprised 1004 suppliers representing a broad cross-section of China's geographical regions

**Table 2** Large-scale field interviews of electronic component suppliers

| <b>Panel A: Interviewee position categories</b>            |  | 1004 | 100.00%     |
|--|--|------|-------------|
| Original large-scale interview survey of Chinese suppliers |  |      |             |
| Major customer is domestic                                 |  | 567  |             |
| Foreign-owned factories                                    |  | 80   |             |
| Unidentified customer country                              |  | 18   |             |
| Chinese suppliers with international customers             |  |      |             |
| Position category  |  | No   | % of Sample |
| Sales Manager/Director/Engineer                            |  | 98   | 28.99%      |
| Business Department Manager                                |  | 67   | 19.62%      |
| CEO/General Manager and Vice General Manager               |  | 54   | 15.93%      |
| Salesman/Representative/supervisor                         |  | 45   | 13.25%      |
| Account/Asset/Purchasing/Project director                  |  | 26   | 7.77%       |
| Foreign/Overseas Sales                                     |  | 25   | 7.47%       |
| Market Department Manager                                  |  | 24   | 6.97%       |

**Panel B: Sample distribution by component and customer country**

| Component complexity <sup>a</sup> | PCB | Passive components | Connector | Transformer | Battery & Power | IC | Optical | Touch Panel | LED | Switches | Materials | Speaker | Generic components | Distribution across |
|-----------------------------------|-----|--------------------|-----------|-------------|-----------------|----|---------|-------------|-----|----------|-----------|---------|--------------------|---------------------|
| USA                               | 10  | 10                 | 25        | 16          | 13              | 2  | 11      | 4           | 7   | 4        | 8         | 1       | 13                 | 124                 |
| Japan                             | 6   | 6                  | 4         | 0           | 1               | 0  | 4       | 2           | 2   | 3        | 3         | 0       | 3                  | 34                  |
| Germany                           | 5   | 6                  | 7         | 0           | 3               | 0  | 1       | 1           | 0   | 1        | 4         | 0       | 5                  | 33                  |
| South Korea                       | 4   | 8                  | 6         | 1           | 3               | 4  | 1       | 1           | 0   | 0        | 2         | 0       | 1                  | 31                  |
| Hong Kong                         | 1   | 3                  | 6         | 2           | 1               | 0  | 2       | 0           | 1   | 1        | 0         | 4       | 2                  | 23                  |
| Taiwan                            | 2   | 1                  | 3         | 0           | 0               | 1  | 0       | 0           | 1   | 4        | 2         | 0       | 0                  | 14                  |
| Russia                            | 3   | 0                  | 4         | 3           | 0               | 0  | 0       | 0           | 0   | 1        | 1         | 0       | 1                  | 13                  |
| France                            | 1   | 1                  | 2         | 0           | 1               | 1  | 0       | 0           | 0   | 1        | 0         | 0       | 1                  | 8                   |
| UK                                | 2   | 1                  | 0         | 1           | 0               | 0  | 0       | 0           | 1   | 0        | 1         | 0       | 2                  | 8                   |
| Turkey                            | 2   | 1                  | 2         | 0           | 1               | 0  | 0       | 0           | 0   | 0        | 0         | 0       | 0                  | 6                   |
| Other 18 countries                | 4   | 9                  | 9         | 6           | 2               | 0  | 2       | 0           | 3   | 3        | 2         | 0       | 5                  | 45                  |
| Distribution across components    | 40  | 46                 | 68        | 29          | 25              | 8  | 21      | 8           | 15  | 18       | 23        | 5       | 33                 | 339                 |

Panel A: 1075 supplier representatives were qualified for and agreed to an interview. Seventy-one suppliers were excluded because they ended the interview early (18), did not manufacture (21), or were duplicate suppliers (32)

Panel B: This table presents the distribution of suppliers by 13 product groups and 28 customer countries of our international sample (N = 339). The complete list of countries is provided in Table 3, Panel C

<sup>a</sup>We define *component complexity* based on component integration and technological newness (Kim and Wilemon 2003). We grouped the 13 types of components into two categories that represented low (0) and high (1) levels of customization and lead time coordination between the customer and seller

(23 provinces). Out of the 1004 suppliers, 552 had a Chinese domestic customer as their major customer, 80 were foreign-owned, and 18 suppliers did not identify the country of the major customer, which left us with 339 suppliers that fit the conditions for this study. As part of the archival measurement of component complexity, the suppliers were distinguished in terms of the product component type (see Panel B, Table 2).

Common method bias may arise when the same participant provides all the information in a self-reported survey, which is often the case in primary sample studies. Thus, this study uses different procedural and statistical techniques to control potential common method bias. First, following Podsakoff et al.'s (2003) call to collect information from different sources, we collected archival data on the suppliers' factory location, components supplied, age, and size to mitigate several weaknesses associated with using survey data sources alone. Second, following Bloom and Van Reenen (2007), a second interviewer independently interviewed another manager in 32 firms (3% of the sample) within six months. The extent of inter-rater reliability was measured using the Spearman-Brown reliability method (James 1982). The reliability coefficient was above the 0.20 benchmark for the performance measurement and monitoring constructs used in the model. The results discussed in the next part indicated a satisfactory level of consistency between the two respondents, suggesting that the interviews revealed consistent management practices within each firm.

## 4.2 Measures

### 4.2.1 Dependent variables – formal management controls

**Performance measurement** Interviewees were asked to assess the importance of seventeen performance measurement criteria in the decision by their major customers to order from them. The seventeen items were grouped under five areas that have been commonly found and reported in the supplier management literature (Choi and Hartley 1996; Wu and Chien 2008): technology innovation (e.g., new product development, product development cycle time), cost (e.g., productivity, cycle time), quality (e.g., product quality, defect rates, refunds/returns), delivery (e.g., on-time delivery), and service (supplier proactiveness, fixing problems, sharing information).

To check the reliability of responses, we asked the interviewees to rank order the level of importance across the five measurement areas. The ranking response is significantly correlated with the Likert scale response ranging from -0.49 to -0.34 ( $p < 0.01$ ). As a check on common method bias, the independent sample Spearman-Brown reliability test was 0.22, above the 0.20 mark for a suitable reliability level.

Cronbach's alphas for the aggregate performance measures for customer measurement importance (0.75, see Panel A, Table 3) and the five performance measurement dimensions (range from 0.65 to 0.75) were acceptable. The ranking correlations and the Cronbach alphas provide additional evidence of coherent measurement scales.

**Monitoring** Monitoring practices used by the major customer comprised five monitoring routine items taken from the Ittner et al. (1999) study. The pilot study helped us clarify the scales used by Ittner et al. (1999) to measure monitoring practices. Four items refer to the frequency of supervision, meetings, communications, and training is undertaken by the major customer for the supplier. In contrast, the fifth item referred to the use of formal support groups. We normalized the last item to make it the same range level as the first four items. As a check on common method bias, the independent sample Spearman-Brown reliability test was 0.24, above the 0.20 mark for a suitable reliability level. While the construct reliability of *Monitoring* is 0.66, each item loaded more than 0.50 in the factor analysis, except for one item (see Panel A, Table 3).

### 4.2.2 Independent variables – geographical and cultural distance

**Geographical distance** The geographical distance between the supplier's China factory location via the two main ports of China (Shenzhen and Shanghai) and the location of the customer that the supplier is shipping to was measured as the number of flight distance km to the two main ports and then onto the factory location (see Table 3, Panel C). This is consistent with how the managers traveled between the procurement office of the customer to the Chinese supplier. At the data collection (2011–2013), Shenzhen and Shanghai were the main entry points for international customers to China. Measuring distance by kilometers, like flight distance, is consistent with studies on cognitive representations of geographical distance, which indicate that an individuals' cognitive representation of geographical distance is influenced most by travel time (Freundschuh 1994).

**Cultural distance** We calculated the cultural distance score based on a factor analysis of four different methods employed in the literature (see Table 3, Panel C). First, in response to the call in the international business literature to take into consideration the correlation between cultural dimensions used to compute cultural distance (Beugelsdijk et al. 2018; Tung and Verbeke 2010), we calculated the Mahalanobis distance between the major customer's country and the supplier's country in the main analysis, based on the five cultural dimensions (power distance, individualism, masculinity, uncertainty avoidance, and Confucian

**Table 3** Descriptive statistics

**Panel A: Confirmatory factor analysis of main model variables**

|  | Loadings | Mean | S.D  | Min | Median | Max |
|--|----------|------|------|-----|--------|-----|
| <b>Performance measurement (17 items) (CA = 0.75)<sup>a</sup></b>  |          |      |      |     |        |     |
| We ask respondents to indicate the importance of the following measurement criteria in the decision by their major customer to order from them using a six-point Likert-type scale from 0 (very low importance) to 5 (very high importance)  |          |      |      |     |        |     |
| a) Technology considerations   |          |      |      |     |        |     |
| Product innovations  | 0.77     | 3.55 | 1.12 | 0   | 4      | 5   |
| Product development cycle time   | 0.88     | 3.51 | 1.14 | 0   | 4      | 5   |
| Product process cycle time   | 0.77     | 3.90 | 1.09 | 0   | 4      | 5   |
| b) Cost of production  |          |      |      |     |        |     |
| Ability to meet cost budgets (e.g., std costs, activity costs)   | 0.76     | 3.89 | 1.01 | 0   | 4      | 5   |
| Target price improvement   | 0.73     | 4.14 | 0.84 | 1   | 4      | 5   |
| Yield rates improvement  | 0.73     | 3.82 | 1.03 | 0   | 4      | 5   |
| c) Quality   |          |      |      |     |        |     |
| Certification program in place? (e.g., updating ISO9000 req)   | 0.60     | 4.45 | 0.81 | 2   | 5      | 5   |
| Statistical Process Control information  | 0.70     | 4.21 | 0.96 | 0   | 4      | 5   |
| Receiving inspection   | 0.77     | 4.36 | 0.79 | 0   | 5      | 5   |
| Total failure (defect) rate  | 0.66     | 4.12 | 1.05 | 0   | 4      | 5   |
| d) Delivery to committed dates   |          |      |      |     |        |     |
| Lead-time  | 0.68     | 4.24 | 0.79 | 1   | 4      | 5   |
| On-time delivery   | 0.72     | 4.40 | 0.77 | 1   | 5      | 5   |
| Flexibility (i.e., maintaining surplus capacity)   | 0.73     | 3.63 | 1.00 | 0   | 4      | 5   |
| Uninterrupted supply   | 0.76     | 3.74 | 1.03 | 0   | 4      | 5   |
| e) Service quality   |          |      |      |     |        |     |
| Purchasing   | 0.72     | 3.73 | 1.07 | 0   | 4      | 5   |
| Communicates problems before detection by customer   | 0.88     | 4.00 | 0.95 | 0   | 4      | 5   |
| Proactiveness in communicating changes to schedules, changes to product or process specifications  | 0.80     | 3.76 | 1.01 | 0   | 4      | 5   |
| <b>Monitoring practices (5 items) (CA = 0.66)</b>  |          |      |      |     |        |     |
| We ask respondents to answer the following questions using the following scales, 0 = Never, 1 = Annual, 2 = Biannual, 3 = Quarterly, 4 = Monthly, 5 = Weekly, 6 = Daily (questions a to d), 1 = Never, 2 = Seldom, 3 = Occasionally, 4 = Usually, 5 = Always (question e). We normalized the last item to make it the same range level as the first four items |          |      |      |     |        |     |
| a) The frequency of supervision or monitoring by the major customer—sending people to the supplier   | 0.68     | 2.11 | 1.26 | 0   | 2      | 6   |
| b) The frequency of training (supplier employees)  | 0.59     | 0.88 | 1.28 | 0   | 0      | 6   |
| c) The frequency that senior executives from your firm and the major customer firm typically meet per year   | 0.57     | 2.85 | 1.50 | 0   | 3      | 6   |
| d) At lower levels (for example, R&D at one firm, manufacturing at another), the frequency of communication taking place   | 0.42     | 4.14 | 1.69 | 0   | 4      | 6   |
| e) Do representatives of the customer regularly attend formal support groups at supplier locations   | 0.67     | 1.64 | 1.66 | 0   | 2      | 6   |
| <b>Cultural distance (4 items) (CA = 0.80)</b>   |          |      |      |     |        |     |



Table 3 (continued)

**Panel A: Confirmatory factor analysis of main model variables**

|   |      |       |      |      |       |       |
|---|------|-------|------|------|-------|-------|
| a) Euclidean distance between customer country and China based on Hofstede (2001)                           | 0.90 | 3.70  | 1.54 | 0.28 | 4.84  | 6.52  |
| b) Mahalanobis distance between customer country and China based on Hofstede (2001)                         | 0.95 | 17.84 | 9.67 | 1.10 | 22.44 | 28.84 |
| c) Mahalanobis distance between customer country and China based on world value survey (Berry et al., 2010) | 0.75 | 12.72 | 7.03 | 1.55 | 13.39 | 20.24 |
| d) Euclidean distance between customer country and China based on world value survey (Berry et al., 2010)   | 0.98 | 2.65  | 2.09 | 0.04 | 2.31  | 6.01  |

**Panel B: Descriptive statistics**

|  | Mean  | S.D   | Min  | Median | Max   |
|--|-------|-------|------|--------|-------|
| <i>Formal management control mechanisms</i>  |       |       |      |        |       |
| Performance measurement ( <i>aggregate</i> ) | 63.69 | 16.46 | 5.00 | 71.00  | 85.00 |
| Technology considerations                    | 10.96 | 3.35  | 0.00 | 12.00  | 15.00 |
| Cost of production                           | 11.85 | 2.88  | 1.00 | 12.00  | 15.00 |
| Quality                                      | 17.14 | 3.61  | 2.00 | 18.00  | 20.00 |
| Delivery to committed dates                  | 16.01 | 3.59  | 2.00 | 17.00  | 20.00 |
| Service quality                              | 7.73  | 3.03  | 0.00 | 12.00  | 15.00 |
| Monitoring practices                         | 11.62 | 7.39  | 0.00 | 11.00  | 30.00 |
| <i>Independent variables</i>                 |       |       |      |        |       |
| Geographical distance (1 item)               | 8000  | 4769  | 14   | 9023   | 18688 |
| Cultural distance (4 items)                  | 36.91 | 20.33 | 2.97 | 42.98  | 61.61 |
| Component complexity                         | 0.23  | 0.40  | 0    | 0      | 1     |
| <i>Control variables</i>                     |       |       |      |        |       |
| Relationship strength (3 items) (CA = 0.85)  | 6.19  | 0.92  | 3    | 18     | 21    |
| Relationship history                         | 12.81 | 5.59  | 5    | 11     | 41    |
| Customer concentration                       | 0.26  | 0.18  | 0.01 | 0.2    | 0.9   |
| Market competition                           | 0.64  | 0.29  | 0.01 | 0.7    | 1     |
| Supplier size                                | 975   | 1810  | 50   | 400    | 14000 |
| Supplier age                                 | 15.51 | 9.40  | 1    | 14     | 57    |

**Panel C: Cultural distance and geographical distance**

| Major Customer Location <sup>a</sup> | No. of observations | Euclidean distance <sup>a</sup><br>(Hofstede 2001) | Mahalanobis distance <sup>a</sup><br>(Hofstede 2001) | Mahalanobis distance <sup>a</sup><br>World Value Survey<br>(Berry et al. 2010) | Euclidean distance <sup>a</sup><br>World Value Survey<br>(Berry et al. 2010) | Geographical distance (km) <sup>b</sup> |
|--------------------------------------|---------------------|--|--|--|--|---|
| U.S. (US)                            | 124                 | 5.01   | 27.33  | 20.24  | 5.08   | 13100.00                                |
| Japan                                | 34                  | 2.83   | 9.35   | 6.94   | 1.23   | 2877.00                                 |
| Germany (GERM)                       | 33                  | 4.48   | 22.44  | 1.55   | 1.42   | 8732.00                                 |
| South Korea                          | 31                  | 2.28   | 7.53   | 3.77   | 0.04   | 2080.00                                 |
| Hong Kong                            | 23                  | 0.28   | 1.11   | 16.31  | 0.10   | 32.00                                   |
| Taiwan (TW)                          | 14                  | 1.32   | 4.12   | 5.81   | 0.07   | 813.00                                  |
| Russia                               | 13                  | 2.72   | 8.40   | 9.12   | 0.08   | 7122.00                                 |
| France                               | 8                   | 4.38   | 19.24  | 11.01  | 2.33   | 9610.00                                 |
| U.K                                  | 8                   | 5.24   | 28.84  | 17.83  | 3.84   | 9607.00                                 |
| Turkey                               | 6                   | 3.33   | 13.09  | 16.21  | 1.75   | 7708.00                                 |
| Latin America                        | 6                   | 2.28   | 8.65   | 18.66  | 3.26   | 18584.00                                |
| Netherlands                          | 5                   | 5.55   | 23.01  | 9.30   | 2.88   | 9261.00                                 |

**Table 3** (continued)

**Panel C: Cultural distance and geographical distance**

|                |   |      |       |       |      |          |
|----------------|---|------|-------|-------|------|----------|
| Australia      | 4 | 5.05 | 27.4  | 12.21 | 3.92 | 7424.00  |
| South Africa   | 4 | 3.71 | 18.13 | 13.39 | 2.31 | 11371.00 |
| India          | 4 | 1.43 | 6.56  | 9.92  | 1.08 | 3625.00  |
| Singapore      | 3 | 2.01 | 6.29  | 8.99  | 0.87 | 2604.00  |
| Finland        | 3 | 4.75 | 20.40 | 8.13  | 2.30 | 7808.00  |
| Switzerland    | 3 | 3.92 | 19.97 | 13.57 | 4.14 | 9380.00  |
| Italy          | 2 | 4.43 | 22.06 | 2.53  | 1.60 | 9265.00  |
| Western Europe | 2 | 4.52 | 21.14 | 9.05  | 2.69 | 9816.00  |
| Indonesia      | 2 | 1.45 | 4.68  | 9.20  | 0.88 | 2593.00  |
| Malaysia       | 1 | 1.43 | 4.02  | 8.55  | 1.88 | 2539.00  |
| Brazil         | 1 | 2    | 8.16  | 9.12  | 2.99 | 17998.00 |
| Bulgaria       | 1 | 2.39 | 8.44  | 6.69  | 0.07 | 8399.00  |
| Sweden         | 1 | 6.52 | 25.52 | 9.88  | 6.01 | 8205.00  |
| Canada         | 1 | 4.59 | 26.56 | 10.76 | 4.73 | 10470.00 |
| Eastern Europe | 1 | 2.98 | 12.51 | 7.84  | 1.96 | 7110.00  |
| Iran           | 1 | 5.81 | 23.57 | 4.69  | 0.85 | 5975.00  |

<sup>a</sup>Using the average CD score of Eastern European countries to calculate the CD of Eastern Europe and the average CD score of Western European countries to calculate the CD of Western Europe

<sup>b</sup>Geographical distance represents the direct km between the supplier's factory location via the two main ports of China (Shenzhen and Shanghai) and the shipping port location of the major customer. We also measured time zone differences to compensate for north–south differences – for example, Australia was over 6000 km away, but only 2–3 hours in time zone difference. However, the correlation between direct km and time zone was high (0.96)

dynamism) reported by Hofstede (2001). Like Berry et al. (2010), we will use the following equation:

$$MM_{ij} = \frac{1}{4}(a - b)c^{-1}(a - b)^T$$

where  $a = (a_1, a_2, a_3, a_4, a_5)$  and  $b = (b_1, b_2, b_3, b_4, b_5)$  are the vectors for the five cultural dimension scores for country  $i$ , and country  $j$  respectively.  $C$  is the covariance matrix for the five dimensions of culture.  $MM_{ij}$  is the cultural distance between country  $i$  and country  $j$ .

Second, we used the Mahalanobis distance based on the scores from the World Value Survey developed by Berry et al. (2010), which selected those questions in the World Value Survey that reflect the cultural dimensions of Hofstede. Third, we used the method developed by Kogut and Singh (1988) and calculated the Euclidean distance between the major customer's country and the supplier's country, based on the five cultural dimensions. Fourth, we calculated the Euclidean distance between the two countries based on Inglehart–Welzel's cultural map from the World Value Survey (Inglehart and Welzel 2005, p. 64), which depicts closely linked cultural values in two predominant dimensions: traditional versus secular-rational values; and survival versus self-expression. Each item

loaded more than 0.90 in the factor analysis, signaling a consistent cultural distance score across the four measures (see Panel A, Table 3).

**4.2.3 Component complexity**

We operationalize component complexity in a way that is specific to our single industry setting (electronics manufacturing) that contributes to information load, diversity, and uncertainty in the sourcing of manufactured components: component complexity. *Component complexity* refers to the level of component integration and technological newness (Kim and Wilemon 2003). We can identify differences in component customization by focusing on a single industry with qualitative data taken from a pilot study to inform the process. We identified the type of electronic component supplied to the major customer in the interview and cross-checked with the components produced by the supplier on its home page to validate the information. We validated this approach through the pilot study interviews of major customers in the electronics supply chain. For example, complex components require more lead time and customization efforts by the parties. We grouped the 13 types of components into two-component complexity categories that represented high and low levels of customization and lead

time coordination between the customer and supplier (see Panel B, Table 2).

#### 4.2.4 Control variables

*Relationship strength* characterizes the supplier's role in the customer's value chain ranging from an arms-length to a partnership-type relationship. We used the Humphreys et al. (2004) three-item strength of the relationship measure: (1) The relationship we have with this major customer continues to strengthen.; (2) We believe that the renewal of agreements in this relationship will occur, and (3) The parties make plans not only for the terms of current purchases but also for the continuance of the relationship. The proxy for *relationship history* is the relationship's length with the largest customer in years (Li et al. 2010). *Customer concentration* is measured by the proportion of a firm's sales to the largest customer, as obtained from the survey (Balakrishnan et al. 1996). *Supplier size* is a control variable because it has been a proxy for various constructs ranging from supplier risk aversion, relative bargaining power, and the diffusion of new contract arrangements (Radaev 2013). The natural logarithm of the average number of employees in 2012 was taken from the interview survey and cross-checked with the number reported on the home page of each supplier. *Market competition*. Based on pilot study work and like Anderson and Dekker (2005), we asked two questions to measure this variable: (i) How many other suppliers are competing to supply the same or similar components to your largest customer? And (ii) What % do you get of your largest customer's average purchase order? *Supplier age* is the natural logarithm of the number of years since the supplier firm is established, obtained from the home page of each supplier (see Panel B, Table 3).

## 5 Results

### 5.1 Descriptive statistics

Table 4 presents the Pearson coefficients for the variables. *Geographical and cultural distance* are highly correlated (Pearson coefficient = 0.74,  $p < 0.01$ ). This is consistent with the high correlation (Pearson coefficient = 0.88,  $p < 0.01$ ) reported by Handley and Benton (2013) for similarly measured constructs. As a result, we tested the association of CD and GD to formal management controls separately. Both *geographical* and *cultural distance* is negatively correlated with *component complexity* and positively with the *supplier size* and *age*. *Customer concentration* is significant and positive with *monitoring*. None of the correlations between the supplier transaction characteristics were significant to pose a multicollinearity problem.

### 5.2 Influence of geographical and cultural distance on formal management controls

We test our hypotheses using OLS regression analyses with standard errors clustered at the province's level where the supplier firm is located to correct potential within-group correlations. Table 5 reports the OLS regression results of geographical and cultural distance. Hypotheses 1a and 1b state that geographical distance will be positively associated with the importance of performance measurement and monitoring practices. The estimates for geographical distance are not significant for performance measurement and monitoring practices (Table 5). Thus, hypotheses 1a and 1b for geographical distance are not supported. Hypothesis 2a and 2b state that cultural distance will be positively associated with performance measurement and monitoring practices. The estimates for performance measurement (H2a) are significant and positive ( $p < 0.01$ ). The estimates for monitoring (H2b) are significant and positive for monitoring ( $p < 0.01$ ). Thus, hypotheses 2a and 2b cultural distance are supported.

### 5.3 Interaction of cultural distance and component complexity

In this part, we report hypothesis 3, which tests the boundary conditions that impact the association between geographical and cultural distance and formal management controls. Hypotheses H3a states that component complexity will positively moderate the association between geographical and cultural distance and the importance of performance measurement. For H3a, we find a significant and positive estimate for the interactions of either *GD* or *CD* and *Component complexity* in predicting the importance of performance measurement (Model 3  $p < 0.05$ ; Model 4  $p < 0.05$ ). H3a is supported. Hypothesis 3b states that component complexity will positively moderate the association between geographical and cultural distance and monitoring practices. For H3b, we find that the estimates for the interactions of *GD* or *CD* and *Component complexity* in predicting the level of monitoring are not significant. Together, these results indicate that for suppliers who supply complex components, more culturally and geographically distant customers will emphasize performance measurement controls in order allocation but not monitoring practices in managing their suppliers.

## 6 Discussion

### 6.1 Theoretical contributions

This study contributes by extending our insights into the locational drivers of control in global supply chains, a significant gap in the literature (Gereffi and Lee 2012).

**Table 4** Pairwise Pearson correlations

| Correlation                                   | 1       | 2       | 3       | 4        | 5        | 6       | 7        | 8        | 9       | 10      | 11   |
|---|---------|---------|---------|----------|----------|---------|----------|----------|---------|---------|------|
| 1. <i>Performance measurement (aggregate)</i> | 1.00    |         |         |          |          |         |          |          |         |         |      |
| 2. <i>Monitoring practices</i>                | 0.14*** | 1.00    |         |          |          |         |          |          |         |         |      |
| 3. <i>Geographical distance</i>               | -0.04   | -0.04   | 1.00    |          |          |         |          |          |         |         |      |
| 4. <i>Cultural distance</i>                   | 0.06*   | -0.00   | 0.74*** | 1.00     |          |         |          |          |         |         |      |
| 5. <i>Component complexity</i>                | -0.01   | 0.07**  | 0.03    | -0.10*** | 1.00     |         |          |          |         |         |      |
| 6. <i>Relationship strength</i>               | 0.20*** | -0.01   | -0.04   | -0.06*   | 0.04     | 1.00    |          |          |         |         |      |
| 7. <i>Relationship history</i>                | 0.10*** | 0.03    | -0.05   | -0.00    | -0.06*   | -0.01   | 1.00     |          |         |         |      |
| 8. <i>Customer concentration</i>              | -0.06*  | 0.09*** | -0.07** | 0.04     | 0.02     | 0.05    | -0.02    | 1.00     |         |         |      |
| 9. <i>Market competition</i>                  | -0.06*  | -0.01   | -0.08** | -0.03    | -0.10*** | -0.07** | -0.10*** | -0.07    | 1.00    |         |      |
| 10. <i>Supplier size</i>                      | 0.15*** | 0.17*** | -0.06*  | 0.12***  | -0.05    | 0.03    | -0.02    | -0.20*** | 0.34*** | 1.00    |      |
| 11. <i>Supplier age</i>                       | 0.13*** | 0.03    | -0.07** | 0.11***  | -0.11*** | -0.05   | -0.10*** | -0.02    | 0.52*** | 0.41*** | 1.00 |

This table presents the Pearson correlation matrix of the key variables of interest

See Table 3 for detailed variable definitions

\*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.10$  (two-tailed). N = 339

Table 5 Regression results for formal management control mechanisms

|                             | Formal management control mechanisms |                      |                         |                      |                         |                      |                         |                      |
|-----------------------------|--------------------------------------|----------------------|-------------------------|----------------------|-------------------------|----------------------|-------------------------|----------------------|
|                             | Geographical Distance                |                      | Cultural Distance       |                      | Geographical Distance   |                      | Cultural Distance       |                      |
|                             | Model 1                              | Model 2              | Model 3                 | Model 4              | Model 1                 | Model 2              | Model 3                 | Model 4              |
|                             | Performance measurement              | Monitoring practices | Performance measurement | Monitoring practices | Performance measurement | Monitoring practices | Performance measurement | Monitoring practices |
| Geographical Distance (GD)  | 0.02<br>(0.58)                       | 0.00<br>(0.16)       | -0.00<br>(-0.09)        | -0.04<br>(-1.17)     | 0.02<br>(0.58)          | 0.00<br>(0.16)       | -0.00<br>(-0.09)        | -0.04<br>(-1.17)     |
| Cultural Distance (CD)      |                                      |                      |                         |                      | 0.09***<br>(3.06)       | 0.12***<br>(4.01)    |                         |                      |
| Component complexity        | -0.11<br>(-1.59)                     | 0.05<br>(0.36)       | -0.13*<br>(-1.88)       | 0.03<br>(0.18)       | -0.13*<br>(-1.88)       | 0.03<br>(0.18)       | -0.15*<br>(-2.02)       | -0.00<br>(-0.03)     |
| Relationship strength       | 0.22***<br>(3.37)                    | -0.02<br>(-0.47)     | 0.21***<br>(3.28)       | -0.03<br>(-0.57)     | 0.21***<br>(3.28)       | -0.03<br>(-0.57)     | 0.22***<br>(3.32)       | -0.02<br>(-0.52)     |
| Relationship history        | -0.01<br>(-0.11)                     | 0.04<br>(0.35)       | -0.02<br>(-0.24)        | 0.03<br>(0.24)       | -0.02<br>(-0.24)        | 0.03<br>(0.24)       | -0.02<br>(-0.21)        | 0.05<br>(0.42)       |
| Customer concentration      | 0.07<br>(1.11)                       | 0.25***<br>(3.51)    | 0.07<br>(1.16)          | 0.26***<br>(3.52)    | 0.07<br>(1.16)          | 0.26***<br>(3.52)    | 0.07<br>(1.18)          | 0.25***<br>(3.81)    |
| Market competition          | -0.234<br>(-1.25)                    | 0.00<br>(0.00)       | -0.21<br>(-1.26)        | 0.04<br>(0.30)       | -0.21<br>(-1.26)        | 0.04<br>(0.30)       | -0.23<br>(-1.29)        | -0.00<br>(-0.02)     |
| Supplier size               | 0.08*<br>(1.95)                      | 0.15***<br>(8.19)    | 0.08*<br>(2.05)         | 0.15***<br>(9.96)    | 0.08*<br>(2.05)         | 0.15***<br>(9.96)    | 0.08*<br>(1.84)         | 0.14***<br>(8.59)    |
| Supplier age                | 0.01<br>(0.94)                       | 0.01<br>(0.99)       | 0.00<br>(0.86)          | 0.01<br>(0.97)       | 0.00<br>(0.86)          | 0.01<br>(0.97)       | 0.01<br>(1.16)          | 0.01<br>(1.267)      |
| GD/CD *Component complexity |                                      |                      |                         |                      |                         |                      | 0.15***<br>(2.22)       | 0.14<br>(0.97)       |
| R <sup>2</sup>              | 0.24                                 | 0.15                 | 0.24                    | 0.16                 | 0.24                    | 0.16                 | 0.24                    | 0.16                 |
| Adjusted R <sup>2</sup>     | 0.15                                 | 0.06                 | 0.16                    | 0.07                 | 0.16                    | 0.07                 | 0.15                    | 0.06                 |
| F statistics                | 2.74<br>(p = 0.00)                   | 1.62<br>(p = 0.00)   | 2.51<br>(p = 0.00)      | 1.76<br>(p = 0.00)   | 2.51<br>(p = 0.00)      | 1.76<br>(p = 0.00)   | 2.66<br>(p = 0.00)      | 1.64<br>(p = 0.00)   |
|                             |                                      |                      |                         |                      |                         |                      | 0.06<br>(1.32)          | 0.06<br>(1.84)       |
|                             |                                      |                      |                         |                      |                         |                      | -0.18***<br>(-3.15)     | 0.01<br>(0.04)       |
|                             |                                      |                      |                         |                      |                         |                      | 0.22***<br>(3.15)       | -0.04<br>(-0.79)     |
|                             |                                      |                      |                         |                      |                         |                      | -0.05<br>(-0.54)        | 0.06<br>(0.49)       |
|                             |                                      |                      |                         |                      |                         |                      | 0.06<br>(0.95)          | 0.26***<br>(3.42)    |
|                             |                                      |                      |                         |                      |                         |                      | -0.20<br>(-1.26)        | 0.04<br>(0.27)       |
|                             |                                      |                      |                         |                      |                         |                      | 0.08**<br>(2.27)        | 0.14***<br>(9.57)    |
|                             |                                      |                      |                         |                      |                         |                      | 0.01<br>(1.09)          | 0.01<br>(0.91)       |
|                             |                                      |                      |                         |                      |                         |                      | 0.20**<br>(1.98)        | 0.03<br>(0.15)       |

N = 339. Each cell reports the regression coefficient estimate and the t-statistic (in parentheses). The standard errors of all the regressions are clustered at the province level. Trade show fixed effects included. Mean VIF scores ranged from 1.13 to 1.20

\*\*\*, \*\*, \* indicates a p-value of  $\leq 0.01$ , 0.05, 0.10 in a two-tailed test

While prior international business studies have examined the impact of geographical and cultural distance on MNCs' entry modes and remote control of their foreign subsidiaries (see Beugelsdijk et al. 2018 for a review), few studies have focused on the effects of geographical and cultural distance on the management control of global supply chains (e.g., Parente et al. 2011). Much like MNCs' foreign operations, the remote management of supply chains is fraught with risk because of location-specific complexity (i.e., geographical distance; cultural distance) (Handley and Benton 2013; Lorentz et al. 2018). Further, the literature is equivocal about the exact nature of the influence of location-specific complexity on the control of foreign operations (Wiengarten and Ambrose 2017).

We use transaction cost theory to understand the problems that buyers' limited knowledge and supplier opportunistic behavior beset international buyer–supplier relationships. We find that performance measurement for order allocation is more important to address the problem as cultural distance increases for suppliers of all products and when geographical distance increases for the suppliers of complex products. Importantly the stronger results for cultural distance indicate that the problems caused by distance are due to differences in understanding and perceptions concerning supplier capability and commitment to international customers. Similarly, we find that cultural distance is more relevant to the need to monitor and address supplier opportunistic behavior. Due to differences in understanding, norms, and values between transacting parties, international customers need to spend more time monitoring their suppliers through joint teams, meetings, and working groups.

In this way, our findings help to shed light on the equivocal results in the literature on the exact nature of the influence of geographical and cultural distance on the control of global supply chains (Wiengarten and Ambrose 2017; Goodall and Roberts 2003). For example, Handley and Benton (2013) find that geographical distance and scale of service (but not cultural distance) are positively associated with control and coordination costs. In contrast to their study, we find that cultural distance and, to a lesser extent, geographical distance to be positively associated with the use of formal management controls deployed by international customers. We attribute this difference in findings to the outsourcing context. While Handley and Benton (2013) studied service outsourcing, we examined the manufacturing supply chain. Researchers have found a greater need for real-time face-to-face interaction to manage service outsourcing relationships (Grimshaw and Miozzo 2006; Li and Choi 2009).

Our analysis also explored the moderating effects of component complexity on the location-specific complexity management control relationship. We find that the relationship between geographical and cultural distance and the importance of performance measurement (outcome)

controls is strengthened when the supplier makes complex components. These findings suggest that international customers tradeoff the costs and benefits of deploying controls. They are more willing to invest in more extensive performance measurement controls when local suppliers produce complex components. These results echo prior studies that have found that stringent control is essential when one party's opportunistic behavior threatens to impose reputational spillover costs on the other (Mayer et al. 2004; Short et al. 2016).

## 6.2 Managerial implications

The remote control of supply chains is fraught with risk because of geographical and cultural distance (Handley and Benton 2013; Lorentz et al. 2018). Despite the dominance of emerging economy suppliers in global supply chains, researchers report continuing challenges and problems associated with weak institutions and trust in suppliers' behavior (Kosmol et al. 2018). These difficulties result in firms increasingly monitoring these emerging economy suppliers to control opportunism and coordination challenges (Handley and Benton 2013). Given these observations, there is little research on the management of emerging economy suppliers from a distance. Addressing this need, the current study contributes to global supply chain management by examining the distance and component complexity characteristics of global sourcing arrangements that influence the deployment of formal management controls. The results indicate that cultural distance and not the customer's geographical distance increase the likelihood of implementing formal management controls.

Our most intriguing findings relate to the effects of the interaction between geographical or cultural distance and component complexity. While cultural distance is associated with the greater use of both outcome and behavioral controls, performance measurement (outcome controls) is higher as a joint function of component complexity and geographical or cultural distance. This result suggests that customers deploy more extensive outcome control mechanisms when there are economic benefits associated with doing so to counteract the higher risk of holding up new product development and rollout. For example, complex components are more likely to have more extensive contracting terms and conditions and possibly strict performance targets to ensure successful integration within the product and on-time delivery. Such contract extensiveness can be complemented with more extensive performance evaluation (outcome) control. While we would also expect greater monitoring (process) controls through the customer's involvement in the design and ramp-up stages, our results failed to reflect this expectation. Therefore, these insights gained from this study are helpful to managers tasked with

managing emerging economy suppliers, deciding the extent to which formal management controls are necessary. Our focus on control activities rather than on contracting terms and conditions enables us to generate managerial insights for foreign firms.

### 6.3 Limitations and future research

Our findings on the use of formal management controls merit further inquiry. While this study used an unprecedentedly large interview survey sample, we acknowledge that we used only part of the large-scale database and could be classified as a convenience sample. Next, we focus on supplier perceptions of the extent to which their largest customer uses two important controls in managing their relationship: performance measurement and monitoring practices. This can induce sample bias since if the supplier is more opportunistic, they might not tell the interviewer the truth or what their customer is concerned about. Further, our focus on formal management controls is just a part of the control mechanisms available to customers. An avenue for future research would be to explore both buyer and supplier perceptions of a broader set of formal and informal management controls as a package.

Future analysis of the management of global supply chains may consider investigating more specific control mechanisms, such as in a balanced scorecard (e.g., HTC, O'Connor et al. 2011). Studies can examine the influences on specific measurement dimensions representing driver/process type indicators versus outcome type indicators (Ittner and Larcker 2001). Different emphasis on these formal management controls may also depend on the component complexity and associated exchange risks in managing the supplier.

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**Code availability** JEL Codes: M11, M16, L14, L24

### Declarations

**Ethics approval** No ethics approval was required because of the interview setting at the time of the study.

**Conflict of interest** The authors declare they have no conflict of interests.

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