

The dark side of supply chain digitalisation: supplier-perceived digital capability asymmetry, buyer opportunism and governance

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The dark side of supply chain digitalisation: Supplier-perceived digital capability asymmetry, buyer opportunism and governance

Abstract

Purpose: In this paper, we seek to contribute to the supply chain digitalisation literature by investigating a potential dark side of supply chain digitalisation from the viewpoint of the small and medium sized enterprise (SME) suppliers: namely, digital capability asymmetry and the partner opportunism of more digitally capable large buyers against SME suppliers. We seek to contribute further to the governance literature by investigating the effectiveness of the governance mechanism (legal contracts and relational contracts) in suppressing partner opportunism of this nature.

Design/methodology/approach: Using survey data collected from 125 Korean SMEs, we employed a hierarchical regression method to test a set of hypotheses focusing on the dark side of supply chain digitalisation and the effectiveness of the governance mechanism.

Findings: Our findings suggest that supplier-perceived digital capability asymmetry, wherein a buyer has a superior digital capability than its SME supplier, increases the SME supplier's dependence on the more digitally capable buyer, with the result that it is more exposed to buyer opportunism. Moreover, the results suggest that only relational governance is effective in protecting SME suppliers from buyer opportunism of this nature.

Originality/value: So far, the overwhelming majority of supply chain digitalisation research has debated its 'bright side'. On the contrary, from the resource dependence theory perspective, this paper explains its dark side by providing empirical evidence on (1) the links between supplier-perceived digital capability asymmetry and a buyer's opportunism through an increased supplier's dependence, and (2) the effectiveness of different types of governance in opportunism suppression.

Keywords: Digitalisation, Buyer–supplier relationship, Opportunism, Governance, SMEs, Resource dependence theory

1 Introduction

In its early days, digitalisation was characterised as the application of digital technologies to bring about changes in the intra and inter-business interactions (Ritter and Pedersen, 2020). However, with technological advancements, recent studies have gone beyond such applications and related organisational capability and have instead conceived digital capability as the complex and unique bundle of technological skills, procedure and cyber-physical systems that generates insight and leverages digitised data and processes to enhance inter-organisational decision-making (Gobble, 2018; Holmstrom *et al.*, 2019). From the focal firm's point of view, digital capability supports firms in creating and capturing value through increased generation, analysis and use of data that enhances their competitiveness (Bjorkdah, 2020).

Supply chain digitalisation refers to the integration of innovative technologies, such as cloud computing, the internet of things (IoT), blockchain, artificial intelligence, smart sensors, and drones, across different processes in upstream and downstream supply chain activities (Hartley and Sawaya, 2019). Supply chain digitalisation is perceived to be a promising agenda for enhancing visibility and transparency across supply chains, since it would facilitate the collection and sharing of real-time information with all stakeholders in the supply chain (Culot *et al.*, 2020; Frank *et al.*, 2019). Furthermore, enhanced visibility and transparency would enable firms to engage stakeholders in 'end-to-end' integrated planning and innovation activities, and based on this, firms could seamlessly offer better service to meet the needs of their customers (Alicke *et al.*, 2016). As such, supply chain digitalisation could potentially enable a firm to leap forward in its competitiveness (Bokrantz *et al.*, 2017; Fosso Wamba *et al.*, 2018). For this reason, many Fortune 1,000 companies are intensively experimenting with various forms of supply chain digitalisation (Fosso Wamba *et al.*, 2018) in order to acquire digital capability across multiple stakeholders. The latest empirical evidence suggests that digitalisation efforts in the supply chain offer firms opportunities to increase revenue or innovation, rather than just to lower costs by setting new standards for operational efficiency (Bjorkdah, 2020).

On the other hand, the progress of supply chain digitalisation among SMEs has been rather slow. Other than innovative start-ups and tech SMEs, there is a large "missing middle" of traditional

manufacturing SMEs which is lagging behind in terms of supply chain digitalisation efforts (Kergroach, 2020). This is mainly due to traditional SMEs' relative lack of the resources, technical knowledge, infrastructure and management capabilities required for supply chain digitalisation (Matt and Rauch, 2020). Digital capability asymmetry created by this delay, wherein a buyer has a superior digital capability than its SME supplier, could implicitly create a new type of dependence for SMEs in relation to their larger and more digitally capable partners. One negative consequence of this would be the SMEs' further exposure to opportunism from their more digitally capable partners.

So far, the majority of research in this area has investigated the promises and benefits of supply chain digitalisation; in contrast, few studies have examined the dark sides of supply chain digitalisation, such as digital capability asymmetry and resulting increase in partner opportunism (Lumineau and Oliveira, 2020). In addition, the existing literature has acknowledged weak governance as a potential reason for such asymmetric gains in supply chain digitalisation (Bjorkdah, 2020). There are, however, few studies that investigate the effectiveness of contractual and relational governance on suppressing buyer opportunism of this nature. Using resource dependence theory as a theoretical lens, we intend to fill these gaps. First, taking the perspective of SME suppliers, we investigate (1) whether the supplier-perceived digital capability asymmetry is related to the SME suppliers' dependence on their buyers, and (2) whether the asymmetry-induced dependence is related to the extent of buyers' opportunism. Then, we seek to investigate whether the existing governance mechanism for buyer–supplier relationships (contractual and relational governance) is still effective in suppressing buyer opportunism stemming from digital capability asymmetry.

2 Theoretical Background

2.1 The dark side of supply chain digitalisation: digital capability asymmetry and opportunism against SME suppliers

Engaging in an inter-firm relationship entails various exchange hazards (Poppo and Zenger, 2002), and the opportunistic behaviours of an exchange partner is one of these. Partner opportunism in an inter-firm relationship refers to a firm's self-interest seeking behaviours with guile (Williamson,

1975) and aims at this firm's unilateral gains at the expense of the other firms involved (Luo, 2007; Poppo and Zenger, 2002). Partner opportunism can take many different forms (Deeds and Hill, 1999). The passive or subtle form of opportunism involves an exchange partner intentionally failing to commit or withholding required resources for joint efforts (Das and Teng, 1996; Handley and Benton, 2012; Luo, 2007), while a more blatant form would involve an exchange partner actively distorting information or practising deception for its own gain (Deeds and Hill, 1999; Luo, 2007). Partner opportunism is prevalent, since an actor in an economic exchange tends to maximise its own interests at the expense of its counterpart if an opportunity arises (Joskow, 1988). Opportunism in an exchange relationship can do serious economic and relational damage to involved parties (Handley and Benton, 2012; Luo, 2007). Broadly literature on opportunism in a buyer-supplier relationship, discusses methods of controlling or minimising partners' overt-opportunism. But there is an open call to review the basic understanding of buyer's opportunism with guile which is insidious and has negative consequences to the suppliers (Kelly *et al.*, 2018).

Scholars have identified various drivers of partner opportunism, such as: (1) uncertainty (Dyer, 1997; Poppo and Zenger, 2002; (2) asset specification (Dyer, 1997; Artz and Brush, 2000; Poppo and Zenger, 2002; (3) information asymmetry (Carson *et al.*, 2003); and (4) dependence (Provan and Skinner, 1989; Kumar *et al.*, 1995; Hill and Deeds, 1996). Dependence, which is the main focus of this paper, refers to a firm's need to maintain relationships with other firms in order to achieve its goals (Emerson, 1962; Kumar *et al.*, 1995). As resource dependence theory postulates, the survival of a firm is often dependent on its ability to secure critical resources from other firms (Casciaro and Piskorski, 2005; Pfeffer and Salancik, 1978). Teece (1986) suggested that when interactions between parties are maintained over a prolonged period of time, both parties may become dependent on each other, entering the stage of bilateral dependence. When this happens, both parties would be more likely to refrain from behaving opportunistically, since they have equivalent stakes in the relationship (Kumar *et al.*, 1995), and any conflict would inflict economic and relational damage for both parties (Crosno and Dahlstrom, 2008).

When this balance is broken or the gap widens, however, the less dependent party would be encouraged to behave opportunistically towards the more dependent one (Pfeffer and Salancik, 1978; Provan and Skinner, 1989; Kumar *et al.*, 1995; Hill and Deeds, 1996; Crosno and Dahlstrom, 2008; Chae *et al.*, 2017). Considering that dependence on a partner is in proportion to a firm's need for resources from that specific partner (Casciaro and Piskorski, 2005), the higher the firm's dependence, the greater the power capacity of the partner will become (Emerson, 1962). This means that the less dependent (more powerful) party can exploit its more dependent (less powerful) partner for economic benefits with less fear of retribution and economic damage (Crosno and Dahlstrom, 2008; Provan and Skinner, 1989).

SMEs often lag behind in new and innovative initiatives (Adams *et al.*, 2012; Son *et al.*, 2019), including supply chain digitalisation (Matt and Rauch, 2020). One of the main reasons for this is SMEs' relative lack of relevant resources and skills, which creates several technological and organisational challenges to do so (Quayle, 2003; Adams *et al.*, 2012). Moreover, SMEs tend not to think in the long-term time frames required for investments of this nature (Ritchie and Brindley, 2000) and are more conservative than larger firms towards investment that involves risk (Adams *et al.*, 2012). Therefore, when a better-resourced and more capable large buyers move ahead with supply chain digitalisation they may acquire unique and valuable information and knowledge, such as enhanced real-time market demand information and end consumer expectations, which may be highly sought after by SME suppliers. Consequently, this could result in SME suppliers' increased dependence on the superior digital capability of the buyers, therefore breaking the dependence balance or increasing the gap between them. Unless the SMEs also decide to undertake costly investment in supply chain digitalisation, the dependence gap may remain or even widen.

Emerson (1962) suggested that actors' power capability over their target is based on the target's dependence. The buyer's power over its SME suppliers is therefore in proportion to the SME suppliers' need for the buyer's unique and valuable information and knowledge acquired through its supply chain digitalisation. This means that supply chain digitalisation can potentially expose SME suppliers to a

new type of opportunism; that is, more digitally capable buyers will exploit suppliers' increased dependence.

2.2 Governance and opportunism mitigation

A firm engaging in exchange activities can control partner opportunism primarily by using a formal legal contract (Artz and Brush, 2000; Das and Teng, 1996; Eisenhardt, 1989; Lumineau and Henderson, 2012; Nooteboom *et al.*, 1997; Poppo and Zenger, 2002). Contractual governance is coercive in nature (Nooteboom *et al.*, 1997) and deters partner opportunism by creating *ex-post* costs for such behaviours (Williamson, 1985). That is, in the event of contract violation, a corrective action to the defected party can be applied via legal means (Artz and Brush, 2000). Typically, such a contract contains contingencies specifying exchange parties' roles in different situations (Williamson, 1996). The effectiveness of the contractual governance is largely dependent upon the extent of (1) the details and preciseness of the contract's specifications (Artz and Brush, 2000; Hill, 1990; Williamson, 1996), and (2) the monitoring of compliance (Hill, 1990; Nooteboom *et al.*, 1997).

Contractual governance, however, is subject to various weaknesses (Artz and Brush, 2000). First, creating a comprehensive contract that covers all possible eventualities in the future can be prohibitively expensive (Teece, 1986; Das and Teng, 1996; Poppo and Zenger, 2002) and may not be possible due to bounded rationality (Lumineau and Henderson, 2012). This means that the uncertainty surrounding the exchanges increases the cost of (1) drafting a comprehensive contract (Carson *et al.*, 2003; Handley and Benton, 2012) and (2) periodic contract renegotiations (Artz and Brush, 2000; Carson *et al.*, 2003), greatly undermining the effectiveness of contractual governance. Second, the efficacy of contractual governance in opportunism mitigation requires significant resources, since it necessitates constant monitoring and enforcement when a breach occurs (Teece, 1986).

As transaction cost economics scholars have acknowledged, formal contracts are not the only opportunism mitigation mechanism available to firms (Dyer and Singh, 1998; Poppo and Zenger, 2002). Another opportunism mitigation mechanism – relational governance – relies on social ties (Lumineau and Henderson, 2012). Relational governance is based on the notion that economic exchanges are

embedded in social ties (Hill and Deeds, 1996), and that such social ties can be an alternative or supplement mechanism to a complex legal contract in reducing partner opportunism (Granovetter, 1985; Gulati, 1995; Hill, 1990; Uzzi, 1997). Relational governance comprises the relational output of a series of positive past interactions between exchange parties. Specifically, this includes trust (Granovetter, 1985, 1992; Hill, 1990; Gulati, 1995; Uzzi, 1997; Li *et al.*, 2010; Son *et al.*, 2016), relational norms (Poppo and Zenger, 2002; Lui *et al.*, 2009), and commitment, and obligation (Coleman, 1988; Granovetter, 1992).

Relational governance mitigates partner opportunism in the following ways. First, forming a closer relationship through repeated interactions can provide a firm with information about others' incentives to behave opportunistically, enabling it to develop an effective mitigation strategy (Uzzi, 1997). Second, relational outputs of positive repeated interactions, such as trust (Granovetter, 1992; Tangpong *et al.*, 2010; Son *et al.*, 2016) can alleviate fears of opportunism in the relationship, therefore fostering a sense of openness and reciprocity (Tsai and Ghoshal, 1998b; Zaheer *et al.*, 1998). Similarly, commitment and obligation can serve to uphold agreed norms of interaction, reducing partner opportunism (Granovetter, 1992; Coleman *et al.*, 1999; Perry *et al.*, 2004). Third, the expectation of continuity reduces partner opportunism (Heide, 1994; Nooteboom *et al.*, 1997; Artz and Brush, 2000; Luo, 2007), since it encourages partners to look at long-term returns from the relationship (Poppo and Zenger, 2002).

To our best knowledge, there are few studies investigating the effectiveness of contractual and relational governance in suppressing buyer opportunism created by unbalanced supply chain digitalisation, particularly from the perspective of SME suppliers. This study attempts to fill this void.

3 Conceptual Model and Hypothesis Development

Using resource dependence theory as a theoretical lens, this paper investigates a potential dark side of supply chain digitalisation, that is, whether an SME supplier being left behind in supply chain digitalisation could potentially increase its exposure to opportunistic behaviours from more digitally capable buyers. Notably, this study focuses on the SME supplier's perspective, since they are more

likely to lag behind their large buyers in digital capability development efforts. We then seek to investigate whether conventional safeguarding mechanisms (contract and relational governance) are still effective in mitigating buyer opportunism of this nature.

As discussed earlier, due to the huge benefits promised by various supply chain digitalisation initiatives, the majority of large companies have implemented some form of such initiatives to enhance their digital capability (Fosso Wamba *et al.*, 2018; Kiron *et al.*, 2014). However, the latest studies suggest that the majority of SMEs are very much behind large companies in supply chain digitalisation (Matt and Rauch, 2020; Somohano-Rodríguez *et al.*, 2020). Such a gap in supply chain digitalisation may result in digital capability asymmetry, making SME suppliers more dependent on their more digitally capable buyers, for example with regards to vital and novel information and knowledge acquired via the buyers' supply chain digitalisation. Considering that the extent of an SME supplier's dependence on its more digitally capable buyer is in proportion to its need for such unique information and knowledge (Casciaro and Piskorski, 2005), one-sided supply chain digitalisation can potentially break the dependence balance and increase the dependence gap. Therefore, we hypothesise the following:

Hypothesis 1: The extent of the supplier-perceived digital capability asymmetry, wherein the buyer has a superior digital capability than its SME supplier, is positively related to the SME supplier's dependence on the buyer.

As resource dependence theory suggests, the main consequence of SME suppliers' increased dependence on more digitally capable buyers is the increased chance of opportunistic behaviours from the buyers (Pfeffer and Salancik, 1978; Provan and Skinner, 1989; Kumar *et al.*, 1995; Hill and Deeds, 1996; Crosno and Dahlstrom, 2008; Chae *et al.*, 2017). This is because SME suppliers' increased dependence on buyers increases the latter's power over the former (Casciaro and Piskorski, 2005). In buyer-supplier relationships, dominant firms can use power to opportunistically exploit the dependence of their partners in order to gain a greater share of relationship benefits or favourable exchange terms,

or to influence them into doing what they would otherwise not do (e.g., by coercing suppliers to extract concessions or breaking informal agreements) (Nyaga *et al.*, 2013). Moreover, a widened dependence gap makes it even harder for SME suppliers to retaliate against buyers' opportunistic behaviours, for fear of losing (1) business opportunities (Quayle, 2003), or (2) access to buyers' unique information and knowledge, enhanced by digitalisation (Crosno and Dahlstrom, 2008; Provan and Skinner, 1989). Therefore, we hypothesise:

Hypothesis 2: The extent of the SME supplier's dependence on its buyer is positively related to its perceived level of the buyer's opportunism

As discussed earlier, relational governance is made up of various relational outputs accumulated as a result of the history of repeated and positive interaction between actors (Heide and John, 1990; Poppo and Zenger, 2002). A high level of trust between an SME supplier and its more digitally capable buyer creates significant incentives to cooperate (Hill, 1990), as well as maintaining a stable relationship (Cao and Lumineau, 2015). Trust in a buyer–supplier relationship also creates a sense of reciprocity (Tsai and Ghoshal, 1998a; Zaheer *et al.*, 1998) between parties. This means that trust will significantly reduce the potential gains that a large and more digitally capable buyer's opportunistic behaviour may aim to achieve by taking advantage of widened dependence.

Another aspect of relational governance – the buyer's commitment/obligation – can encourage the buyer to abide by the agreed norms of interaction, rather than behaving opportunistically by taking advantage of the widened dependence gap (Granovetter, 1992; Perry *et al.*, 2004). Moreover, relational governance extends the buyer's expectation of the continuity of its relationship with the SME supplier in the future (Heide, 1994; Nooteboom *et al.*, 1997; Artz and Brush, 2000; Luo, 2007). Furthermore, if the buyer expects that the relationship will last for a long period, and related benefits are anticipated, it may refrain from taking advantage of the dependence gap that has been widened by digitalisation at the expense of the SME supplier (Poppo and Zenger, 2002). This means that relational governance can be

particularly effective in suppressing dependence-gap-induced opportunism. Therefore, we hypothesise as follows:

Hypothesis 3: The extent of the relational governance in the buyer-supplier relationship is negatively related to the SME supplier's perceived level of the buyer's opportunism

In most cases, a buyer-supplier relationship is safeguarded with a formal legal contract (Eisenhardt, 1989). Therefore, a legal contract is the first line of safeguarding available for SME suppliers against larger and more digitally capable buyers' attempts to exploit the widened dependence gap created by digital capability asymmetry (Artz and Brush, 2000; Hill and Deeds, 1996; Lumineau and Henderson, 2012; Luo, 2007). Contractual governance firstly suppresses opportunism by creating *ex-post* costs (Williamson, 1985), as discussed previously. This means that a legal contract clearly specifying (1) obligations and duties of exchange partners (Artz and Brush, 2000; Lumineau and Henderson, 2012), and (2) legal penalties for opportunistic behaviours (Luo, 2005) would reduce the likelihood of the large and more digitally capable buyer taking advantage of the widened dependence gap and behaving opportunistically.

Second, supply chain digitalisation can potentially create a huge amount of uncertainty in a buyer-supplier relationship, and such uncertainty may increase a partner's opportunistic behaviour, since it can enable some opportunism to go unnoticed, therefore reducing the chance of sanctions (Carson *et al.*, 2006). A contract with a detailed process for resolving foreseeable and unforeseen problems would facilitate SME suppliers' efforts to monitor and detect buyers' opportunistic behaviours (Poppo and Zenger, 2002; Carson *et al.*, 2006). This means that such contracts would reduce the likelihood of opportunistic behaviours, such as withholding or manipulating information, haggling, shirking obligation and deceiving, on the part of the large buyers (Luo, 2007). Therefore, we hypothesise:

Hypothesis 4: The extent of the contractual governance in the buyer-supplier relationship is negatively related to the SME supplier's perceived level of the buyer's opportunism.

<Insert Figure 1 here>

4 Methodology

4.1 Sampling and data collection

Since this study focuses on the SME supplier's viewpoint, we collected data from SMEs in South Korea (either annual sales do not exceed 150 million USD or total assets are less than 500 million USD)¹. South Korea has an extensive information communication technology infrastructure for supply chain digitalisation; for example, globally it has the most optical fibre connections per capita (31.9 subscriptions per 100 people) (Schwab, 2016), and it launched the world's first commercial 5G service in 2019 (Harrison, 2019). In addition, according to the IMD World Digital Competitiveness Ranking 2020, Korea is ranked overall eighth out of 63 countries, and third in the future readiness factor (IMD, 2020). Therefore, many South Korean firms have been actively involved in supply chain digitalisation in recent years (Yeo, 2019). This makes the South Korean companies well suited to the purpose of this study.

The target population of this study was SME suppliers whose major buyers are large firms with over 1,000 employees in Korea. To generate a target sampling pool, we first identified 205 large firms from the Korea Enterprise Data² and the list of *chaebol* firms from the Korean National Commission for Corporate Partnership. These 205 companies, accounting for about 60% of all large corporations (with over 1,000 employees) in Korea, are highly ranked in sales revenue and are also recognised for their economic and social impacts by the Korean National Commission for Corporate Partnership. To find SME suppliers that have a business relationship with these large firms, we merged three databases

¹ This shall be based on Article 2 of the Framework Act on Small and Medium Enterprise (www.mss.go.kr).

² The Korea Enterprise Data (www.kedkorea.com) is the nation's largest corporate database, containing information about 8.9 million Korean corporates and providing information on unlisted SMEs.

(the Korean Enterprise Information,³ the Korea Enterprise Data and KISLINE⁴), and searched for SMEs that declared at least one of the 205 large firms as their major customer(s). We initially identified 2,054 SME firms, and eliminated those with incorrect contact information, insolvency or both; the final sampling pool contained 1,875 firms.

As the data for this research was collected from the supplier-side only, there is a possibility of exception fallacy, which refers to "an erroneous finding where researchers draw biased aggregate or group conclusion among stakeholders on the basis of a single rater" (Roh *et al.*, 2013, p 712). Indeed, the past papers reported such differences between a buyer and a supplier on a certain aspect of a buyer-supplier relationship (Ellarm and Hendrick, 1995; Spekman *et al.*, 1997; Corsten and Kumar, 2005; Son *et al.*, 2016). Roh *et al.*, (2013) suggested that clearly positioning a study for one side of a relationship only would reduce the possibility of exception fallacy. We followed this suggestion to reduce the exception fallacy in our results.

4.2 Survey administration

The survey instrument was reviewed by two supply chain management (SCM) academics and a practicing purchasing manager to improve clarity and readability. All 1,875 SME suppliers were contacted by phone and asked to participate in the study. As a result, 429 out of the 1,875 firms agreed to join the study. The online survey link was then sent to the firms via email, text message or both. We also followed up with the 429 firms by phone at least twice to remind and encourage them to complete the survey. In order to ensure that respondents had sufficient knowledge about SCM and digitalisation, we explained the purpose of the study to the participants and informed them that the questionnaire should be completed by either chief executive officers, executives or senior managers, if possible (Kumar *et al.*, 1993).

³ The Korean Enterprise Information, published by the *Korea Economic Daily*, deals with information on 280,000 Korean enterprises, and aggregates corporate status and financial information based on audit reports and statements of accounts held by the Korean Financial Supervisory Service and an investor service company in Korea (NICE) (www.nicerating.com)

⁴ KISLINE (www.kisline.com) is the largest database of financial, R&D and general corporate information, covering almost 2.4 million companies in South Korea.

A total of 137 SME suppliers completed the survey, giving a response rate of 7.31% (137/1,875). To confirm the eligibility of the respondents, we asked questions about how well they knew their firms' digital transformation and their business relationships with the major buyer firms (1 = 'don't know', 3 = 'moderate' and 5 = 'very knowledgeable'). Of 137 responses, 12 were removed because of the respondents' insufficient knowledge (score = 1 or 2), resulting in 125 usable responses. The respondents' average self-evaluation scores (the relationship with the large buyer = 3.65, digital transformation = 3.32) and work experience in SCM departments of each responding firm (eight years) are comparable to those of extant research (Carey *et al.*, 2011). Furthermore, more than 70% of respondents are senior managers who worked for more than 10 year. These confirm that the respondents were sufficiently knowledgeable. Therefore, there were 125 firms in the final response.

As in Durach *et al.* (2020), to examine non-response bias we compared key firm attributes (firm age, sales revenue and the number of employees) across (1) responding firms versus non-responding firms and (2) firms that accepted to participate versus those that declined to partake. No significant difference was found across the respective two groups, indicating that non-response bias is not a serious concern in this study.

4.3 *Measurement development*

To ensure the quality of the measures for this research, we endeavoured where possible to use either established measures or those adapted from the extant literature. All measurement items used in this study were measured on a 5-point Likert scale, from 'Not at all' to 'A very great extent' (see Appendix 2). In terms of the supplier-perceived digital capability asymmetry construct, due to the lack of existing measures, a new 5-item scale was developed, based on existing digitalisation studies (Lu and Ramamurthy, 2011; Akdil *et al.*, 2018; Hartley and Sawaya, 2019; Culot *et al.*, 2020). The scale examines the extent of the supplier-perceived differences in the supplier's digital capability relative to the large buyer firm, as well as the supplier's orientation towards embracing new digital technologies. Our approach of providing respondents with a reference point, which is its own digital capability, would make their responses reliable and it is a common approach in measuring capabilities and performances

using a survey instrument (e.g., Lu and Ramamurthy, 2011). In order to measure an SME supplier's dependence on its large buyer, a 5-item scale was used. In a buyer–supplier relationship, the supplier's dependence on its buyer is often measured as the extent of the supplier's products purchased by the buyer (Provan, 1993) and the switch cost (Gulati and Sytch, 2007). Based on this, the first two questions were intended to measure the new type of dependence created by the digital capability asymmetry, in which the SME supplier becomes dependent on information or knowledge that the buyer has acquired through supply chain digitalisation. Provan and Skinner's (1989) functional dependence measure was adopted to measure the extent of suppliers' dependence on demand information, market and technology intelligence. The remaining three items in the scale, drawn from the existing studies (Provan, 1993; Heide, 1994; Kumar *et al.*, 1995; Gulati and Sytch, 2007), captured the extent of a supplier's dependence in terms of its revenue creation, and its switching-related efforts in terms of the difficulty of finding an alternative buyer, the cost of replacing the existing buyer and the difficulty in replacing sales and profit from the buyer.

A 3-item scale, selected from the literature, was used to measure the extent of SMEs' perceived level of buyer opportunism (Lui *et al.*, 2009; Rokkane *et al.* (2003). Various forms of partner opportunism such as lying about certain things to protect their interests and breaching informal agreements were measured.

Two different types of governance-based partner opportunism mitigation mechanism were measured. First, the supplier-perceived level of contractual governance in a relationship was measured using a 3-item scale. Building on previous studies (Lui *et al.*, 2009; Zhou and Poppo, 2010; Carey *et al.*, 2011; Zhou and Xu, 2012; Cao and Lumineau, 2015), the scale captured the extent of formal contract with a specific buyer perceived by the SME supplier in terms of details and specificity, roles, and responsibilities. Second, the supplier-perceived level of relational governance was measured using a 3-item scale taken from the existing literature (Poppo and Zenger, 2002; Zhou and Xu, 2012), focusing on the various relational output-based mechanisms, such as trust, joint decision-making, and conflict resolution routine.

4.4 Control variables

Since other factors outside the research model of this study may have influenced dependent variables, several control variables were considered. First, industry dummy variables were included to control for industry differences, since significant industry variation in supply chain digitalisation has been reported (Dalenogare *et al.*, 2018). Environmental uncertainty often significantly influences transaction relationships, including partner opportunism (Carson *et al.*, 2003). Therefore, demand uncertainty and technology uncertainty were used as control variables. Large suppliers are likely to invest actively in supply chain digitalisation, as they have sufficient resources and capacity, and this can in turn lead to superior performance outcomes (Yli-Renko *et al.*, 2001; Carey *et al.*, 2011). For this reason, we added a control variable of the firm size (revenue). Moreover, a firm's accumulated knowledge and experience can affect the level of supply chain digitalisation and its performance (Yli-Renko *et al.*, 2001; Kim *et al.*, 2015). As a proxy for a supplier's accumulated knowledge and experience, firm age was used, as the number of years elapsed since the founding of the firm. Relationship characteristics between SME suppliers and their large buyer firms, such as relationship duration (Carey *et al.*, 2011; Kim *et al.*, 2015) and supplier-perceived buyer's dependence (Heide, 1994; Kumar *et al.*, 1995) were also considered as control variables. Finally, the more firms have adopted digital technologies, the more likely they are to have excellent digital capabilities (Frank *et al.* 2019; Culot *et al.* 2020). Thus, the extent of SME suppliers' digital technology adoption (hereafter SDTA) was included as a control variable and measured the sum of adopted digital technologies (1 = adopt, 0 = do not adopt).

4.5 Measurement validity and reliability

This study establishes the unidimensionality of the latent constructs by all measurement variables loading on their intended first-order latent constructs in an exploratory factor analysis (Koufteros *et al.*, 2007). Reliability was confirmed through Cronbach's alpha and composite reliability, each of which should exceed the recommended minimum value of 0.6 (Nunnally, 1978). The reliability measures of all constructs also exceeded the recommended value (see Appendix 2). A confirmatory factor analysis (CFA) was conducted to assess the constructs' validity. The CFA results confirmed that

our model yielded an acceptable fit for the data (normed $\chi^2 = 1.456$, comparative fit index = 0.908, incremental fit index = 0.912, root mean square error of approximation = 0.061). As shown in Appendix 2, all measurement items loaded significantly on their intended constructs, and their loadings were highly significant ($p < .001$), confirming convergent validity (Anderson and Gerbing, 1988). Finally, as shown in Table 3, none of the average shared variances (AVEs) was below the squared correlation between corresponding construct pairs, providing evidence for discriminant validity (Fornell and Larcker, 1981).

<Insert Table 1 here>

4.6 *Common method bias*

Given that self-reported data was used, and that the same respondents answered the questions on both performance and its determinants, common method bias (CMB) was a possibility (Podsakoff *et al.*, 2003). Several steps were taken in the data collection process to avoid such bias. First, the respondents were assured that their identities would remain anonymous. In addition, we organised the questionnaire in such a way that respondents would read instructions and then proceed to answer the questions in each section; we also placed adjacent measurement variables in distinct sections (Podsakoff *et al.*, 2003). To test CMB, we conducted Harman's single-factor test (Podsakoff *et al.*, 2003). The result showed that an unrotated factor analysis of all variables revealed that a total of 69.3% of the variance was accounted for, and that the first factor captured only 15.7% of the variance. Following Harman's single-factor solution, we used a confirmatory factor analysis as another method for testing CMB. The model fit is not acceptable (normed $\chi^2 = 3.562$, comparative fit index = .427, incremental fit index = .440, root mean square error of approximation = .144), and significantly worse than those of the hypothesised measurement model. These results help alleviate CMB concerns and collectively confirm that CMB is not a serious concern in this research.

4.7 *Endogeneity*

We adopted two approaches to address the problems of endogeneity. First, we included a comprehensive set of control variables to address the problems of omitted variables. Second, we conducted two-stage least squares (2SLS) regression analysis with an instrumental variable and conducted a Durbin-Wu-Hausman postestimation test to assess endogeneity of the explanatory variable, buyer–supplier asymmetry in digital capability. We first identified the instrumental variable (IV) that theoretically and statistically related to the explanatory variable but was exogenous to the dependent variable and error term: the extent of suppliers’ digital technology adoption. At the first-stage regression analysis, the variable, supplier-perceived digital capability asymmetry, was regressed on our instrumental variable and control variables. The instrumental variable is strongly correlated with the explanatory variable ($b = -2.741$, $p = 0.000$). In the second stage, the predicted value of the explanatory variable was used as an independent variable to retest our proposed relationships. Supplier-perceived digital capability asymmetry is significantly and positively associated with the supplier’s dependence on the buyer ($B = .272$, $p = .028$), which is consistent with OLS estimation results. We conducted a test to see if the chosen IV was strong. The null hypothesis, that is the weak IV was rejected ($F = 53.576$, $p = .000$). In addition, the R-squared value for the first-stage regression (.383) is significantly higher than that of the control-variable-only model (.324), which supports the effectiveness of the IV (Pu *et al.*, 2019). Despite the strong instrumental variable, however, the result of the Durbin-Wu-Hausman test supports the exogeneity of the supplier-perceived digital capability asymmetry, since the null hypothesis that the digital capability asymmetry is exogenous cannot be rejected ($F = 0.0756$, $p = .7838$). Through these tests, we confirmed that the relationship between the supplier-perceived digital capability asymmetry and supplier dependence is unlikely to be excessively affected by endogeneity. Thus, we decided to use OLS regression in our subsequent hypotheses testing, since 2SLS estimation is less efficient than OLS estimation when the explanatory variable is exogenous (Durach *et al.*, 2020).

5 Analysis and Results

This study employed a hierarchical regression method (see Table 2), using SPSS 25 to test the proposed hypotheses. To investigate a potential dark side of supply chain digitalisation, we hypothesised that an SME supplier left behind by its large buyer in terms of supply chain digitalisation

– that is, facing widening digital capability asymmetry – would potentially experience increased exposure to buyer opportunism (H₂) through an increase in its dependence (H₁). These hypotheses were then followed by H₃ and H₄, in which negative relationships between the conventional safeguarding mechanism (contractual and relational governance) and the extent of opportunistic behaviours by large buyers were postulated. As seen in Table 2, our findings supported H₁ and H₂, suggesting that an increase in supplier-perceived digital capability asymmetry could significantly increase the suppliers' dependence on their large buyers (H₁: unstandardised $\beta = .222$, $p < .05$), therefore resulting in higher exposure to the buyers' opportunism (H₂: unstandardised $\beta = .244$, $p < .05$). As expected, the results suggested a significant negative relationship between relational governance and a buyer's opportunism (H₃: unstandardised $\beta = -.663$, $p < .000$), implying that this type of governance is still effective in controlling buyer opportunism from a new source – that is, digital capability asymmetry. However, the impact of contractual governance on buyer's opportunism was not significant, suggesting that the current form of contractual governance may not be suitable for curbing buyer opportunism.

<Insert Table 2 here>

To evaluate the mediation effect of supplier dependence between supplier-perceived digital capability asymmetry and buyer opportunism, we employed the causal step approach initially suggested by Baron and Kenny (1986). The results satisfy all three conditions specified by this approach. In addition, to confirm the complete mediation relationship, we checked whether the independent variable no longer affected the dependent variable after the mediation was controlled. Model 5 in Table 2 shows that SME suppliers' dependence is significantly associated with buyers' opportunism (unstandardised $\beta = .258$, $p < .05$), but that supplier-perceived digital capability asymmetry is no longer significant, confirming the complete mediation. We assessed the significance of the indirect effects using the PROCESS macro with bias-corrected bootstrapping (Hayes, 2018). The indirect effect of supplier-perceived buyer–supplier digital capability asymmetry on buyers' opportunism is statistically significant (Indirect effect = .0602, Boot SE = .0395), as zero does not fall between the lower and upper

bounds of the 95% confidence interval (95% bias-correct confidence interval of indirect effect = [.0015, .1510]).

6 Discussion and Conclusions

6.1 Theoretical contributions

Using resource dependence theory as a theoretical lens, our paper contributes to the growing literature on supply chain digitalisation by investigating its potential dark side. This refers to the situation in which less digitally capable companies become more vulnerable to the opportunistic behaviours of more digitally capable partners. For this purpose, taking the perspective of SME suppliers, we analysed survey data of 125 relationships between SME suppliers and their larger buyers. As a first step, we investigated whether being left behind in supply chain digitalisation and the resulting digital capability asymmetry increased SME suppliers' dependence and their exposure to opportunistic behaviours from more digitally capable buyers. Then, we tested whether governance-based opportunism mitigation mechanisms, such as contractual and relational governance, were still effective in suppressing such behaviours, caused by a new type of dependence.

Supply chain digitalisation is an emerging field and so far, the overwhelming majority of research has focused on its 'bright side', while to our best knowledge, there are only a few papers discussing its potential dark side (e.g., Lumineau and Oliveira, 2020). Similarly, with regards to partner opportunism, the small number of existing studies, which are mostly conceptual in nature, have suggested that supply chain digitalisation (e.g., IoT and blockchain) would play a game-changing role in controlling partner opportunism by reducing information asymmetry and uncertainty related to exchanges (Saber *et al.*, 2019; Schmidt and Wagner, 2019). The suggestions of these studies would only be applicable to those well-resourced and technologically capable firms that are taking advantage of the benefits of supply chain digitalisation to reduce blind spots in their relationships so as to better manage partner opportunism.

Our findings show the other side of the coin: that unbalanced supply chain digitalisation (and the resulting digital capability asymmetry) can encourage opportunistic behaviours from more digitally

capable firms (large buyers) against less digitally capable counterparts (SME suppliers). This is because SME suppliers, driven by the resulting digital capacity asymmetry to become more dependent on the buyers' unique and valuable information and knowledge, acquired via the latter's superior digital capability. Moreover, the SMEs' increased dependence on the buyers' digital capability could eventually lead to greater overall dependence; this refers to a supplier's reliance for revenue generation with the buyer (Provan and Skinner, 1989).

As resource dependence theory suggests, such a widening dependence gap could increase SME suppliers' exposure to buyer opportunism (Pfeffer and Salancik, 1978; Provan and Skinner, 1989; Kumar *et al.*, 1995; Hill and Deeds, 1996; Crosno and Dahlstrom, 2008). Considering that the majority of supply chain digitalisation research has focused on positive aspects, the major contribution of this paper is to initiate a discussion on the dark side of this phenomenon by providing empirical evidence that unbalanced supply chain digitalisation and the resulting digital capability asymmetry could create an intended or unintended increase in the opportunism of more powerful buyers. In addition, this paper sheds light on the mechanism of increased buyer opportunism from the resource dependence theory perspective.

Unless SME suppliers attempt to reduce the dependence gap by accelerating their own supply chain digitalisation efforts, which would be difficult due to their low resource and competence endowment (Matt and Rauch, 2020; Somohano-Rodríguez *et al.*, 2020), this gap will most likely widen in the future. For this reason, this paper investigated whether the existing opportunism mitigation mechanism is sufficient in providing SME suppliers with protection. However, our results suggested that contractual governance was not significantly related to the level of buyer opportunism. On the other hand, our results supported the hypothesis of a negative relationship between the extent of relational governance and buyers' opportunistic behaviours. The other contribution of the study is that the finding existing governance mechanism is partially effective in mitigating buyer opportunism induced by digital capability asymmetry.

Our findings are in line with extant literature on contractual governance, suggesting the contractual governance's poor suitability for mitigating opportunism in high-uncertainty exchanges,

due to (1) bounded rationality preventing the creation of comprehensive contracts (Teece, 1986; Das and Teng, 1996; Poppo and Zenger, 2002; Lumineau and Henderson, 2012) and (2) the cost of creating, monitoring and enforcing such complex contracts (Teece, 1986; Artz and Brush, 2000; Carson *et al.*, 2003; Handley and Benton, 2012).

As discussed earlier, a contract containing a clear process for resolving unforeseen problems could provide some level of protection against opportunism in these situations (Carson *et al.*, 2003; Poppo and Zenger, 2002). However, our results suggested that due to the magnitude of changes brought into the dynamics of a relationship, this argument may not be applicable to supply chain digitalisation. This suggests that the only governance-based mechanism fit to tackle opportunism of this nature is relational governance. As discussed earlier, a sufficient level of relational governance would encourage buyers of higher digital capability not to take advantage of the dependence gap, widened by digitalisation. Relational governance could be an alternative to complex and inflexible legal contracts in reducing partner opportunism (Granovetter, 1985; Gulati, 1995; Hill, 1990; Uzzi, 1997), especially for high-uncertainty situations (Carson *et al.*, 2003; Lumineau and Henderson, 2012). Relational governance is also less costly than contractual governance (Hill, 1990); therefore, SMEs with limited resources and knowledge (both technical and legal) may prefer to rely on this form of governance rather than committing significant resources to legal means (Son *et al.*, 2019).

However, it takes time for the sufficient level of relational governance for this purpose to develop, since a history of repeated and positive interactions between actors is necessary (Heide and John, 1990; Poppo and Zenger, 2002). In addition, its development is a joint effort (Adler and Kwon, 2002; Son *et al.*, 2016) and cannot be achieved by suppliers alone. Moreover, over-reliance on relational governance for mitigation might give SMEs a false sense of security, and thus deter them from seeking other means of safeguarding (Son *et al.*, 2019).

6.2 *Managerial implications*

Overall, our results indicate that the inequality of digital capability between buyers and SME suppliers intensifies supplier's dependence on valuable information buyer has, which increases their

exposure of buyer's opportunistic behaviours. As resource dependence theory suggests, one fundamental way to safeguard against opportunism is to address its very source, that is, the dependence gap (Crosno and Dahlstrom, 2008). This would entail an SME supplier ramping up its investment to enhance its own digital capability to catch up, however, it would be difficult due to the various reasons discussed earlier, for example, the lack of resources and technical know-hows. Nevertheless, SME suppliers can't be free from the shift of digitalization and need to consider that supply chain digital technology could provide them with real-time visibility and traceability also increasing buyers' dependence on them, reducing the dependence gap. Thus, basing on past research which found that top management support is the most important determinant of SMEs' adoption of enterprise systems such as ERP, SCM and CRM (Ramdani *et al.* 2009; Newby *et al.* 2014), an effort of top management in SMEs to broaden a perspective on supply chain digitalisation and its impact on the balance of buyer-supplier dependence can be a good start. In addition, as other means of closing the dependence gap, SME suppliers can try customer diversification, by searching for additional sources of knowledge and information (Bruyaka and Durand, 2012), and a coalition with other weak suppliers (Choi and Linton, 2011; Kalaitzi *et al.*, 2018). Meanwhile, buyers have been realising that true digitalisation comes when every bits of its supply chain becomes digitalised. This is because, total visibility cannot be achieved without SME supplier sufficiently digitalised. Recently, to build complete supply chain digitalisation and maximize benefits, buyers have been creating and offering a supplier development program specific to digital capability such as training for digital technology, managerial counselling, and loan for IT infrastructure deployment (Kim *et al.*, 2020). This is also an important opportunity for SME suppliers to ramp up their digital capabilities and thus they need to take full advantage of it.

6.3 *Limitations and further research*

Despite its theoretical and managerial contributions, this study has several limitations. Therefore, we would like to summarise these limitations and suggest future research measures to overcome them. First, this study collected data from suppliers only. As discussed earlier, we followed the suggestions by (Roh *et al.*, 2013) to reduce the possibility of exception fallacy by clearly positioning this study from the supplier's perspective. We must acknowledge, however, that the contractual and

relational governance constructs could have been better measured using dyadic data. We suggest a future research employing dyadic data on this. Second, we collected survey data only from suppliers who accepted our survey requests. As with all other survey studies, we acknowledge that our self-reporting survey method may raise concerns about selection bias (Durach *et al.*, 2020; Pu *et al.*, 2019; Golini and Gualandris, 2017). Future research should consider using the matching model method, the regression discontinuity design method and the differences-in-differences method in order to alleviate concerns over self-selection (Hernán *et al.*, 2004; Ho *et al.*, 2017). Third, in the case of the potential endogeneity of relational and contractual governance mechanisms, we could only identify weak instrumental variables, which made IV estimation and subsequent regression analysis impossible. We acknowledge that the possibility of endogeneity between governance mechanisms and suppliers' perceptions of buyers' opportunism cannot be completely excluded. Thus, future research needs to develop and test strong instrumental variables for governance mechanisms. Fourth, since this study collected data from SME suppliers in Korea, its research findings may be applicable to comparable social and economic settings in Asia. However, the findings may not be readily generalised to buyer–supplier relationships in developed economies. To increase the external validity of this research, we suggest that future studies extend the sampling framework to cover firms of various sizes across multiple countries. Fifth, future studies could integrate resource dependence theory with contingency theory, which identifies and matches contextual settings with organisational settings. Appropriate relational governance depends on contingency factors, such as the condition of a firm's task environment. One variation in a firm's task environment could be its rate of digital technological innovation (Volberda *et al.*, 2012). Finally, future research could show more specific results on buyer–supplier asymmetry in digital capability by further refining opportunism (e.g., passive and proactive).

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