Guanxi [1] and Information Sharing in Supply Chain Quality Management: a Multi-Method Investigation

Wenjuan Zeng [a], Ying Kei Tse [b *], Robert Mason [b]

[a] *Essex Business School, University of Essex, 11 Elmer Approach, Southend-on-Sea, SS1 1LW, United Kingdom*

[b] *Cardiff Business School, Cardiff University, Cardiff, CF10 3EU, United Kingdom*

[*] TseM1@cardiff.ac.uk

[1] Guanxi refers to a cultural feature of Chinese Confucianism that has significant implications for interpersonal and interorganisational dynamics in China (Park and Luo, 2001; Shou, Gong, and Zhang 2022)

Abstract

Companies are facing increasing challenges in managing product quality in their supply chains. To address the question of how to effectively mitigate quality issues by conducting quality management practices in the supply chain, the present study seeks to explore the relationship between Guanxi, information sharing (IS) and four important dimensions of supply chain quality management (SCQM). Our empirical investigation follows a mixed-methods approach using survey data from 468 managers working in Chinese companies and by applying structural equation modelling, outcomes suggest that separately applying Guanxi and IS can improve the performance of SCQM activities. Considering the interdependencies between different SCQM processes, we apply a fuzzy-set qualitative comparative analysis (fsQCA) method to demonstrate different combinations of core elements in their attainment of high levels of SCQM dimensions. Three case studies are also conducted to determine how these factors, as well as other crucial enablers or inhibitors, emerge, interact, and impact each SCQM stage. The outcomes of case studies reinforce and refine the findings of the fsQCA analysis and highlight the synergy effects between four SCQM dimensions and how Guanxi and IS can be applied when orchestrating these dimensions.

Keywords

Supply Chain Quality Management, Guanxi, Information Sharing, SEM, FsQCA

1. Introduction

In recent years, companies have adopted various manufacturing practices to retain profitability and maintain their competitive edge in the market. However, the globalized supply chain can also lead to uncertainties in product quality and create additional quality considerations on the components or final product (Hwang, Radhakrishnan, and Su 2006; Tse et al. 2019). The outbreak of the COVID-19 pandemic increased pressure on suppliers in their efforts to maintain consistency and efficiency under certain restrictive regulations (Ketchen and Craighead 2020). Quality management (QM) in supply chain, therefore, became even more critical, as nonconforming materials or components supplied for use in a medical device or lifesaving equipment could post significant health hazards (Machado et al. 2019). Moreover, failure to cope with quality issues in supply chain could have led to a range of repercussions for companies, including longer production lead times, inferior products and service quality, manufacturing distribution problems, slower product development, conflicts with supply chain partners, and loss of a company's reputation (Foster, Wallin, and Ogden 2011; Tse et al. 2021).

Supply chain quality management (SCQM) is referred to as an extension of supply chain management (SCM), which aims to build supply chain competencies through tailored QM practices (Kuei, Madu, and Lin 2011). Tse et al. (2019) stated that handling quality problems through appropriate management practises is particularly important for the company's competitiveness and survival in the market. Thus, a challenge for all researchers in this domain is to build quantitative models related to quality threats in SCQM practices (da Silva, Barbosa-Póvoa, and Carvalho 2020). Various management initiatives and actions are taken to manage the supply function with the purpose of improving the overall organisational quality performance (Lo and Yeung 2006), for instance, using supplier quality development for increasing quality, reliability and efficiency of suppliers (Noshad and Awasthi. 2015), applying quality monitoring to

ensure continuous performance improvement throughout the supply chain leading to higher levels of customer satisfaction (Ben-Daya et al., 2020). Although a number of recent studies provided a fertile area for elucidating SCQM practice (e.g., Foster, Wallin, and Ogden 2011; Soares, Soltani, and Liao 2017), academic studies to date have not provided companies with a deep insight into the design and implementation of assurance systems to prevent quality catastrophe in supply chain (Huo, Zhao and, Lai 2013; Tse et al. 2019). Therefore, this study aims to contribute to filling this gap by gaining a deeper insight and understanding of QM practices from a supply chain perspective, and by providing further insight into the synergy effects of deploying four SCQM practices that are advocated to be used simultaneously to best proactively adress supply chain quality threats (Clemons and Slotnick 2016).

Grounded on previous research, which argued that adopting SCQM requires the orchestration of complementary organisational resources (e.g., Robinson and Malhotra 2005; Zu and Kaynak 2012), this study posits that depending on the context of examination, Guanxi and information sharing (IS) will have a greater or lesser significance in effectively performing SCQM processes. Despite the fact that SCM studies have demonstrated a strong understanding that boundary sinners can have an impact in a variety of ways for organisations, such as trust, promises, and recommendations, these studies have ignored the cultural nature that underpins the influence of boundary spanners (e.g., Bachmann, Gillespie, and Priem 2015; Li et al. 2021). Given the cultural differences, the way the West companies observed channel behaviour may differ from that of non-Western countries (Johnson et al., 1993). In China, individuals and businesses value Guanxi because it affects their attitudes and behaviours and determines resource allocation (Shou, Gong, and Zhang 2022), nevertheless, the investigation of how Guanxi influence supply chain competencies in QM practices is

essential but lacking in the literature. Furthermore, Yurt and Yildirim (2022) noted that majority research on integrated solutions in the supply chain context has been conducted in developed countries. This study fills this gap by focusing on an emerging country, namely China, to explore the role and centrality of both factors as a means of influencing SCQM approaches.

When a supplier and a buyer have strong Guanxi, they may communicate information about their inputs, issues, and goals to support other supply chain participants in making accurate forecasts and strategies to prevent potential supply chain quality issues (Kembro, Näslund, and Olhager 2017). However, supply chain actors are not guaranteed to share information to avoid quality problems, as they may hide some unfavorable information to preserve their reputation and power (Park and Luo 2001), and this lack of transparency could result in information asymmetry, which may have negative consequences for supply chain activities. Accordingly, whether Guanxi positively influences SCQM strategies is closely related to how supply chain partners deal with the information they are provided with, and this links to another important concept, IS. Yet there is a dearth of empirical studies demonstrating how IS simultaneously influences different SCQM practises (Zhou and Li 2020; Bäckstrand and Fredriksson 2020), and previous research has paid little attention to the complementary effect of Guanxi on SCQM practises (Shou, Gong and Zhang 2022). Therefore, this study investigates the effect of Guanxi and IS on SCQM (Lee et al. 2018). By providing building blocks that can drive the setting of quality threat mitigation activities, this research helps companies to avoid, or reverse, the trends of quality problems in their supply networks. Drawing on a sample of 468 survey responses from managers in Chinese companies, we examine the impact of Guanxi and IS on four dimensions of SCQM: supplier quality development, quality monitoring, quality oriented supplier selection and quality risk transfer. We then

consider the potential synergy effect between the and apply a novel methodology, fsQCA, to attain the combinations that facilitate different SCQM dimensions. Three case studies are then conducted to uncover how these elements, as well as other core enablers or inhibitors emerge and how they coalesce and influence each SCQM stage.

The paper is structured as follows. After this introduction, we provide a review of the literature on SCQM, Guanxi and IS in Section 2, in which we summarise the current state of knowledge and highlight the existing gaps that this study attempts to fill. We also introduce the research model and outline the theoretical perspective on which this study is based. In Section 3, we describe the general research approach with detailed descriptions of the study methodology (i.e., collection of data, construct measures, reliability and validity tests, and case study data collection method). In Section 4, we present the results of the fsQCA analysis and the results of the three case studies. In Section 5, we summarise the findings, highlight the theoretical and practical implications, and indicate limitations and suggestions for future research.

2. Theoretical background and hypotheses setting

2.1 Supply chain quality management dimensions

SCM is generally described as the integration of operations and marketing management, which elevates the important of downstream and upstream linkage (Flynn and Flynn 2005; Gallear et al. 2021), drawing on QM, which emphasises the importance of companies' quality assurance efforts across an organisations' boundaries (Soares, Soltani, and Liao 2017). Existing literature stresses the important requirement for further theories that help understanding of the operationalised the interface between SCM and QM since quality practices need to be translated from the traditional company-centric and product-based mindset to an inter-organisational supply chain orientation setting (e.g.,

Foster, Wallin, and Ogden 2011; Kaynak and Hartley 2008). This has resulted the emergence of SCQM, which incorporates examining purchasing and logistics functions with a more quality minded approach to create value and achieve satisfaction for intermediate and final customers in the marketplace (Robinson and Malhotra 2005; Machado et al. 2019).

SCQM practices have long dominated firms to achieve excellence in their business and have been studied through the lens of agency theory (Zu and Kaynak 2012). Agency theory is concerned with the problems of sharing risk among groups and individuals (Shou, Gong, and Zhang, 2022). The 'agency problem' refers to problems related to different parties having different attitudes towards risk sharing during the cooperation between principal and agent. There are two main problems in an agency problem: (i) the ultimate goals of principal and agent are in conflict; (ii) it is difficult or expensive for the principal to verify exactly what the agent has done (Eisenhardt 1989). The problem arises in an agency relationship where the principal (i.e., buyer) is the party which delegates work to the agent (i.e., supplier). Thus, the two parties may prefer different actions because they have different perspectives on mitigating risk in product quality. For example, the buyer demands an excellent product from the supplier. However, it is difficult for the buyer to closely monitor the supplier's efforts in producing the product and to ensure that the supplier does not engage in opportunistic behaviour (Eisenhardt 1989). In such a case, a researcher can focus on identifying situations where the buyer and the supplier have conflicting goals and then develop an appropriate mechanism to limit the supplier's self-interested behaviour by referring to agency theory.

Although scholars have recognized important practices in SCQM, little empirical examination has been conducted from a supply chain perspective (Huo, Zhao, and Lai 2013). This study aims to contribute to filling this gap by investigating four SCQM

practices, namely, supplier quality development, quality monitoring, quality oriented supplier selection and quality risk transfer. In particular, we coin the concept of supplier quality development, which further furbishes the concept of supplier development with a focus on QM in the supply chain context (Lo and Yeung 2006; Noshad and Awasthi. 2015). Quality monitoring and quality oriented supplier selection are extracted from the research of Xu (2011) and Lin et al. (2005) respectively. We borrow the concept "risk transfer" from the areas of risk management and financial studies (e.g., Yang et al., 2009; Camuffo, Furlan and Rettore 2007; Balachandran and Radhakrishnan 2005). Since the study of risk transfer is not limited to the realm of classical debt-equity relationships, and can occur in any informationally inefficient context, this study focuses on quality-relevant risk transfer in buyer-supplier relationships. Among these four practices, quality oriented supplier selection takes place before suppliers are selected, while quality monitoring and supplier quality development are applied to reduce the possibility of quality hazard by reviewing the product quality and assisting suppliers in making operational improvements. Quality risk transfer is a measure that buyer companies can use to reduce their losses after quality issues occur. The detailed information on these practices are displayed in Table 1.

Table 1. Existing knowledge of key SCQM practices.

SCQM dimensions	Supplier quality development	Quality monitoring	Quality oriented supplier selection	Quality risk transfer
Definition	The efforts made by the industrial buying company to improve supply quality with assistance to operations improvement in supplier side (Krause, Handfield, and Scannell 1998; Lo and Yeung 2006; Kaynak and Hartley 2008).	Quality monitoring is conducted to monitor the quality aspects of products, based on buyer-specified quality characteristics, delivered by suppliers (Xu 2011).	The way to select appropriate suppliers based on their capacity to meet the quality needs of the enterprise (Lin et al. 2005; Cole and Aitken 2019).	The way that focal companies shift the responsibility to manage and resolve known or foreseeable quality related risks to their suppliers.
Nature	External practices across organisational boundaries.	Internal practice within buyer's organisation.	Internal practice within buyer's organisation.	External practices across organisational boundaries.
Purpose	• To solve focal buyer company's uncertainty about the supplier's production capacity (Noshad and Awasthi. 2015); • Minimising the impact of supplier quality defects by collaboration.	• Maximising the chance of finding defect products; • Ensuring the products meets international safety standards; • Reducing the likelihood of quality issues occurring by appropriate incoming monitoring strategy.	• This strategy is geared toward reducing the quality defect event probability to zero by removing root caused from upstream supply chain (Hajmohammad and Vachon 2016); • Reducing the likelihood of quality issues occurring in the first place (Gallear et al. 2021).	• To take a form of insurance of particular risk, i.e., quality defect; • Minimising the impact a loss might have for supplier, if it does occur (Camuffo, Furlan and Rettore 2007); • To shift quality risks to other entities who may have better capability to solve them (Bhattacharya and Tang 2013).
Key managerial activities	• Buyer companies make investment on suppliers' facilities to improve quality of the parts and materials (Salimian, Rashidirad, and Soltani 2021);	• Buyer monitoring policies are typically combined with penalties and rewards in a supply chain contract; • When deviations occur, corrective actions, like determining possible	• Selecting the right supplier based certain criteria, such as whether the supplier has reliable quality assurance systems, effective control of operations for maintaining high quality, build in quality in day-to-day activities,	• Increasing the penalty for defective products, which raise suppliers' concern for the quality of the product; • Additional penalty for compensation is required if buyer companies have any lost

	• Buyer companies provide education and training opportunities for suppliers to gain knowledge about product quality (Zu and Kaynak 2012).	preventive measurement and providing guidelines for further improvement, will be taken (Xu 2011).	continuous quality improvement, awareness of relevant quality policy, and international quality certificates, like ISO certification (Lo and Yeung 2006).	due to defects or quality problems from material (e.g., clients' penalty, product recall, unconditional replacement).
Outcome	• With the long-term assistance provided by buyer, it improve the suppliers' ability on improving quality and solving quality and safety issues (Tse et al. 2019); • The relationship between buyer and supplier would also improve due to the frequent communication and coordination.	• Close monitoring of the quality of incoming materials and parts effectively reduce the number of defects entering the process (Starbird, 2001) • The practice can detect early quality issues, and assuring that production is functioning optimally. • Quality threats are reduced by effectively curbing supplier's opportunism behaviour (Zu and Kaynak 2012).	• Identify and avoid inappropriate suppliers who might bring quality problems or threats to the supply chain. • This practice makes companies select supplier based on quality instead of price or schedule (Cole and Aitken 2019).	• Buyers can operate with minimal uncertainties since they would be compensated for the insured loses. • This practice potentially causes an unequal power relationship which triggers disadvantages of those lower down the supply chain, and can lead to work intensification and precarious employment (Bhattacharya and Tang 2013).

2.2 Guanxi and SCQM dimensions

Guanxi can be viewed as an important element of the social network rooted in traditional Chinese culture. It means a subset of relationships established by a supplier and a buyer according to certain norms and reciprocity, which also generate a social network containning implicit mutual obligations, assurances and understanding (Park and Luo 2001; Liu et al. 2008; Burt and Burzynska 2017). Guanxi developes in uncertain environments and at its core involves (1) familiarity, intimacy (2) trust, and (3) mutual obligations. Guanxi circle is akin to an inner circle of business elites that strongly emphasises the role of trust and mutual obligations for network advantage (Burt and Burzynska 2017). The development of Guanxi places great emphasis on relationships between business partners to achieve mutual benefits and involves the use of personal and/or inter-company connections to secure long term advantages (Lee and Humphreys 2007, Salimian, Rashidirad, and Soltani 2021).

In the supply chain context, literature have emphasized the significant of Guanxi in buyer-supplier relationships (e.g., Wiegel and Bamford 2015; Shou, Gong, and Zhang 2022; Luo et al. 2015). For example, Zhao et al. (2008) indicated that Guanxi positively influences buyer-supplier relationships in China through reciprocal exchange of favours and obligations. Li et al. (2007) argued that the relationship between supplier development and buyers' competitiveness is established through mutual trust and joint actions. Similarly, Wiegel and Bamford (2015) implied that Guanxi relationships affect trust between supply chain partners, as guanxi partners usually trust each other when there is prior cooperation and interactions between them. Moreover, Lee et al. (2018) emphasised that both buyers and suppliers can benefit from the resources invested in SCM practises if they employ good guanxi. These include reducing volume uncertainty, increasing transaction frequency and improving their ability to innovate in processes and

products to survive in a more competitive globalised market. However, past studies on the significance of Guanxi in mitigating quality problems are scarce and there are only a handful of studies (Shou, Gong, and Zhang 2022). Some studies assert that SCM is based on social interaction and cooperation between buyers and suppliers, and Guanxi supports this, by attributing to companies' long-term competitiveness and performance through fostering buyer-supplier relationships (e.g., Wiegel and Bamford 2015; Li, Ye, and Sheu 2014; Cheng, Yip, and Yeung 2012). However, the results of some studies are contradictory. Peng and Luo (2000) argue that buyers may invest too much effort and time in maintaining Guanxi network while hindering buyers' adoption of SCM practices. Luo et al. (2015) also claim that higher levels of Guanxi between buyer and supplier reduce the willingness to implement QM practices, which could raise the vulnerability of supply chains to quality problems. These contradictory findings remain to be resolved and represent a significant research gap in SCQM. This study opens a new avenue of research by proposing the role of Guanxi in the adoption of different SCQM practices.

We argue that the application of Guanxi can mitigate the threat to quality and support the SCQM process by providing a strong motivation for buidling strategic partnerships with suppliers (Lee and Humphreys 2007). When the product is manufactured, buyers could make efforts to improve supply quality through operational improvement on the supplier side to reduce suppliers uncertainty behaviour. The development of Guanxi facilitates communication, which could help to generate task programmability defined by both sides to efficiently ensure the correct behaviour of suppliers. Meanwhile, companies always intend to prepare for predicting, identifying and dealing with quality issues, which is usually done through strict monitoring. As mentioned earlier, good buyer-seller relationships reflect those frequent contacts take place and deep trust has been established between buyers and suppliers, which not only

facilitates the establishment of an explicit monitoring mechanism, but also makes the implementation of monitoring activities less intrusive. Additionally, many leading local companies may show more willingness in selecting a supplier based on quality, and Guanxi may help companies generate a better understanding of suppliers' capacity to meet quality demands by allowing access to limited resources and information. Finally, the reason that buyer companies transfer quality risk to suppliers is not only because they are concerned about product quality, but also because they want to counter opportunistic behaviour by their suppliers, which is also a reflection of a lack of trust (Zu and Kaynak 2012). According to this line of reasoning, we postulate the following hypotheses:

H1a: Guanxi positively affects supplier quality development

H1b: Guanxi positively affects quality monitoring

H1c: Guanxi positively affects quality oriented supplier selection

H1d: Guanxi positively affects quality risk transfer

2.3 IS and SCQM dimensions

IS is defined as "the degree to which each party discloses information that can facilitate the other party's activities" (Heide and Miner, 1992). Developing IS helps partners understand each other's business and maintain a long-term partnership (Fu, Han, and Huo 2017). In the supply chain context, IS refers to the situation in which supply chain partners share critical and proprietary information that may facilitate the other party's activities (Fawcett et al. 2007, Shen et al. 2019). Previous studies emphasise that sharing quality related information with partners in their supply chains can improve the coordination of logistics and production related activities, and play an important role in helping supply chain partners understand each other's business and form long-term partnerships (e.g., Lee and Whang 2000; Sahin and Robinson 2002; Saldanha et al. 2013; Riley et al. 2016; Bäckstrand and Fredriksson 2020). Researchers have highlighted the

role of IS as an essential ingredient for any SCM system as well as one of the key enablers to mitigate supply chain problems (e.g., Jüttner 2005; Kembro, Näslund, and Olhager 2017; Shen, Choi, and Minner 2019; Bäckstrand and Fredriksson 2020). Jüttner (2005) claimed that "openness to share quality related information" and "acceptance of joint risks" are pivotal to the effective application of SCQM approaches. Zhou and Benton (2007) also emphasised that effective IS significantly improves the effectiveness of supply chain practices.

Although the existing research emphasises the significance of IS in SCQM (Zhou and Benton 2007; Xu 2011; Kembro, Näslund, and Olhager 2017; Christensen et al. 2021), how specific SCQM processes are affected by IS has received less attention. IS can contribute to supplier quality development at multiple levels, including production status and costs, transportation availability and quantity discounts, inventory costs, inventory levels, various capacities, demand data from all channel members, and all planned promotional strategies (Sahin and Robinson 2002). The fundamental motive for a buyer to assist suppliers is to increase product quality and lower costs through improved supplier performance (Salimian, Rashidirad, and Soltani 2021). Finally, information exchange provides suppliers with knowledge that allows them to adjust their manufacturing and production strategies, as well as giving the buyer a competitive advantage by enabling them to increase sales of their products/services (Christensen et al., 2021).

Quality monitoring necessitates a high level of visibility across the supply chain, and supply chain visibility would require accurate IS (Xu 2011; Ben-Daya et al. 2020). Specifically, supply chain visibility refers to the extent to which supply chain actors have access to the timely and accurate information regarding to be critical or beneficial to their operations (Somapa, Cools, and Dullaert, 2018). High supply chain visibility may

eliminate any information asymmetry between the buyer and supplier when there is accurate and effective IS (Xu 2011), allowing the buyer to mitigate imperfect observability of supplier quality and identify possible accidents (Lee and Whang 2000; Shen, Choi, and Minner 2019).

Moreover, quality oriented supplier selection is an action preparation process that usually involves a set of selection criteria to check whether members have adequate quality performance (Lin et al. 2005; Gallear et al. 2021). This process aims to identify and distinguish whether a supplier is at an acceptable state or position to work whilst displaying the best potential for continuously meeting buyer's needs. IS provides data, information and knowledges of supply chain that brings an opportunity to learn about suppliers, such as quality assurance systems, relevant quality policies and quality relevant certificates, so that buyers can identify and avoid inappropriate suppliers that may introducing quality problems into the supply chain (Hwang, Radhakrishnan, and Su 2006).

In quality risk transfer practices, buyers typically assess the potential risks, anticipate them and then transfer them downstream in the supply chain. The evaluation of risks is closely related to the degree of IS because when information is initially shared, the recipient must decide whether the information is accurate, trustworthy, timely, useful and in an easily usable format (Ge et al. 2016). Since IS can provide accurate and timely data which can increase the accuracy of evaluation, it allows buyers to make better decisions on risk transfer. This leads to the following hypotheses:

H2a: IS positively affects supplier quality development

H2b: IS positively affects quality monitoring

H2c: IS positively affects quality oriented supplier selection

H2d: IS positively affects quality risk transfer

2.4 Guanxi, IS and SCQM dimensions

Given that both Guanxi and IS are closely relevant to SCQM practices, this raises the question of how best to apply Guanxi and IS in Chinese supply chains. Current knowledge suggested that Guanxi is positively related to IS in supply chain since Guanxi bridges knowledge gaps between buyers and suppliers. The increased inflow of knowledge of buying companies would help to detect the opportunism on the part of suppliers, while suppliers who want to save their own face would be less likely to engage in opportunism (Shou, Gong, and Zhang 2022; Park and Luo, 2001). Moreover, having Guanxi to the personnel of supplier allows buyer to quickly obtain information from suppliers to achieve a safe supply of goods and smooth transactions (Wiegel and Bamford 2015). In this study, we investigate that in the case of Chinese companies, Guanxi and IS could be applied simultaneously to mitigate quality threats in different steps of SCM. The conceptual model is displayed in Figure 1. Therefore, it could be envisaged that IS can operate as the complement of Guanxi when the aims are to achieve different SCQM processes. Specifically, many Chinese firms are developing Guanxi to cultivate business relationships, managing scarcity and secure factors of production, but suppliers' opportunistic behaviour is still present due to the lack of legitimacy, and has become an obstacle to the development of supplier quality (Wiegel and Bamford, 2015). This concern can be dismissed by IS for its ability to implement effective internal and external operation practices and allows companies to have a realistic focus on supply chain quality assurance decisions. Moreover, through IS in supply chain, exchanges quality information and other operational information is shared with suppliers. This makes it easier for manufacturers to apply statistical quality control methods and develop quality information systems and improve supply quality on the supplier side (Zhou and Li, 2020). Meanwhile, some Guanxi-triggered behaviours may have an impact on quality monitor results, for instance, bribery would be utilized to pass an unqualified product. IS can

reduce the occurrence of such things because it can retain relevant information about product quality and monitoring results, effectively reducing information dissymmetry and information distortion that Guanxi might cause (Lee et al. 2018). Even if the information is false, it may be easier to be held accountable afterwards. In terms of quality oriented supplier selection, the choice of focal company is particularly important as an unqualified supplier could bring quality problems. However, some purchasing managers choose the supplier with good relationships, rather than based on the ability to produce a high-quality product. This behaviour could increase the possibility of producing defective products. However, this can be offset by IS as detailed and accurate information about the supplier's production capacity and the quality of the manufactured products is shared by senior managers, forming a more rigorous internal monitoring mechanism (Bäckstrand and Fredriksson 2020). In the practices of quality risk transfer, buyers routinely transfer risk to the supplier, believing that the supplier should bear primary responsibility for the product's quality (Camuffo, Furlan and Rettore 2007). This behaviour will severely damage the trust between them if the buyer is unable to prove that the exact fault lies with the supplier. On the other hand, IS enables sufficient visibility and traceability in the supply chain, which is vital for identifying risks, and provides concrete evidence of who should be responsible for the risk (Fu, Han, and Huo 2017; Razak, Hendry, and Stevenson 2021), reducing suspicion and mistrust between buyers and suppliers.

Increasingly complex supply chains make it difficult to develop strong relationships, as multiple links and exchanges make it difficult to forecast, aggregate, and share accurate and timely information (Kembro, Näslund, and Olhager 2017). In contrast, the Guanxi factor can inlufence the flow of information and interaction between buyer and supplier companies in the Chinese business environment (Park and Luo 2001). In particular, when using IS to promote SCQM processes, buyers may turn information into

solid evidence to alert a supplier to defects. This can lead to unequal power relations in supply chain, making suppliers feel that they are in a more passive role. If IS identifies ways in which buyers can assist suppliers in the stage of supplier quality development, buyers will have to invest money and time, while suppliers will also have to make some changes to meet the requirement of buyers, and both may be reluctant as this can be costly and time-consuming. However, any quality problem in the supply chain should be recognised as joint threats, which means that companies should have a joint responsibility for supply chain quality. In an ideal world, as the chance of identifying potential defects or existing problems increases significantly when they actually share valid information with each other. The development of Guanxi involves favour and obligation, and the process of reciprocal exchange that can reduce uncertainty in the supply chain (Cheng, Yip, and Yeung 2012). In addition, SCQM practices could lead to those lower down the supply chain bearing the loss and feeling disadvantaged. For instance, quality monitoring may include strict reliability testing for the quality of incoming products and keeping careful record of goods. Supplier selection may result in several suppliers being in a competitive relationship and being rigorously evaluated by buyers at the same time, with suppliers being penalised if they make mistakes. The development of Guanxi could alleviate these tensions as it emphasises mutual obligation, assurance and understanding among supply chain members (Lee and Humphreys 2007). It helps suppliers understand that cooperating with buyers can achieve mutual benefits and success in the long term, which increases their interest in developing SCQM processes. Based on this logic, we propose the following hypotheses:

H3a: The use of guanxi and IS simultaneously will function in promoting supplier quality development

H3b: The use of guanxi and simultaneously will function in promoting quality monitoring

H3c: The use of guanxi and IS simultaneously will function in promoting quality oriented supplier selection

H3d: The use of guanxi and IS simultaneously will function in promoting quality risk transfer

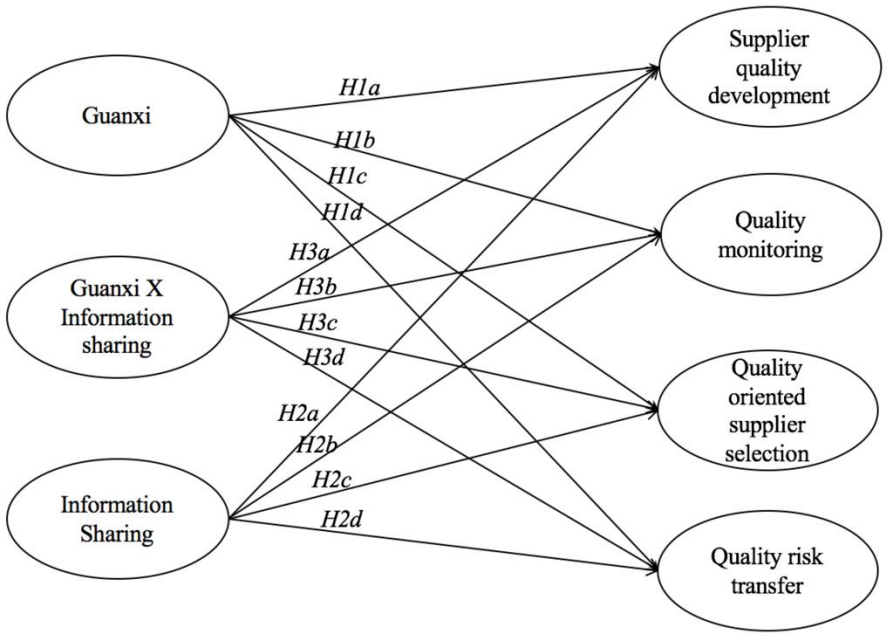


Figure 1. Conceptual model.

3. Method

3.1 Data

To examine the degree of significance of factors to the effectiveness of SCQM approach, a survey instrument was developed and administered to key informants within companies. A survey-based approach has been widely adopted to accurately capture the maturity of company's SCQM (e.g., Foster, Wallin, and Ogden 2011; Soares, Soltani, and Liao 2017; Zhang, Hu, and Zhao 2020). To operationalize concepts and constructs we used a well-accepted practice in large-scare empirical research, a 7-point Likert scale,

to evaluate how effective their company is in developing Guanxi and IS to support each of the aforementioned dimensions of SCQM (1 – Not effective at all, 7 – Highly effective).

The research objectives can best be achieved by soliciting responses from relevant managers and presenting a set of SCQM practises aimed at solving quality and safety problems. In population addressed in this investigation is targeted companies in Hong Kong, all of which have their own factories in the Pearl River Delta (PRD) region of China. Most Hong Kong companies have their manufacturing facilities in the Pearl River Delta, which is located in the east and south of China and has the second highest GDP per capital in China (Zhao et al, 2008). The unit of analysis in this study focuses on the implementation of SCQM in a single company. A director or senior manager of the respective company is the informant. Data were collected through a survey of 2440 companies in the garment, furniture, plastics, metal, computer, electronics and measuring instrument industries in Hong Kong and the PRD regions. The US Standard Industrial Classification (SIC) was used for the categories as it is the most commonly used in the leading operations management journals. Each of the targeted respondents was contacted with a pre-notication letter and a primary invitation letter with a link to the online survey. Before the questionnaires were distributed to the targeted respondents, the possible companies that should have implemented Guanxi and IS in their SCQM and had experienced some degree of product recall or withdrawal were screened out. A total of 468 valid responses were obtained, representing an effective response rate of 9.5%. The demographics of the sample companies and their representativeness are presented in Table 2. Companies in our sample operated in various industries, the largest being the electronics sector (36.8%), followed by plastics (19.9%), computing (11.1%), clothing (3.2%), metals (2.1%), furniture (1.7%), measuring (0.4%), while a large proportion came

from other sectors (24.8%). The majority were medium-sized companies, accounting for 63.2% of the sample, while small-sized and large companies were 21.2% and 15.6% respectively.

Table 2. Descriptive statistics of the sample and respondents.

Factors	**Sample (N=468)**	**Percentage (%)**
Industry		
Electronic	175	37.4%
Plastic	126	26.9%
Compute	55	11.8%
Metal	34	7.3%
Furniture	29	6.2%
Cloth	20	4.3%
Measure	18	3.8%
Other	11	2.4%
Company size (number of employees)		
≤50	97	20.7%
51-250	196	41.9%
>251-500	175	37.4%
Annual sales		
<RMB10m	121	25.9%
>RMB10m-RMB50m	193	41.2%
>RMB50m-RMB200m	117	25.0%
>RMB200m	37	7.9%
Respondent's position		
Project manager	48	10.3%
Supplier manager	30	6.4%
Quality manager	58	12.4%
Purchasing manager	164	35.0%
Director	130	27.8%
Other	38	8.1%

3.2 Measurement

Regarding the process of item generation, Guanxi and IS were measured according to the previous literature (e.g., Lee and Humphreys 2007; Fawcett et al. 2007). Considering that the practices of SCQM were based upon different previous works, and a new concept "quality risk transfer" had been developed by us. We developed the scale

in an iterative process. Firstly, we specify the domain and dimensionality of the construct "risk transter" according to related theoretical foundations (e.g., Yang et al., 2009; Camuffo, Furlan and Rettore 2007; Balachandran and Radhakrishnan 2005). Then a sample of measurement items of quality risk transfer were generated. Finally, the extent to which scale items appear to be consistent with the theoretical domain/dimensionality of the construct were assessed (Churchill, 1979). Besides, a pilot test was conducted with five academics and five practitioners to evaluate the applicability and clarity of the questionnaire and the adequacy of research design.

When using the seven-point Likert scale and single informants for data collection, the potential problem of common method bias (CMB) needs to be considered (Podsakoff et al. 2003). Thus, we ran a Harmon one-factor on the main variables of our study, and the outcomes showed that there was no uni-factor solution because the maximum variance explained by any one factor was 24.509%. This indicated the absence of CMB. In addition, a common latent factor test was adopted to reinforce the results of the CMB test. Twenty-four question items were formed as a single factor, and the model fit (X^2/df = 7.499, CFI = 0.451, IFI = 0.455, GFI = 0.569 and RMSEA = 0.162) for the single factor model showed a poor model fit, which indicated that the single factor model was not acceptable. Thus, the CMB problem was not a concern for this study.

3.3 Structural model

To assess construct reliability, a two-step procedure suggested by Narasimhan and Jayaram (1998) was adopted. Firstly, we ran exploratory factor analysis (EFA) to check the unidimensionality of the constructs. The EFA was conducted using the principal component method with varimax rotation and without specifying the number of factors. EFA concompanyed the measures of adequacy of sampling because the Kaiser-Meyer-Olkin was greater than 0.5, at 0.858, and the Bartlett's test of sphericity was significant

at 0.001 level with X^2 = 5913.591 and degree of freedom (df) = 276. Thus, the result of EFA indicated that the data was suitable to proceed with factor analysis. Based on the EFA results, six distinct factors were obtained with eigenvalues greater than 1, which explained 69.578 per cent of the total variance. The indicators were strongly linked to the proposed latent variable, where the size of factor loadings was higher than 0.646. In addition, no significant cross loading also indicated that the "items were unidimensional with regard to the proposed constructs" (O'Leary-Kelly and Vokurka 1998).

Confirmatory factor analysis (CFA) is conducted to assess the reliability and validity of constructs. The results of the CFA provide evidence for the convergent and discriminant validity of the theoretical constructs (Shou, Gong, and Zhang 2022). The measurement model is regarded to be acceptable if the comparative fit index (CFI) is greater than 0.90, the value of normed chi-square (X^2 / *df*) is less than 5, and the root mean square error of approximation (RMSEA) is less than 0.08. In the measurement model, this study established links between the indicators and respective constructs then freely estimated the covariance among all six constructs. By using SPSS AMOS 23, it was found that the model fit indices obtained all indicated an excellent fit for the measurement model (X^2 = 597.333; df = 256; X^2 / *df* = 2.333; p-value = 0.000; CFI = 0.941; GFI = 0.908; RMSEA = 0.053; IFI = 0.942).

In addition, this study used the average variance extracted (AVE) and HTMT to assess validity, as suggested by Henseler, Hubona, and Ray (2016). According to Chin (1998), to measure convergent validity it is necessary for the square root of AVE for each construct to be greater than its correlations with other constructs. In Table 3, the AVE is higher than 0.5, and therefore, is regarded as acceptable, even though the AVE of Quality oriented supplier selection is less than 0.5, the convergent validity of the construct is still acceptable as the composite reliability is higher than 0.6 (Fornell and Larcker 1981).

Besides, the Fornell-Larcker criterion, HTMT was done to test discriminant validity. For the Fornell-Larcker criterion, a factor's AVE should be higher than its squared correlations with all other factors in the model (Fornell and Larcker 1981). The HTMT is the estimation of factor correlation (see as Table 4). When clearly discriminating between two factors, HTMT should be significantly smaller than 0.900 for liberal and 0.800 for strict (Henseler, Ringle, and Sarstedt 2015).

Table 3. Reliability and Validity Measures.

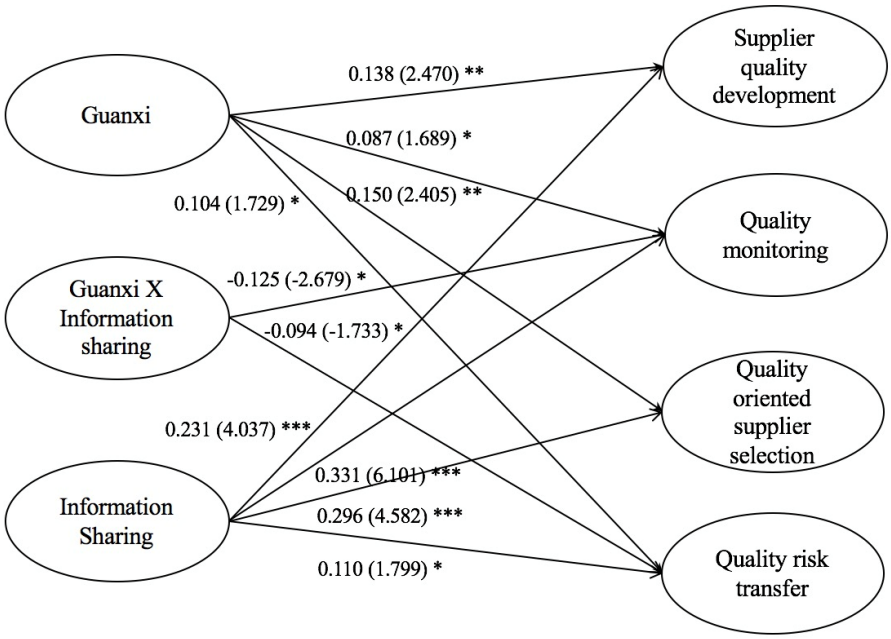
	GX	IS	SQD	QM	QSS	QRT
Guanxi (GX)	**0.794**					
Information sharing (IS)	0.380***	**0.822**				
Supplier quality development (SQD)	0.211***	0.267***	**0.721**			
Quality monitoring (QM)						
Quality oriented supplier selection (QSS)	0.220***	0.406***	0.337***	**0.821**		
Quality risk transfer (QRT)						
Mean	0.256***	0.362***	0.427***	0.591***	**0.632**	
Standard deviation						
Composite reliability						
Cronbach's alpha	0.152**	0.181**	0.377***	0.322***	0.316***	**0.718**
AVE						
	4.744	5.667	4.273	5.505	5.396	4.301
	1.061	1.022	1.248	1.222	1.109	1.085
	0.871	0.913	0.841	0.891	0.659	0.761
	0.865	0.912	0.839	0.888	0.648	0.759
	0.630	0.676	0.519	0.673	0.399	0.516

Note: Diagonal entries (in bold) are average variances extracted; entries below the diagonal are correlations. *Significant at 0.050 level; **Significant at 0.010 level; ***Significant at 0.001 level.
GX = Guanxi; IS = Information sharing; SQD = Supplier quality development; QM = Quality monitoring; QSS = Quality oriented supplier selection; QRT = Quality risk transfer

Table 4. HTMT results.

	Guanxi (GX)	Information sharing (IS)	Supplier quality development (SQD)	Quality monitoring (QM)	Quality oriented supplier selection (QSS)	Quality risk transfer (QRT)
GX						

IS	0.381					
SQD	0.139	0.193				
QM	0.204	0.256	0.387			
QSS	0.261	0.399	0.294	0.441		
QRT	0.235	0.407	0.338	0.389	0.627	



Regression weight p-value: *p<0.1; **p<0.05; p***<0.01
Model Fit Index: X^2 / *df* = 2.333; p-value = 0.000; CFI = 0.941; GFI = 0.908; RMSEA = 0.053; IFI = 0.942
Figure 2. Structural model.

To explore the interaction of Guanxi and IS through the method structural equation modelling (SEM), as suggested by Hair et al. (2010), was used to test the interaction. The interaction construct was not only added into the proposed model, but also tested with other constructs of SCM strategies. This study used SPSS AMOS 23 to run SEM for assessing the support of the conceptual model and hypotheses. Figure 2. exhibits the results of the structural model and the standardized regression weights of all the entries. Overall, the model fit indices obtained all met the requirement of a good fit benchmark (Flynn, Huo, and Zhao 2010), and proved that the fit of the structure model was acceptable.

The model was assessed by examining the variance explained (R^2) of the endogenous construct or dependent variables and the intensity of the path coefficients (β). The maximum value of R^2 was 18 per cent for quality monitoring and the minimum was 5 per cent for quality risk transfer. H1a, H1b, H1c and H1d hypotheses all had positive relations between Guanxi and supplier quality development, quality monitoring, quality oriented supplier selection, quality risk transfer (see as Table 5). The positive effects were on H1a (β = 0.138, t =2.470), H1b (β = 0.087, t =1.689), H1c (β = 0.150, t = 2.405) and H1d (β = 0.104, t =1.729). The paths also supported the relationships of H2a, H2b, H2c and H2d. This implied that IS was a critical predictor of supplier quality development (β = 0.231, t = 4.037), quality monitoring (β = 0.331, t = 6.101), quality oriented supplier selection (β = 0.296, t = 4.582) and quality risk transfer (β = 0.110, t = 1.799). In addition, it was hypothesized that the interaction between Guanxi and IS was positively associated with four SCQM processes. However, the result indicated that the positive impact on supplier quality development (β = 0.025, t = 0.505) and quality oriented supplier selection (β = -0.024, t = -0.440) were not significant, and the impact on quality monitoring (β = -0.125, t =-2.679) and quality risk transfer (β = -0.094, t = -1.733) were negative and significant. In addition, this study provided further evidence to resolve the uncertainty of whether Guanxi and IS should be applied as complements or substitutes for each other in achieving quality monitoring and quality risk transfer. As illustrated in Figure 3 and Figure 4, when IS was not widely used in companies, Guanxi had a positive effect on quality monitoring and quality risk transfer, while with the high adoption of IS related activities, there was not much effect from Guanxi to quality risk transfer and even a negative effect from Guanxi to quality monitoring, and the results showed that IS dampens the positive relationship between Guanxi and two SCQM dimensions, e.g. quality monitoring and quality risk transfer. In fact, Guanxi encouraged companies to

manage business by cooperating with goodwill and trust and allowing parties to interact with focal companies and communicate about the potential supply chain quality problems directly (Wong and Tjosvold 2010). While the development of IS could break the mode that Guanxi operates within because it relies more on quality data collection from multiple sources to identify vulnerabilities (Riley et al. 2016). Given the fact that effective IS could also help to identify and communicate information about supply chain quality threats, the role of Guanxi became less vital when companies leveraged good IS activities. Thus, the results of our empirical study rejected H3a, H3b, H3c and H3d, and perhaps surprisingly offered a completely different view to that previously accepted in the Guanxi and IS literature.

Table 5. Results of hypotheses H1abcd, H2abcd, and H3abcd using SEM.

Path	**β**	**t-value**	**p-value**	**Hypothesis support**
Main effect				
Guanxi - > Supplier quality development	0.138	2.470	0.014**	Supported
Guanxi - > Quality monitoring				
Guanxi - > Quality oriented supplier selection	0.087	1.689	0.091*	Supported
Guanxi - > Quality risk transfer	0.150	2.405	0.016**	Supported
Information sharing - > Supplier quality development	0.104	1.729	0.084*	Supported
Information sharing - > Quality monitoring	0.231	4.037	***	Supported
Information sharing- > Quality oriented supplier selection			***	
Information sharing- > Quality risk transfer	0.331	6.101	***	Supported
	0.296	4.582	0.072*	Supported
Interaction effect	0.110	1.799		Supported
Guanxi x Information sharing - > Supplier quality development			0.614	
Guanxi x Information sharing - > Quality monitoring	0.025	0.505	0.007***	Not supported
Guanxi x Information sharing - > Quality oriented supplier selection	-0.125	-2.679	0.660	Supported
Guanxi x Information sharing - > Quality risk transfer	-0.024	-0.440	0.083*	Not supported
	-0.094	-1.733		Supported

Notes: The entries in the table are standardized path coefficients. *p < 0.1; **p < 0.05; ***p<0.01

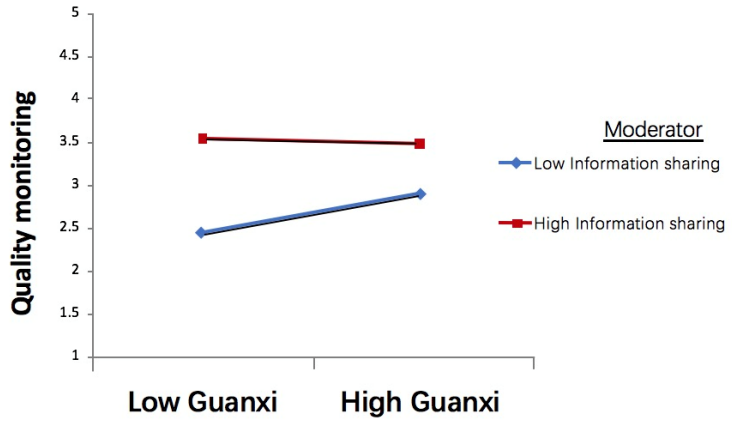


Figure 3. Effect of the interaction term of quality monitoring.

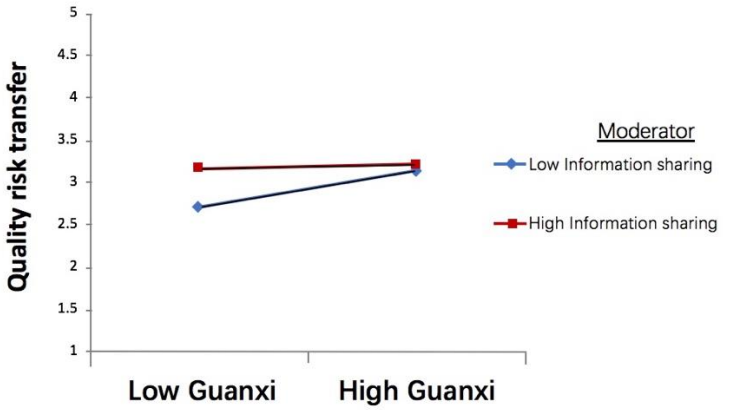


Figure 4. Effect of the interaction term of quality risk transfer.

3.4 Qualitative data

After a survey was conducted as a quantitative method, case studies were then used to supplement the collection of additional qualitative data. Surveys have been criticized for oversimplifying reality but allowing statistical generalization. Interviews as part of case studies have been criticized because they tend to promote interviewer and respondent bias, but they are a purposeful method of data collection and are often insightful. Integrating a survey with case studies combines the advantages and minimizes

the disadvantages of each method and allows for qualitative refinement of the theory underlying the quantitative survey (Wieland and Wallenburg 2012). Specifically, Case studies allow researchers to understand how the phenomena under study emerge in specific contexts (Yin 2009), and it were used to build on the survey results presented to interviewees to provide new insights into the adoption of Guanxi and IS in the context of SCQM. Thus, the goal of case studies was to further explore (1) the interdependencies of core SCQM practices, (2) whether the impact of Guanxi and IS on SCQM differed from the empirical results when considering the synergy effects between the different dimensions.

Preliminary knowledge obtained from the survey results were the starting point for the case study, followed by a multiple case study approach and several precautionary measures to ensure quality and rigour (Wilhelm et al., 2016). According to Yin (2009), the selection of case companies should be driven by the research questions rather than by random sampling. We used a multistep sampling process for the selection of the most appropriate cases. Initial access to cases was determined by availability. Diverse entry points were employed through tangential research links, seminars, MBA and MSc courses. In the first round, unsuitable case companies were filtered out based on three criteria: (i) companies that did not have a production facility in China, (ii) companies that did not source critical components from Chinese suppliers, and (iii) companies that did not consider Guanxi as an important asset of the social network. To further refine the sample, a questionnaire based on a set of SCQM strategy items was sent to the managers of thirteen companies. The items were selected and grouped based on examples from recent SCQM literature on quality and safety issues. Three companies were then selected for investigation (see as Table 6), and a total of nine directors and senior managers were interviewed.

Table 6. Information of selected companies for case study.

Company	Business type	Company size	Number of sites
Company A	An internationally renowned brand known for its lighting equipment business	More than 3,500 employees	Four Chinese sites
Company B	One of the largest independent manufacturers of recording components for computer storage devices used in consumer electronics such as digital video recorders and data storage devices.	Approximately 50,000 employees	Five Chinese sites
Company C	A toy and stationery company covering the design, manufacturing, purchasing and after sales service of its toy products.	Approximately 520 employees	One manufacturing site in China's Pearl River Delta region

The companies themselves are labelled A, B and C. Semi-structured interviews were conducted, with four or five meetings lasting about two to two and a half hours in each case company. Since the nature of the research requires confidential data (material defects, product recalls), an important condition of access was that much of the descriptive material be obscured (e.g., the finished product and critical components are obscured). Managers were asked about their company's actual or potential response to the presence of the identified SCQM. The discussion was open-ended to allow interviewees to respond in their own words and identify guanxi and information with specific response SCQM strategies.

To achieve a high-quality research design, this study followed the recommendations of Yin (2009). Reliability, i.e., the likelihood that the study can be repeated with the same findings, was ensured through the use of a case study protocol and the development of a case study database. Construct validity, i.e., the identification of the correct operational measures, was achieved through the use of multiple sources of

evidence and the development of a chain of evidence that allows a third party to follow all steps of the study (Wilhelm et al., 2016). Furthermore, internal validity was not a concern due to the exploratory nature of this study. External validity, i.e., testing generalisability beyond the immediate case study, was also achieved by selecting companies at the levels described above, therefore replication in these areas was possible.

The interviews were recorded and transcribed verbatim. Subsequently, the data from the case study database were analysed according to the steps suggested by (Wieland and Wallenburg 2012): The recorded interviews were listened to repeatedly and the transcribed interview data were read repeatedly. Themes that emerged from the data were used in within-case analyses to combine and cluster the information from all data sources. Most importantly, cross-case analysis was used to complement the information gleaned from the individual cases and to find general patterns that allowed for the following theses. The analysis attempted to identify patterns in the respondents' answers and finally categorised the companies' practises in terms of actual SCQM practises or the combination of guanxi and IS.

4. Fuzzy set qualitative comparative analysis

To determine what combinations of organisational resources are most important in the attainment of performance for companies operating in varying contexts, this study employed a fuzzy-set Qualitative Comparative Analysis (fsQCA). According to Fiss (2011), fsQCA follows the principles of complexity theories in a configurational approach, which allows for the examination of interplays that develop between elements of a messy and non-linear nature. The reason for applying fsQCA with other statistical methods is that it supports equifinality, meaning that a particular outcome may be caused by different combinations of elements, and that these combinations of elements may differ depending on context (Mikalef et al. 2019). FsQCA has been used as an appropriate

complementary analysis to SEM when detecting effects caused by unobserved heterogeneity (Ali, Kan, and Sarstedt 2016; Mikalef et al. 2019; Kaya et al. 2020), and this method is particularly relevant to the case of SCQM dimensions since depending on what the knowledge discovery in the filed is targeted, the factors that essentially contribute to it may vary considerably. It is therefore important to isolate the combinations of factors and conditions that enable companies to achieve high SCQM dimensions. FsQCA follows such a paradigm as it is geared towards reducing elements for each pattern to the fundamentals necessary to attain sufficient conditions. Moreover, fsQCA supports the occurrence of causal asymmetry, indicating that the presence and absence of a causal condition for an outcome to occur depends on how that causal condition is combined with one or more other causal conditions (Fiss 2011).

4.1 Calibration

Based on the method proposed by Ragin (2009), the first step of the fsQCA analysis is to calibrate the dependent and independent variables in fuzzy or crisp sets, i.e., the original values from the survey were converted to values ranging from 0 to 1. As presented previously, one of SCQM practices was set as the dependent variable of our study, while the independent variables that were used, including Guanxi, IS, the size-class of the companies, and other three SCQM dimensions. The reason we included the other SCQM practices as independent variables is because of the possible synergy effects between them. Crisp sets are best suited for categorical variables that have two, and only two options. For example, company size was categorized into large companies with 250 or more employees and small-medium enterprises (SMEs) with fewer than 250 employees. On the other hand, fuzzy sets on the continuous scale can range from 0, indicating an absence of set membership, to 1, indicating full set membership (Mikalef et

al. 2019). It is appropriate in converting continuous values like the constructs that are on a 7-point Likert scale, and we followed the process described by Ordanini, et al. (2014) to transfer them into fuzzy sets. The full membership thresholds were set to values greater than 6, crossover points to 4.5, and full non-membership scores to 3. The reason for setting full non-membership of 3 rather than 2 was due to the distribution of values, which was based on whether respondents answering strongly agreed or disagreed (Mikalef et al. 2019).

4.2 Fuzzy set qualitative comparative analysis

FsQCA 3.0 was used to analyse configurations leading to high SCQM activities (Ragin 2009). When applying the fsQCA algorithm, a truth table of 2k rows was produced, where k refers to the number of predictor elements, and each row represents a possible combination. FsQCA then sorted all 468 observations into each of these rows based on their degree of membership in all causal conditions. Consequently, some truth table rows may have contained many cases and others just a few or even none. The next step was to reduce the number of rows according to two conditions: (1) a row must contain a minimum number of cases, this value was set to a frequency threshold of 5 cases (Ragin 2009); and (2) we selected rows that achieved a minimum consistency level of 0.90. Consistency measures the degree to which a subset relation has been approximated and it resembles the notion of significance in statistical models (Schneider and Wagemann 2010). A value below 0.75 was suggested as a consistency, while a more restrictive consistency was selected to be in line with the general claims in extant literature (Schmitt, Grawe, and Woodside 2017). Thus, solutions that did not adhere to this threshold were not included in the analysis. On the other hand, solution coverage assessed the empirical relevance of a consistent subset, an analogous measure of R^2 in regression analysis

(Mendel and Korjani 2012; Mikalef et al. 2019). Here, a set of a minimum of three cases for each solution was set, according to the suggestion of Ragin (2006).

Four separate fsQCA analyses were conducted and four dimensions of SCQM practices were set as dependent variables separately. Only the results for quality monitoring and quality oriented supplier selection were presented in fsQCA, while the results for supplier quality development and quality risk transfer were not generated because the matrix was empty. The results presented in Table 7 and Table 8 provide the best configurations for quality monitoring and quality oriented supplier selection. The black circles (●) indicate the presence of a condition, and crossed-out circle (⊗) denotes the absence of one. Core elements of a configuration, which are refined as those casual conditions for which the evidence indicates a strong causal relationship with the outcome of interest, are marked with a large circle, whereas peripheral elements, which refer to those for which the evidence for a causal relationship with the outcome is weaker (Fiss 2011), are recorded with small ones. Blank spaces mean "don't care", in which case the causal condition maybe either present or absent (Mikalef et al. 2019).

Table 7. Configuration for achieving high level of quality monitoring.

Configuration	Solution				
	Quality monitoring				
	1	2	3	4	5
Supplier quality development			⊗	⊗	●
Quality oriented supplier selection	●	●		●	●
Quality risk transfer			●	⊗	●
Guanxi				⊗	⊗
Information sharing	●	●	●		
Large companies	●	⊗	⊗	⊗	●
SME enterprises	⊗	●	●	●	⊗
Consistency	0.937	0.917	0.939	0.935	0.935
Raw coverage	0.316	0.493	0.178	0.156	0.156
Unique coverage	0.240	0.273	0.012	0.01	0.006
Overall consistency	0.918151				
Overall coverage	0.834821				

Table 8. Configuration for achieving high level of quality oriented supplier selection.

Configuration	Solution				
	Quality oriented supplier selection				
	1	2	3	4	5
Supplier quality development			⊗		●
Quality monitoring	●	●	●		●
Quality risk transfer			⊗	●	●
Guanxi				●	⊗
Information sharing	●	●		●	
Large companies	●	⊗	⊗	⊗	●
SME enterprises	⊗	●	●	●	⊗
Consistency	0.919	0.896	0.879	0.934	0.997
Raw coverage	0.322	0.501	0.251	0.254	0.084
Unique coverage	0.244	0.136	0.013	0.013	0.006
Overall consistency	0.855524				
Overall coverage	0.895338				

The outcomes of the fsQCA analysis for achieving high level of quality monitoring revealed five solutions. The first and fifth solutions applied to large companies. Solution 1 indicated that large companies operating under conditions of high-quality monitoring have developed quality oriented supplier selection and IS. Solution 5 also applied to large companies operating under conditions characterised by an absence of Guanxi. This solution was the only one in which all other three dimensions of the SCQM process went hand in hand with quality monitoring, while neither Guanxi nor IS were necessary conditions in this case. Particularly, Guanxi should not be present in this configuration. The results of solutions 2, 3 and 4 were all under conditions characterised by a lack of supplier quality development and Guanxi, suggesting that developing a close supplier-buyer relationship and assisting suppliers' improve their operations are not necessary conditions for effectively product quality assessment for SME enterprises.

A separate analysis was performed to determine configurations of conditions that led to high level of quality oriented supplier selection. Solutions 1 and 5 were similar to those that led to high quality monitoring, and they suggested that the impact of Guanxi, IS and other practices of SCQM on quality monitoring and quality oriented supplier

selection was realised in large companies under the same specific conditions. The absence of Guanxi reflectes that large companies avoided building a strong Guanxi network with their partners. Large companies generally implemented complete SCQM practices that were effective in avoiding quality problems, whereas the adoption of Guanxi has the potential to induce partners into opportunistic behaviour and trigger undesirable accidents. Solutions 2, 3 and 4 were suitable for SME enterprises and suggest that under condition of an absence of supplier quality development, quality monitoring, quality risk transfer, Guanxi or IS, while the supplier quality development were not present in all of them, suggesting that focal companies' efforts to improve supplier capabilities and performance were not a necessary condition for achieving good preparedness actions to forecast, measure and respond to quality issues.

To test predictive validity, the sample was split into two equal subsamples by random selection, e.g., modelling subsamples for quality monitoring and quality oriented supplier selection as subsample 1 and subsample 2; modelling holdout samples for quality monitoring and quality oriented supplier selection as holdout sample 1 and holdout sample 2 (Ali, Kan, and Sarstedt 2016, Mikalef et al. 2019). An fsQCA analysis was run for the modelling subsample using the same observation number and consistency criteria as in the original analysis. The solution of the analysis for the modelling subsample for quality monitoring and quality oriented supplier selection are presented in Table 9 and Table 10 respectively, and show that the patterns of the complex combination of conditions were causally consistent indicators of high levels of quality monitoring and quality oriented supplier selection. Moreover, the models produced by the modelling subsample were tested on the holdout sample data. Plotting each model on its respective outcome variable produced highly consistent models with high coverage. Figure 5 illustrates how data from the holdout sample plot produced by the modelling subsample

for quality monitoring and quality oriented supplier selection. Additional predictive test findings for the holdout sample suggest that the first part of the solution for modelling the subsample was causally relevant for predicting high levels of quality monitoring and quality oriented supplier selection, with a consistency higher than 0.80 (Ragin 2009).

Table 9. Solutions of high-quality monitoring for subsample 1.

Quality monitoring			
	Raw coverage	Unique coverage	Consistency
1. LF * QSS * ~SME * IS	0.351	0.196	0.930
2. ~SQD * ~QSS * ~LF * SME * IS	0.120	0.012	0.850
3. SQD * QSS * ~LF * SME * IS	0.274	0.038	0.944
4. ~ SQD * QSS * ~QRT * ~LF * SME * ~GX	0.151	0.022	0.922
5. SQD * QSS * QRT * LF * ~SME * ~GX	0.115	0.012	0.950
6. ~ SQD * QSS * QRT * LF * ~SME * GX	0.099	0.002	0.913
7.~ SQD * ~LF * SME * GX * IS	0.231	0.002	0.895
8. ~LF * QSS * SME * GX * IS	0.348	0.024	0.918
Solution coverage: 0.822573			
Solution consistency: 0.899694			

Supplier quality development (SQD); Quality oriented supplier selection (QSS); Quality risk transfer (QRT); Large company (LF); Small and medium-sized enterprises (SME); Guanxi (GX); Information sharing (IS)

Table 10. Solutions of high quality oriented supplier selection for subsample 2.

Quality oriented supplier selection			
	Raw coverage	Unique coverage	Consistency
1. QM * LF * ~SME * IS	0.347	0.137	0.931
2.~ SQD *~QRT * ~LF * SME * IS	0.239	0.017	0.866
3.~ QRT * ~LF * SME * GX * IS	0.242	0.008	0.929
4. SQD * QM * ~LF * SME * IS	0.271	0.040	0.978
5. QM * ~LF * SME * GX * IS	0.344	0.046	0.949
6. ~SQD *QM * ~QRT * LF * ~SME * ~GX	0.097	0.004	0.923
7. ~SQD * QM * ~QRT * ~LF * SME * ~GX	0.149	0.008	0.894
8. SQD * QM * QRT * LF * ~SME * ~GX	0.114	0.011	0.996
9. SQD * QRT * LF * ~SME * GX * IS	0.137	0.008	0.972
Solution coverage: 0.834395			
Solution consistency: 0.90743			

Supplier quality development (SQD); Quality monitoring (QM); Quality risk transfer (QRT); Large company (LF); Small and medium-sized enterprises (SME); Guanxi (GX); Information sharing (IS)

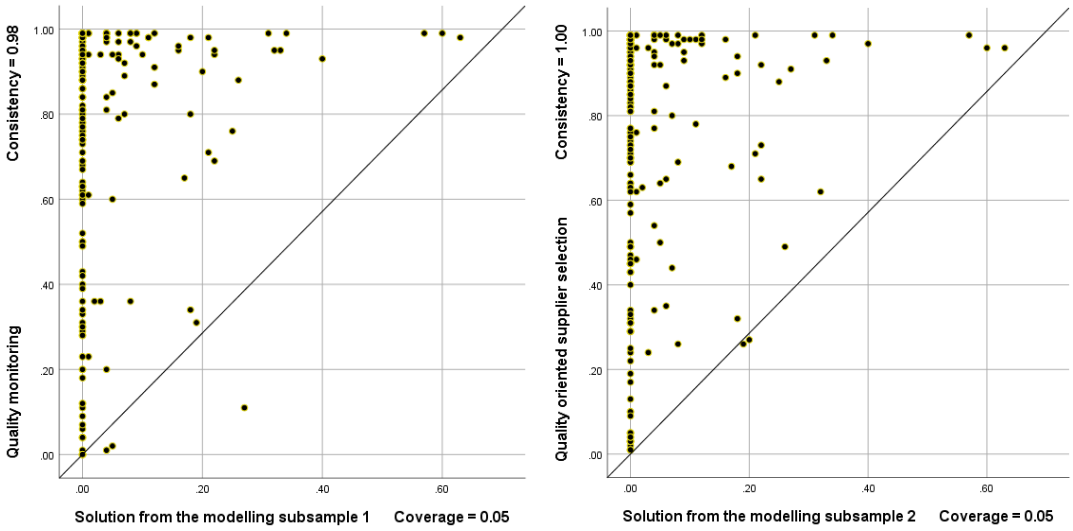


Figure 5. Test of the solution from the modelling subsample 1 and 2 using data from holdout sample 1 and 2.

5. Case study

In this section, three exemplary case studies are presented to further explore how Guanxi and IS influence SCQM strategies and to provide additional explanations for the interdependence between SCQM dimensions. Organisations with different characteristics (e.g., industry, company size, supply chain complexity) were selected to illustrate the equivalence of different SCQM practices. Case studies are an appropriate tool to complement quantitative methods, as they help to understand how different factors examined in a quantitative study coalesce, as well as the dynamics between factors in reducing quality threats in supply chain (Mikalef et al. 2019). Below is a detailed explanation of the within and cross case analysis.

5.1 Within case analysis

Within case analysis is the process of data reduction and management with the aim of structuring, defining, reducing, and making sense of the information collected (Pagell and Wu 2009). The within case analysis included four components. First, we

attempted to make sense of these organisations' SCQM, and then we identified the organisation's four essential practises in regard to SCQM, which is the focus of this research. Third, we identify Guanxi and IS activities that the company was participating in that helped SCQM practises, which had not previously been highlighted in the management literature. The final phase was attempting to connect Guanxi, IS, and the four dimensions of SCQM, look for the hidden synergy of these processes, and discover what were truly important and effective for company to improve each SCQM practice. The end result of the within case analysis was a concise description of SCQM, as well as the adoption of Guanxi and IS at each of the companies.

The results indicate that Company A involved in SCQM activities including the selection of high-quality suppliers, ongoing performance evaluations of these suppliers, and the maintenance of approved supplier lists for both production and procurement managers. In comparison to other industries, the likelihood of encountering product quality and safety issues arising from the upstream supply network in the lighting industry is relatively low, as the materials purchased from suppliers are mostly raw materials such as iron sheets and unprocessed plastics. In situations necessitating product replacement, Company A's managers prefer to rework the defective materials with the supplier covering the associated costs. This practice required a certain level of IS agreed beforehand. Specifically, Company A needs to disclose its rework procedure and provide detailed cost breakdowns to its suppliers. Besides, Guanxi was mentioned several times as the major factor in the firm's reluctance to adopt quality risk transfer activities (Company A: "*We cannot solely transfer all the responsibility and negative consequences of quality risk to the supplier. The guanxi between us [Company A's managing director and suppliers' directors] will be spoiled*.").

Comparatively, Company B has a shorter supply chain consisting of two tiers in the upstream supply chain and only two components in the bill of materials. The SCQM activities of Company B are performed by two departments: supplier quality engineering, and purchasing. The supplier quality engineering department is responsible for checking the technical performance of suppliers' samples, quality auditing, and maintaining the approved vendor list, while the purchasing department is responsible for sourcing decisions, such as order allocation and supplier selection. Company B use Guanxi as a key metric to select strategic supplier partners, as this may involve resource investment and IS. The company does not want to share their valuable resources with parties that are not inside their Guanxi network. IS is treated as an important factor of quality risk transferring in Company B. Suppliers are requested to provide production SPC data and critical testing results on a daily basis. (Company B: "*Since [name of component] is a micro-component, there are tight requirements on the quality acceptance level, and the production processes need to be carried out precisely… We need clear testing results and SPC data in every task, so we can figure out the quality problems of components in the very early stages before the products are shipped to us*.") Thus, Company B is able to control and monitor the supplier quality via a higher level of information sharing.

Whilst Company C adopts a multi-sourcing strategy in materials procurement, which entails typically engaging 2 or 3 suppliers to provide a single material. The current approach to select supplier is to review the potential suppliers according to the evaluation criteria. After evaluation, the suppliers that have exceeded the pre-determined score are added to the approved supplier list. Regarding the replacement of product, Company C adopts similar product replacement practice as Company A for their outsourced products, reworking defective products returned by customers. A Company C manager stated that guanxi can be an influential factor in risk remedy practices, whereby the firm can learn

about the quality risk at an earlier stage. (Company C: "*We get to know the more reliable information related to product issue rumours in the market via the guanxi network*."). Thus, the firm can trigger a proactive action in a timely manner. Additionally, Company C's managers were most enthusiastic about exchanging information in their guanxi network. They mentioned that in addition to formal information sharing among the firms, sharing information in a social network could enhance the risk perception with regard to the purchased component.

5.2 Cross case analysis

The cross case analysis attempts to uncover patterns across multiple organisations (Pagell and Wu 2009). It is enabled using various technologies to reduce the amount of data and present the data in a relevant manner (Yin 2009). Data reduction was accomplished mostly by looking for commonalities and differences in our key constructs, patterns, and themes in a cross case analysis (Ketokivi and Choi 2014; Wilhelm et al., 2016). The following are the key insights that arise from the analysis.

5.2.1 Interdependencies among SCQM practices

A prominent theme from the case studies was understanding the interaction among SCQM practices, that is, whether the joint value of some dimensions was greater than the sum of the stand-alone values. In some cases, it was found that quality monitoring and quality oriented supplier selection can reinforce each other and were thus more applicable (Company C: "*If we only passively guard against the threats when testing the quality of the product rather than proactively cooperating with the trusted supplier, like choosing a supplier with quality certificate and excellent quality performance, the effectiveness of quality monitoring also can be reduced*."). Quality oriented supplier selection involves

activities aims at minimising probability of quality issues and attempts to set up a reliable supply base by providing high quality materials. Without a thorough supplier evaluation system and reliable supplier selection testing, companies cannot establish a strategic relationship with suppliers to implement quality oriented supplier selection, while quality monitoring consists of a rigorous appraisal system and regular operational testing to ensure the quality of the product, product quality monitoring can be considered as a tactic to select reliable suppliers with the purpose of reducing potential threats. The results show that quality monitoring and quality oriented supplier selection should be adopted simultaneously, as they share some common processes such as material quality testing and selection of qualified suppliers. This result ties in well with the results of previous fsQCA studies (quality monitoring solution 5 and quality oriented supplier selection solution 5), where the application of both practices can be regarded as a bundle – the cost of the joint operation is lower than the sum of the stand-alone operations cost of each process. These two practices should be treated as a complementary set so that employing them simultaneously can increase the reward to a greater degree than the application of the individual practices.

Meanwhile, large companies usually emphasise more on the comprehensive adoption of SCQM from different practices to guarantee the reduction of quality issues and make less effort on the development of Guanxi networks. (Company A: "*Compared with some SMEs, once a product recall incident occurs, it will cause greater damage to the reputation and income of large companies like ours. Therefore, we attach great importance to SCQM by investing a lot of resources in developing various SCQM practices. We also believe that a more standardized management policy of a company can reduce the possibility of quality hazards. Once we build a very complete management strategy with the suppliers, we will avoid further development in Guanxi, because we do*

not want Guanxi to affect the implementation of our management strategy."). In line with the finding of fsQCA, this phenomenon can be explained by complementarity theory, which refers to doing more of any activities these complement each other and increase the returns of doing more of the others (Choi et al. 2008). This theory can be used to describe the situation where some of the companies' activities and practices are mutually complementary, thus, these practices tend to be adopted together, with each enhancing the contribution of the others (Choi, Poon, and Davis 2008). The case studies show that the bundling of different SCQM practices together act as the resources that form unique values to a company, specifically, the complementary nature of quality monitoring and quality oriented supplier selection for SME companies, as well as having all four SCQM practices for large companies.

5.2.2 Guanxi, IS and SCQM practices

The cases show that Guanxi network has been deemed as a powerful asset which benefits the company in terms of quality problem prevention in supply chain, and in all three cases the importance of exchanging the valid information at multiple levels within the organisation was also noted. These findings are directly in line with the results of the survey study. In particular, interviewees were requested to share their opinion on whether working on Guanxi and IS at the same time could inhibit SCQM actions and strategies. Managers from Company B and Company C noted that inter-organisational Guanxi was usually built upon and extended through personal relationships. Managers may have sought ways to increase the level of exchanging favours (i.e., the exchange of more valuable favours) with the executives of their business partners, and the incremental level of favour exchange may have contributed to the personal Guanxi into inter-organisational Guanxi. However, where Guanxi gradually deepens inter-relationships and leads to more

mutually beneficial information exchange, these managers, especially from the company that only worked with certain suppliers, may have avoided using quality risk transfer as a mean to reduce quality issues. (Company B: "*When we receive information from our suppliers, we are expected to return the favour with equally valuable information, and this favour is expected of us and provided regularly and voluntarily. Transferring risks to suppliers would break our Guanxi with them and may affect our future cooperation*."). This result matches well with the study in which the interaction of Guanxi and IS was found to restrain the adoption of quality risk transfer.

Interestingly, an inconsistency of the results between survey study and fsQCA regarding the application of quality oriented supplier selection can be found. The finding of fsQCA implies that Guanxi, IS and quality risk transfer are core elements when companies aim to increase their level of quality oriented supplier selection, while empirical results showed that working on Guanxi and IS simultaneously had no impact on quality oriented supplier selection and may even lead to less efficient quality risk transfer. In the case studies, this problem was particularly evident in Company C, where the importance of Guanxi and IS was greater than in the large companies. When it comes to using Guanxi and IS to achieve high level of SCQM, the importance of each dimension needs to be considered. For instance, if quality oriented supplier selection was the key task that the company needed to achieve at a certain moment, while quality risk transfer was not the focus, then the company may decide to sacrifice this practice to develop quality oriented supplier selection activities more efficiently. (Company C: "*Through the information exchange in our Guanxi network, we can learn the private information that we cannot get outside the network… we get snippets of information from our Guanxi network. For example, one of the potential suppliers used a fake test report for their paints/pigments that might have high level of lead content; a supplier with a bad-*

reputation changed their company name; the poor financial status of some of our suppliers… When we knew more information about potential suppliers, we increased the penalties for suppliers to focus their attention on production quality. Even though this behaviour may damage our relationship with them, we can effectively improve quality of the paints/pigments from then, thus avoid further quality threats or accidents".

Moreover, managers may need to carefully decide whether to invest in suppliers to achieve quality improvement. Case studies show that there were different opinions on how to develop supplier quality. For example, Company A and C have complex supply chains and tend to exchange information with suppliers through official procedures. They provide training to suppliers, especially new suppliers, to improve product quality. Company C has sent its quality assurance team to its outsourcing company to monitor product quality and IS has been adopted as an effective way to provide regular demand of suppliers to buyers, while close Guanxi potentially brings about frequent social interactions and mutual help which may mean that regular information reported by the supplier is ignored. On the other hand, Company B emphasises the role of Guanxi in supplier quality development. (Company B: "*We have relatively short supply chains, and prefer to work with suppliers we are familiar with, and they can ask for assistance any time they need... It is not flexible enough if everything goes through formal information exchange*"). Case studies show that the advantages of Guanxi and IS in terms of the adoption of supplier quality development are sometimes offset. This may can also explain why the empirical statistics show that interaction of Guanxi and IS has no impact on the adoption of supplier management.

The respondent stated that the application of Guanxi and IS would lower the level of quality oriented supplier selection and quality monitoring. Directors of both Company A and Company B stated that they exchange information (for example, quality or product

recall scandals in the local area) with other industrialists informally via social networks on a regular basis. (Company B: "*This is an underlying rule. The supplier with good guanxi has a better chance to be chosen ... The director of the supplier has kept a good guanxi with us and it has similar ratings as other qualified companies. So, why not?*"). Company A's managers stated that they apply tools to detect potential design flaws and quality problems from the sourced component. However, the effectiveness of these tools depends on the value of the information provided by suppliers. (Company A: "*Suppliers never provide the information related to the cost structure of components. Therefore, it is hard to detect the self-interested behaviours that allow them to cut corners on quality, such as the use of lower grade materials. This is difficult to detect if the suspect component is at the lower level of the BOM*.").

6. Discussion and conclusion

The domain of QM has received increasing attention in recent decades. Most studies have been concentrated on identifying and prioritising core practices and their impact on business performance, while offering limited understanding of how to handle quality issues through effective supply chain practices. More importantly, the ongoing pandemic has exacerbated overall quality challenges and placed stress on the importance of preventing defective products reaching customers (Tse et al. 2019). The results of this study contribute to the management of quality issues by showing the relationship between Guanxi, IS and four different key SCQM practices: supplier quality development, quality monitoring, quality oriented supplier selection and quality risk transfer. The assumption was posited that working on Guanxi and IS separately or simultaneously would both lead to higher levels of SCQM practice. To prove this research question, we conducted a mixed methods approach which bridged quantitative and qualitative methods. The combination

of empirical examination and qualitative research provided comprehensive evidence suggesting that by deploying Guanxi and IS in an appropriate way can better address the threats of quality problem in supply chain.

6.1 Theoretical contribution

Firstly, this study adds to the SCQM literature by build quantitative models that relate to quality threats practice (da Silva, Barbosa-Póvoa, and Carvalho 2020). Few academics have been able to identify the efficient ways to address operations issues regarding the potential quality issues in the supply chain, and traditional SCQM studies also leave a blank in exploring the needs of organisations in using appropriate strategies in different circumstances (Huo, Zhao and, Lai 2013; Tse et al. 2019). Based Drawing on agency theory, some supply chain factors such as information asymmetry, goal conflict and supplier risk need to be considered. This study is in line with Zu and Kaynak (2012) that firms should choose different management practices for suppliers depending on the situation rather than relying on a general SCQM approach. Therefore, this research fills the gap by offering a comprehensive understanding of supplier quality development, quality monitoring, quality oriented supplier selection and quality risk transfer to address quality problems. The selective practices provide a well-grounded standard for which SCQM activities can be considered to reduce quality problems that arise. The items generated for each practice offer helpful guidelines for future research to understand the specific processes of SCQM. Second, the findings of this study make an important contribution to the literature by documenting the impact of Guanxi and IS on improving different SCQM practices. In the SCM literature, Guanxi and IS are viewed as important activities that enable buyers and suppliers to achieve mutual benefits in their partnerships. However, as key activities within the partnership model, they have received limited

attention, particularly in understanding their role in different SCQM practices. This paper fills this gap by examining the interaction effects between Guanxi and IS in detail. Moreover, this study differs significantly from the existing literature in SCQM by looking into how specific strategies or practices are interdependent to each other. Drawing from complementarity theory, we added to the existing literature by scrutinising the complementary effects of different practices of SCQM and also provided additional information on how Guanxi and IS could influence the synergy of these processes. The application of complementarity theory in this research is an effort towards providing a more comprehensive and realistic picture of SCQM. Hence, this study provided new insights that suggest that different SCQM practices need to be considered concurrently and the synergy effects between them could be used to enhance a particular SCQM strategy.

From a methodological standpoint, one type of research method is commonly adopted in the field of SCM (Lei et al. 2021). However, the combination of different methodological approaches and research designs is a significant strength of OM research (Ketokivi and Choi 2014). As a result, in order to eliminate the possible bias that a single approach may introduce, this study adds by presenting both quantitative and qualitative findings using SEM, fsQCA, and a case study that provided a full picture of SCQM. The SEM methodology is appropriate in examining the causal paths through whether Guanxi, IS or the interaction between them impact different SCQM practices, while fsQCA provides a deeper understanding of the complex, non-linear and synergy effects of Guanxi, IS and other SCQM practices on a specific SCQM practice, and finally the case study highlights the inter-relationships between these elements and outlines issues that organisations need to solve when orchestrating resources to realise advanced SCQM. Overall, the results of SEM demonstrate the general tendency, fsQCA exhibits the

multiple realities that exist in terms of achieving a desired state, whereas the case study reveals how these core enablers coalesce and impact SCQM practices (Mikalef et al. 2019).

6.2 Practical implications

From a managerial perspective, this research provides feasible suggestions for practitioners in several ways. This study presents the definition of four SCQM practices that can help managers to accurately understand the specific meaning of each dimension to take the appropriate actions. The valid measurement of these processes identifies the specific activities that companies could undertake to minimise quality risk (Zhang, Hu, and Zhao 2020). And managers could use the questionnaire items as a checklist of SCQM processes for company's QM planning. Second, this study provides constructive suggestions for managers with regards to the adoption of Guanxi and IS for different SCQM practices. The results show that Guanxi and IS have a direct positive impact on all four SCQM practices, while only one of the Guanxi and IS should be adopted at one time, rather than being applied simultaneously. In the study by Lee et al. (2018), Guanxi and IS are generally considered relevant concepts in the framework of SCM as they are both closely related to information exchange and mutual trust between suppliers and buyers. However, our results for the interaction effect between the Guanxi and IS emphasise the need to operationalise them individually in most cases. Third, this paper considers that the selection of appropriate SCQM practices could be an effective way to achieve SCQM, which could significantly lessen specific quality threat to a company and even the quality disruption to the whole supply chain (Lei et al. 2021). In detail, an advanced QM ability can be derived when efforts are made to synchronise the capabilities of these four SCQM practices. Companies seeking to improve SCQM in the upstream

supply chain should not only address individual QM practices but also demand complementarity of some practices to sustain the company in a lower risk position. The findings suggest that practitioners should exploit a complementary set of quality monitoring and quality oriented supplier selection, so that this unique set of SCQM processes can create unique values that are concurrently valuable, rare, hardly imitable, and non-substitutable. Fourth, the configuration arguments of fsQCA continue to fuel existing debates about the influence of Guanxi and IS on the SCQM practices. Besides, this reasoning detail is also complementarity with ways in which the dimensions of SCQM are set. In this study, fsQCA was used to identify five configurations of quality monitoring or quality oriented supplier selection and complement the results of the SEM method, thus, managers can follow the suggestions of each configuration that is suitable for them. For instance, even though working on Guanxi and IS simultaneously could inhibit quality risk transfer, a continued configuration of Guanxi, IS and suppressed risk transfer could improve the performance of quality oriented supplier selection. Moreover, large companies should be aware of the overall development of four different SCQM practices, while avoid using Guanxi network. Thus, the fsQCA analysis provides concrete suggestions for companies to design these dimensions in a complementary manner.

6.3 Limitations and future research directions

Despite its contributions, this study is constrained by a few limitations that need to be considered in future research. First, SCQM practice was conceptualised according to the theoretical suggestions, and it was decided to consider only four practices that companies take to manage supply chain quality issues in this study. Considering the different typology of SCQM, it would be beneficial for future research to explore other SCQM processes that companies may adopt. Second, Guanxi is an unique component of

Chinese culture, and its networks are recognised to be the most important informal institution in the Chinese-speaking society, and this study will benefit countries that embrace a more collectivist culture rather than an individualistic culture. Given the similarities across rising economies, cross-country comparisons can be undertaken with other counties of the world, such as Malaysia and Philippines. Third, we collected survey data from individual respondents from one company, which may cause response bias and common method bias. Future research could be further improved by collecting data from multiple respondents and from companies' different sections. Fourth, this study focuses on the upstream portion of the supply chain, i.e. the company's suppliers and the processes used to manage buyer-supplier relationships, as well as the internal processing in the supply chain to transform materials provided by suppliers into finished goods. Further research could take a broader focus that looks at the entire supply chain network, including the organisations and processes for distributing and delivering products to end customers. This complementary perspective would allow a better understanding of the role that Guanxi and IS play in SCQM.

Data availability statement

Due to the research ethical agreement between the researcher and respondent, the data is not an open data source. Further query please contact the corresponding author.

Reference

Ali, M., K.A.S. Kan, and M. Sarstedt. 2016. “Direct and configurational paths of absorptive capacity and organisational innovation to successful organisational performance.” *Journal of business research* 69 (11): 5317-5323. https://doi.org/10.1016/j.jbusres.2016.04.131.

Bachmann, R., N. Gillespie, and R. Priem. 2015. “Repairing trust in organisations and institutions: Toward a conceptual framework.” *Organisation Studies* 36(9): 1123-1142. doi: 10.1177/0170840615599334

Bäckstrand, J. and A. Fredriksson. 2020. “The role of supplier information availability for construction supply chain performance.” *Production Planning & Control* pp.1-12. https://doi.org/10.1080/09537287.2020.1837933.

Balachandran, K. R. and S. Radhakrishnan. 2005. “Quality Implications of Warranties in a Supply Chain.” *Management Science* 51 (8): 1266-1277. https://doi.org/10.1287/mnsc.1050.0408

Ben-Daya, M., E. Hassini, Z. Bahroun, and B. H. Banimfreg. 2020. “The role of internet of things in food supply chain quality management: A review.” *Quality management journal* 28(1): 17-40. https://doi.org/10.1080/10686967.2020.1838978

Bhattacharya, S. and L. Tang. 2013. “Fatigued for safety? Supply chain occupational health and safety initiatives in shipping.” *Economic and Industrial Democracy* 34(3): 383-399. doi: 10.1177/0143831X12439760.

Burt, R. S., and K. Burzynska. 2017. “Chinese Entrepreneurs, Social Networks, and Guanxi.” *Management and Organisation Review* 13 (2): 221-260. doi: 10.1017/mor.2017.6.

Camuffo, A., A. Furlan, and E. Rettore. 2007. “Risk sharing in supplier relations: an agency model for the Italian air-conditioning industry.” *Strategic Management Journal* 28 (12): 1257-1266. https://doi.org/10.1002/smj.635

Cheng, T. C. E., F. K. Yip, and A. C. L. Yeung. 2012. “Supply risk management via guanxi in the Chinese business context: The buyers perspective.” *International Journal of Production Economics* 139 (1): 3-13. doi: 10.1016/j.ijpe.2011.03.017.

Chin, W. W. 1998. “Issues and opinion on structural equation modelling.” *MIS Quarterly: Management Information Systems* 22 (1): 1-8.

Choi, B., S. K. Poon, and J. G. Davis. 2008. “Effects of knowledge management strategy on organisational performance: A complementarity theory-based approach.” *Omega* 36 (2): 235-251. doi: 10.1016/j.omega.2006.06.007.

Christensen, F.M.M., P. Jonsson, I. Dukovska-Popovska, and K. Steger-Jensen. 2021. “Information sharing for replenishment planning and control in fresh food supply chains: a planning environment perspective.” *Production Planning & Control* pp.1-22. doi: 10.1080/09537287.2021.2013558

Churchill, G. (1979), “A paradigm for developing better measures of marketing constructs.” *Journal of Marketing Research*, Vol. 16 No. 1, pp. 64-73.

Clemons, R., and S. A. Slotnick. 2016. “The effect of supply-chain disruption, quality and knowledge transfer on company strategy.” *International Journal of Production Economics* 178: 169-186. doi: 10.1016/j.ijpe.2016.05.012.

Cole, R., and J. Aitken. 2019. “Selecting suppliers for socially sustainable supply chain management: post-exchange supplier development activities as pre-selection requirements.” *Production Planning & Control* 30(14), pp.1184-1202. https://doi.org/10.1080/09537287.2019.1595208.

da Silva, C., A.P. Barbosa-Póvoa, and A. Carvalho. 2020. “Environmental monetization and risk assessment in supply chain design and planning”. *Journal of Cleaner Production* 270: 121552.

Eisenhardt, K.M. 1989. “Building theories from case study research.” *Academy of management review* 14(4): 532-550.

Fawcett, S. E., P. Osterhaus, G.M. Magnan, J.C. Brau, and M.W. McCarter. 2007. “Information sharing and supply chain performance: The role of connectivity and willingness.” Supply Chain Management 12 (5): 358-368. doi: 10.1108/13598540710776935.

Fiss, P. C. 2011. “Building better causal theories: A fuzzy set approach to typologies in organisation research.” *Academy of Management Journal* 54 (2): 393-420. doi: 10.5465/AMJ.2011.60263120.

Flynn, B.B. and Flynn, E.J., 2005. Synergies between supply chain management and quality management: emerging implications. *International Journal of Production Research* 43(16), pp.3421-3436.

Flynn, B. B., B. Huo, and X. Zhao. 2010. “The impact of supply chain integration on performance: A contingency and configuration approach.” *Journal of Operations Management* 28 (1): 58-71. doi: 10.1016/j.jom.2009.06.001.

Fornell, C. and D.F. Larcker. 1981. “Structural equation models with unobservable variables and measurement error: Algebra and statistics.” *Journal of Marketing Research* 18 (3): 382-388.

Foster Jr, S.T., C. Wallin, and J.,Ogden. 2011. “Towards a better understanding of supply chain quality management practices.” *International Journal of Production Research* 49(8): 2285-2300.

Fu, S., Z. Han, and B. Huo. 2017 “Relational enablers of information sharing: Evidence from Chinese food supply chains.” *Industrial Management and Data Systems* 117 (5): 838-852. doi: 10.1108/IMDS-04-2016-0144.

Gallear, D., A. Ghobadian, Q. He, V. Kumar, V. and M. Hitt. 2021. “Relationship between routines of supplier selection and evaluation, risk perception and propensity to form buyer–supplier partnerships”. *Production Planning & Control*, pp.1-17. https://doi.org/10.1080/09537287.2021.1872811

Ge, H., J. Nolan, R. Gray, S. Goetz, and Y. Han. 2016. “Supply chain complexity and risk mitigation – A hybrid optimization–simulation model.” *International Journal of Production Economics* 179: 228-238. doi: 10.1016/j.ijpe.2016.06.014.

Grötsch, V. M., C. Blome, and M. C. Schleper. 2013. “Antecedents of proactive supply chain risk management - A contingency theory perspective.” *International Journal of Production Research* 51 (10): 2842-2867. doi: 10.1080/00207543.2012.746796.

Hair, J. F., W. C. Black, B. J. Babin, and R. E. Anderson. 2010. *Multivariate Data Analysis*. Englewood Cliffs, NJ: Prentice Hall. doi: 10.1016/j.ijpharm.2011.02.019.

Heide, J.B. A.S. Miner. 1992. “The shadow of the future: effects of anticipated interaction and frequency of contact on buyer-seller cooperation.” *Academy of Management Journal* 35 (2): 265-291.

Henseler, J., C.M. Ringle and M. Sarstedt. 2015. “A new criterion for assessing discriminant validity in variance-based structural equation modeling.” *Journal of the academy of marketing science* 43(1): 115-135.

Henseler, J., G. Hubona, and P.A. Ray. 2016. “Using PLS path modeling in new technology research: updated guidelines”. *Industrial management & data systems* 116(1), pp.2-20.

Huo, B., Zhao, X. and Lai, F., 2013. Supply chain quality integration: antecedents and consequences. *IEEE transactions on engineering management* 61(1), pp.38-51.

Hwang, I., S. Radhakrishnan, and L. Su. 2006. "Vendor certification and appraisal: Implications for supplier quality." *Management Science* 52 (10): 1472-1482. doi: 10.1287/mnsc.1060.0557.

Johnson, J.L., T. Sakano, J.A. Cote, and N. Onzo. 1993. "The exercise of intercompany power and its repercussions in U.S.- Japanese channel relationships." *Journal of Marketing* 57(2): 1-10.

Jüttner, U. 2005. "Supply chain risk management: Understanding the business requirements from a practitioner perspective." *The International Journal of Logistics Management* 16 (1): 120-141. doi: 10.1108/09574090510617385.

Kaya, B., A. M. Abubakar, E. Behravesh, H. Yildiz and I.S. Mert. 2020. "Antecedents of innovative performance: Findings from PLS-SEM and fuzzy sets (fsQCA)." *Journal of Business Research* 114: 278-289. doi: 10.1016/j.jbusres.2020.04.016.

Kaynak, H., and J. L. Hartley. 2008. "A replication and extension of quality management into the supply chain." *Journal of Operations Management* 26 (4): 468-489. doi: 10.1016/j.jom.2007.06.002.

Kembro, J., D. Näslund, and J. Olhager. 2017. "Information sharing across multiple supply chain tiers: A Delphi study on antecedents." *International Journal of Production Economics* 193: 77-86. doi: 10.1016/j.ijpe.2017.06.032.

Ketchen, D. J., and C. W. Craighead. 2020. "Research at the Intersection of Entrepreneurship, Supply Chain Management, and Strategic Management: Opportunities Highlighted by COVID-19." *Journal of Management* 46 (8): 1330-1341. doi: 10.1177/0149206320945028.

Ketokivi, M., and T. Choi. 2014. “Renaissance of case research as a scientific method.” *Journal of operations management* 32(5): 232-240. http://dx.doi.org/10.1016/j.jom.2014.03.004.

Krause, D. R., R. B. Handfield, and T. V. Scannell. 1998. “An empirical investigation of supplier development: Reactive and strategic processes.” *Journal of Operations Management* 17 (1): 39-58. doi: 10.1016/S0272-6963(98)00030-8.

Kuei, C.H., C.N. Madu and C. Lin. 2011. “Developing global supply chain quality management systems.” *International Journal of Production Research* 49 (15): 4457-4481.

Lee, H. L., and S. Whang. 2000. “Information sharing in a supply chain.” *International Journal of Manufacturing Technology and Management* 1 (1): 79-93. doi: 10.1504/IJMTM.2000.001329.

Lee, P. K. C., and P. K. Humphreys. 2007. “The role of Guanxi in supply management practices.” *International Journal of Production Economics* 106 (2): 450-467. doi: 10.1016/j.ijpe.2006.07.007.

Lee, V. H., K.B. Ooi, A.Y.L. Chong, and A. Sohal. 2018. “The effects of supply chain management on technological innovation: The mediating role of guanxi.” *International Journal of Production Economics* 205: 15-29. doi: 10.1016/j.ijpe.2018.08.025.

Lei, Z., M.K. Lim, L. Cui, and Y. Wang. 2021. “Modelling of risk transmission and control strategy in the transnational supply chain.” *International Journal of Production Research* 59 (1): 148-167. doi: 10.1080/00207543.2019.1698782.

Li, H., Y. Yang, P. Singh, H. Sun, and Y. Tian. 2021. “Servitization and performance: the moderating effect of supply chain integration.” *Production Planning & Control* pp.1-18. doi: 10.1080/09537287.2021.1905900.

Li, W., P.K. Humphreys, A.C. Yeung, and T.E. Cheng 2007. “The impact of specific supplier development efforts on buyer competitive advantage: an empirical model.” *International Journal of Production Economics* 106(1): 230-247. doi:10.1016/j.ijpe.2006.06.005

Li, Y., F. Ye, and C. Sheu. 2014. “Social capital, information sharing and performance.” *International Journal of Operations and Production Management* 34(11): 1440-1462. doi: 10.1108/IJOPM-03-2013-0132

Lin, C., W.S. Chow, C.N. Madu, C.H. Kuei and P.P. Yu. 2005. “A structural equation model of supply chain quality management and organisational performance.” *International journal of production economics* 96(3): 355-365.

Liu, Y., Y. Li, L. Tao, and Y. Wang. 2008. “Relationship stability, trust and relational risk in marketing channels: Evidence from China.” *Industrial Marketing Management* 37 (4): 432-446. doi: 10.1016/j.indmarman.2007.04.001.

Lo, V. and A.Yeung. 2006. “Managing quality effectively in supply chain: a preliminary study.” *Supply Chain Management: An International Journal* 11 (3): 208-215.

Luo, J., A.Y.L. Chong, E.W. Ngai, and M.J. Liu. 2015. “Green Supply Chain Collaboration implementation in China: The mediating role of guanxi.” *Transportation Research Part E: Logistics and Transportation Review* 74: 37-49. doi: 10.1016/j.tre.2014.09.005.

Machado, M.C., R. Telles, P. Sampaio, M.M. Queiroz and A.C. Fernandes. 2019. “Performance measurement for supply chain management and quality management integration: a systematic literature review”. *Benchmarking: An International Journal* 27(7): 2130-2147.

Mendel, J. M., and M. M. Korjani. 2012. “Charles Ragin’s Fuzzy Set Qualitative Comparative Analysis (fsQCA) used for linguistic summarizations.” *Information Sciences* 202: 1-23. doi: 10.1016/j.ins.2012.02.039.

Mikalef, P., M. Boura, G. Lekakos, and J. Krogstie. 2019. “Big data analytics and company performance: Findings from a mixed-method approach.” *Journal of Business Research* 98: 261-276. doi: 10.1016/j.jbusres.2019.01.044.

Narasimhan, R., and J. Jayaram. 1998. “Causal linkages in supply chain management: An exploratory study of North American manufacturing companies.” *Decision Sciences* 29 (3): 579-605. doi: 10.1111/j.1540-5915.1998.tb01355.x.

Noshad, K., and A. Awasthi. 2015. “Supplier quality development: A review of literature and industry practices.” *International Journal of Production Research* 53(2): 466-487. doi: 10.1080/00207543.2014.954679

O’Leary-Kelly, S. W., and R. J. Vokurka. 1998. “The empirical assessment of construct validity.” *Journal of Operations Management* 16 (4): 387-405. doi: 10.1016/s0272-6963(98)00020-5.

Ordanini, A., A. Parasuraman, and G. Rubera. 2014. “When the Recipe Is More Important Than the Ingredients: A Qualitative Comparative Analysis (QCA) of Service Innovation Configurations.” *Journal of Service Research* 17 (2): 134-149. doi: 10.1177/1094670513513337.

Pagell, M., and Z. Wu. 2009. “Building a more complete theory of sustainable supply chain management using case studies of 10 exemplars.” *Journal of supply chain management*, 45(2), pp.37-56. https://doi.org/10.1111/j.1745-493X.2009.03162.x.

Park, S. H., and Y. Luo. 2001. “Guanxi and organisational dynamics: Organisational networking in Chinese companies.” *Strategic Management Journal* 22 (5): 455-477. doi: 10.1002/smj.167.

Peng, M. W., and Y. Luo. 2000. “Managerial ties and company performance in a transition economy: The nature of a micro-macro link.” *Academy of Management Journal* 43 (3): 486-501. doi: 10.2307/1556406.

Podsakoff, P. M., S. B. MacKenzie, J. Lee, and N. P. Podsakoff. 2003. “Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies.” *Journal of Applied Psychology* 88:879–903. doi: 10.1037/0021-9010.88.5.879.

Ragin, C. C. 2006. “Set relations in social research: Evaluating their consistency and coverage.” *Political Analysis* 14: 291-310. doi: 10.1093/pan/mpj019.

Ragin, C. C. 2009. “Qualitative Comparative Analysis Using Fuzzy Sets (fsQCA).” pp. 87-122 in *Configurational Comparative Methods*. Thousand Oaks, CA: Sage.

Razak, G.M., L.C. Hendry, and M. Stevenson. 2021. “Supply chain traceability: A review of the benefits and its relationship with supply chain resilience.” *Production Planning & Control* pp.1-21. https://doi.org/10.1080/09537287.2021.1983661

Riley, J. M., R. Klein, J. Miller, and V. Sridharan. 2016. “How internal integration, information sharing, and training affect supply chain risk management capabilities.” *International Journal of Physical Distribution and Logistics Management* 46 (10): 953-980. doi: 10.1108/IJPDLM-10-2015-0246.

Robinson, C. J., and M. K. Malhotra. 2005. “Defining the concept of supply chain quality management and its relevance to academic and industrial practice.” *International Journal of Production Economics* 96 (3): 315-337. doi: 10.1016/j.ijpe.2004.06.055.

Sahin, F., and E. P. Robinson. 2002. “Flow Coordination and Information Sharing in Supply Chains: Review, Implications, and Directions for Future Research.” *Decision Sciences* 33 (4): 505-536. doi: 10.1111/j.1540-5915.2002.tb01654.x.

Saldanha, T. J. V., N. P. Melville, R. Ramirez, and V.J. Richardson. 2013. “Information systems for collaborating versus transacting: Impact on manufacturing plant performance in the presence of demand volatility.” *Journal of Operations Management* 31 (6): 313-329. doi: 10.1016/j.jom.2013.07.007.

Salimian, H., M. Rashidirad, and E. Soltani. 2021. “Supplier quality management and performance: the effect of supply chain oriented culture.” *Production Planning & Control* 32(11), pp.942-958. doi: 10.1080/09537287.2020.1777478

Schmitt, A. K., A. Grawe, and A. G. Woodside. 2017. “Illustrating the Power of fsQCA in Explaining Paradoxical Consumer Environmental Orientations.” *Psychology and Marketing* 34 (3): 323-334. doi: 10.1002/mar.20991.

Schneider, C. Q., and C. Wagemann. 2010. “Standards of good practice in qualitative comparative analysis (QCA) and fuzzy-sets.” *Comparative Sociology* 9 (3): 397-418. doi: 10.1163/156913210X12493538729793.

Shen, B., T. M. Choi, and S. Minner. 2019. “A review on supply chain contracting with information considerations: information updating and information asymmetry.” *International Journal of Production Research* 57 (15-16): 4898-4936. doi: 10.1080/00207543.2018.1467062.

Shou, Z., Y. Gong, and Q. Zhang. 2022. “How boundary spanners' guanxi matters: managing supply chain dependence in China.” *International Journal of Operations & Production Management* 42(3): 384-407. doi: 10.1108/IJOPM-08-2021-0492.

Soares, A., E. Soltani, and Y.Y. Liao. 2017. “The influence of supply chain quality management practices on quality performance: an empirical investigation.” *Supply Chain Management: An International Journal* 22(2): 122-144. doi: 10.1108/SCM-08-2016-0286.

Somapa, S., M. Cools, and W. Dullaert. 2018. “Characterizing supply chain visibility–a literature review.” *The International Journal of Logistics Management* 29(1): 308-339. doi: 10.1108/IJLM-06-2016-0150.

Tse, Y. K., M. Zhang, K.H. Tan, K. Pawar, and K. Fernandes. 2019. “Managing quality risk in supply chain to drive company’s performance: The roles of control mechanisms.” *Journal of Business Research* 97: 291-303. doi: 10.1016/j.jbusres.2018.01.029.

Tse, Y.K., M. Zhang, W. Zeng, and J. Ma. 2021. “Perception of supply chain quality risk: Understanding the moderation role of supply market thinness.” *Journal of Business Research* 122: 822-834. doi: 10.1016/j.jbusres.2020.07.003.

Wiegel, W., and D. Bamford. 2015. “The role of guanxi in buyer–supplier relationships in Chinese small-and medium-sized enterprises–a resource-based perspective.” *Production Planning & Control* 26(4): 308-327. doi: 10.1080/09537287.2014.899405.

Wieland, A., and C.M. Wallenburg, 2012. “Dealing with supply chain risks: Linking risk management practices and strategies to performance.” *International journal of physical distribution & logistics management* 42(10): 887-905. DOI 10.1108/09600031211281411

Wilhelm, M.M., C. Blome, V. Bhakoo, and A. Paulraj. 2016. “Sustainability in multi-tier supply chains: Understanding the double agency role of the first-tier supplier*.” Journal of operations management* 41: 42-60. http://dx.doi.org/10.1016/j.jom.2015.11.001

Wong, A., and D. Tjosvold. 2010. “Guanxi and conflict management for effective partnering with competitors in China.” *British Journal of Management* 21 (3): 772-788. doi: 10.1111/j.1467-8551.2010.00690.x.

Woodside, A. G. 2013. “Moving beyond multiple regression analysis to algorithms: Calling for adoption of a paradigm shift from symmetric to asymmetric thinking in data

analysis and crafting theory." *Journal of Business Research* 66: 463-472. doi: 10.1016/j.jbusres.2012.12.021.

Xu, L.D. 2011. Information architecture for supply chain quality management. *International Journal of Production Research* 49(1), pp.183-198.

Yang, Z., G. Aydın, V. Babich, and D.R. Beil. 2009. "Supply disruptions, asymmetric information, and a backup production option." *Management science* 55(2): 192-209. https://doi.org/10.1287/mnsc.1080.0943

Yin, R.K. 2009. *Case study research: Design and methods*. Thousand Oaks, CA: sage.

Yurt, O., and C. Yildirim. 2022. "Exploring integrated solutions in the supply chain context: a dyadic perspective in an emerging economy setting." *Production Planning & Control* pp.1-25. https://doi.org/10.1080/09537287.2022.2044084

Zhang, M., H. Hu, and X. Zhao. 2020. "Developing product recall capability through supply chain quality management." *International Journal of Production Economics* 229: 107795. doi: 10.1016/j.ijpe.2020.107795.

Zhao, X., B. Huo, B.B. Flynn, and J.H.Y. Yeung. 2008. "The impact of power and relationship commitment on the integration between manufacturers and customers in a supply chain." *Journal of operations management* 26(3): 368-388. doi:10.1016/j.jom.2007.08.002

Zhou, H. and Li, L., 2020. The impact of supply chain practices and quality management on company performance: Evidence from China's small and medium manufacturing enterprises. International Journal of Production Economics, 230, p.107816. https://doi.org/10.1016/j.ijpe.2020.107816

Zhou, H., and W. C. Benton. 2007. "Supply chain practice and information sharing." *Journal of Operations Management* 25 (6): 1348-1365. doi: 10.1016/j.jom.2007.01.009.

Zu, X. and H. Kaynak. 2012. “An agency theory perspective on supply chain quality management.” *International Journal of Operations & Production Management* 32(4): 423-446.