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**An empirical analysis of supply and manufacturing risk and business performance: A Chinese manufacturing supply chain perspective**

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## **An empirical analysis of supply and manufacturing risk and business performance: A Chinese manufacturing supply chain perspective**

### **Abstract**

**Purpose** – This study explores the importance and impact of supply and manufacturing risk management upon business performance within the context of Chinese manufacturing supply chains.

**Design/Methodology/Approach** – A two phased multi-method approach was adopted, which included a survey questionnaire to practitioners in Chinese manufacturing supply chains followed by semi-structured interviews. The findings included 103 valid survey responses complemented by six semi-structured interviews.

**Findings** – The results indicate that in Chinese manufacturing context supply risk and manufacturing risk management are both vital for business performance. A high correlation between business and manufacturing risk management performance exists, however no significant impact of supplier dependency, systematic purchasing, maturity of production and supply chain, and human resources was found despite previously these elements being regarded as key influencers for supply and manufacturing risk management performance. The Chinese manufacturing supply chain indicated that elements such as the supplier and customer orientation, flexibility, manufacturing and supply risk highly connotes with business performance.

**Theoretical/Practical implications** – In the current unpredictable and volatile business environment the competitiveness of manufacturing supply chains to a large extent depend on their ability to identify, assess and manage the manufacturing and supply risks. The findings of this study will assist supply chain managers in taking decision on manufacturing and supply risk management and reducing the uncertainty upon their business performance.

**Originality/value** – The supply chain risk has been widely explored within the context of individual case studies, or standalone models focusing on either supply or manufacturing risk in supply chains, however to what extent this has been applicable to a wider context and its impact upon business process has not been explored. Hence, this study simultaneously has analysed manufacturing risk and supply risk and its impact upon Chinese manufacturing supply chains business performance. Moreover, this study uses a combination of quantitative and qualitative methods, which is often limited in this area. Finally, the institutional theory lens offers novel insights in better understanding the factors that can affect the impact of supply and manufacturing risk management upon business performance in those contexts, such as China, where the institutional aspect presents specific features.

**Keywords** – Institutional Theory, Supply Chain Management, Supply Chain Risk, China, Manufacturing Risk, Supply Risk, Business Performance,

**Article Classification** – Research paper

## Introduction

The growing scale and scope of supply chain architecture has brought various risks influencing an organization's capability to operate continually and provide goods and services to the market (Jordan and Bak, 2016). According to the Business Continuity Institute (BCI) 81% of international enterprises suffered at least one supply chain disruption in 2013 compared to 78.6% in 2010 (Alcantara, 2014) indicating that the disruption of supply chains around the world has reached a pervasive level. Some well-known examples of such incidents are Ericsson's crisis in 2000, the 9/11 terrorism event in 2003 and the tsunami in Japan affecting Toyota in 2011 (Jüttner et al., 2003; Sun et al., 2012; Ho et al., 2015). Considering that approximately 20% of supply chain disruptions are experiencing a financial loss of over \$500 million with a potential of 25% average decrease of share prices, reflects that firms who experience supply chain disruption are likely to suffer long-term impact on financial performance (Conrad and Walker, 2012; Sun et al., 2012).

Therefore, identifying the inherent supply chain risks is a core activity since it allows managers to understand risk better and improve the management of supply chain risks (Lin and Zhou, 2011). From a supply chain managers' perspective it is difficult to justify the investments made on risk mitigation initiatives if they are not directly related to the payoff (Rajagopal et al., 2017). In order to overcome the idea that "nobody gets credit for fixing problems that never happened" (Repenning and Sterman, 2001: 64) and to promote supply chain risk management (SCRM) best mitigation practices, the relation between the actions taken and the impact on the business performance needs to be investigated (Colicchia and Strozzi, 2012). However, only few contributions have empirically investigated the relationship between supply chain risk and performance. Furthermore, the supply chain risk has been widely explored within the context of individual case studies, or standalone models, while the research on multiple supply chain risks and their simultaneous impact on business performance through empirical research are limited. As advocated by Ho et al. (2015), further investigations on the interrelationships among different types of risk rather than standalone risks would better support SCRM decision-making process.

Supply and manufacturing risks gained increasing attention due to the high connectivity of supply chains. Supply chains in fact are increasingly operating in networked and

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3 global environment, where the ability to build and maintain relationships with suppliers  
4 is equally critical and challenging for businesses (Hallikas and Lintukangas, 2016). For  
5 example, the outsourcing of non-core activities to suppliers and service providers  
6 increases firms' dependency on external resources (Bustinza et al., 2010), and it is widely  
7 acknowledged that purchasing can heavily affect business performance (Hallikas and  
8 Lintukangas, 2016; Aberdeen Group, 2013). The volatility in purchasing can lead to risks  
9 of product obsolescence, investment in capital assets and high inventory level. Hence,  
10 supply risk is closely connected to manufacturing risk that can affect the ability of the  
11 focal company to produce high quality goods and services in a timely manner and, in  
12 turn, achieve profitability (Ho et al., 2015).  
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20 According to Eloot et al. (2013) the manufacturing sector accounted for 40% of China's  
21 gross domestic product (GDP) in 2013, which led to new supply chain risk exposure due  
22 to four major challenges: the rising labour cost, the shift in consumer expectations  
23 towards product quality, innovation, and service, the increase of value chain complexity  
24 and the volatile global economic environment (Eloot et al., 2013). Previous research has  
25 investigated the contextual risks associated with outsourcing activities to China's  
26 manufacturers (Huang, Zhang and Liu, 2013; Jia and Rutherford, 2010; Olson and Wu,  
27 2011; Kumar and Sosnoski, 2009). Jia and Rutherford (2010) argue that cultural  
28 difference is a critical factor contributing to the supply risks in the business between  
29 western purchasing companies and Chinese suppliers. They suggest that understanding  
30 the cultural difference and adopting cultural adaptation are crucial to mitigate the related  
31 risks. More recently, Ellinger et al. (2015) highlight that research examining cultural and  
32 behavioural factors that may improve SCRM practice is still scarce.  
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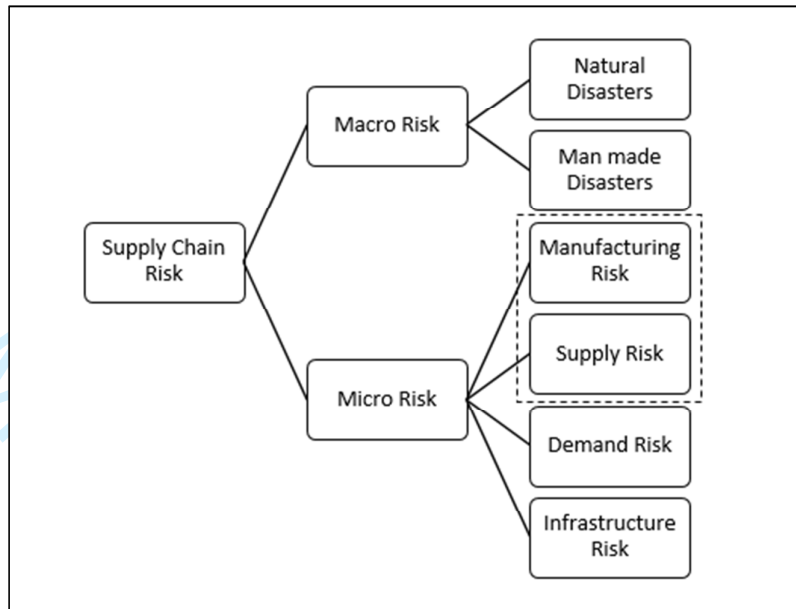
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43 A survey conducted by Marchese and Paramasivam (2013) indicated that China is  
44 regarded as a costly source of adverse outcomes from risk events in the supply chain,  
45 following the United States and Canada. When it comes to investigations concerning  
46 SCRM in Chinese manufacturing, the attention from researchers increases significantly  
47 due to the rapid growth of China's economy (Olson and Wu, 2010). However, the current  
48 studies on SCRM in the Chinese manufacturing sector are still scarce (Special issue on  
49 SCRM in China, 2009). Moreover, most recent literature investigated SCRM in Chinese  
50 manufacturing firms from a perspective of purchasing or outsourcing (Huang, Zhang and  
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3 Liu, 2013; Jia and Rutherford, 2010; Olson and Wu, 2011; Kumar and Sosnoski, 2009)  
4 or investigated risk mitigation strategies (Liu et al., 2007).  
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8 Therefore, the primary aim of this paper is to investigate supply and manufacturing risk  
9 management simultaneously and the impact upon business performance. The case of  
10 Chinese manufacturers will be explored since it represents a relevant and overlooked  
11 context as “companies operating in such weak institutional environments face many risks  
12 which can disrupt... operations” (Ke et al., 2014:1591). In fact, it is acknowledged that  
13 there is a relationship between a firm and the institutional environment in which it  
14 operates, as this latter shape the guiding principles of the company and the way it  
15 complies with external rules, norms, and values (Oliver, 1991). This applies to a context,  
16 like the China, where culture and other national characteristics play a relevant role in  
17 shaping business practices and affecting related performance (Adebanjo, Teh and  
18 Ahmed, 2017). Although research has indicated that weak institutional environments  
19 have an impact upon agricultural supply chains and their performance (Yeboah et al.,  
20 2014), the choice of Chinese manufacturers context may also provide an understanding  
21 of weak institutional environment and its association to supply chain risk to achieve  
22 better performance in China. Hence, we adopt institutional theory as a lens to help  
23 understand and contextualise the study’s findings and to see if there are any ‘influencing  
24 factors’ which are unique to China that may affect the relationship of how these two  
25 variables impact business performance.  
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### 39 **Theory and hypotheses: Supply and Manufacturing Risk Management** 40 41 **Performance** 42

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44 Supply chain risk is a broad concept that offers a variety of risks, and presents a variety  
45 of methods for classification. Ho et al. (2015) propose a useful classification that takes  
46 account of both comprehensiveness and varieties of impact degrees: (a) macro risks are  
47 akin to environmental risks, the factors include natural and man-made disasters such as  
48 earthquakes, wars and economic downturns, and (b) micro risks are classified to four  
49 categories; demand risks, manufacturing risks, supply risks and infrastructure risks  
50 (Figure 1).  
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**Figure 1:** Classification & Scope of Supply and Manufacturing Risk (Ho et al., 2015)

Among different types of risks, in the last decade, the changing economic landscape and supply chain structure have brought many supply and manufacturing risks (Manyika et al., 2012). Supply risk can be defined as “the probability of an incident associated with inbound supply from individual supplier failures or the supply market occurring, in which its outcomes result in the inability of the purchasing firm to meet customer demand or cause threats to customer life and safety” (Zsidisin, 2003, p.222). Manufacturing risk refers to factors and events that affect the ability of companies to produce goods and services, quality and timeliness of production activities, and profitability (Wu et al. 2006). A number of contributions have focused on the assessment and management of supply and manufacturing risks. For instance, Zsidisin et al. (2004) present a framework of supply risk assessment techniques, while Tomlin (2006) investigates strategies for managing supply risk through an analytical model. Tse and Tan (2011) propose a framework for assessing product quality risk in a multi-tier global supply chain, in which the quality risk could stem from supply, manufacturing or logistics operations in any tier within supply chain network. Tang (2006) claims that the key concern of supply chain risk regarding product manufacturing is to decrease the inventory cost associated with a certain range of products.

As mentioned above, it is essential for firms to measure the outcomes of supply chain risk practices. Berg et al. (2008) noted that measurement of performance allows

companies to assess the result of practices carried out. For managers, this understanding of associated supply chain risk would allow them to adopt specialized strategies for specific types of risk (Ho et al., 2015). Nagy and Venter (2011) propose an approach to measure supply chain performance with the following metrics: the proportion of supply chain related costs/overall sales revenue, customer satisfaction level and customer service level. By contrast, PwC (2015) covers three main categorizations of business performance: profitability, efficiency and service.

With the current studies concentrates on general supply chain risks (Qiang et al., 2014; Tang and Tomlin, 2008; Brun et al., 2006; Christopher and Lee, 2004) and specific risk types (Ellinger et al., 2015; Tang et al., 2012), only a few studies focused on two risk types simultaneously (Ho et al., 2015; Baghalian, Rezapour, and Farahani 2013; Qiang and Nagurney 2012; Goh et al., 2007). indicating a lack of investigation on the relationship between risk management and performance (Sun et al., 2012; Berg et al., 2008) with most of the literature regarding this relationship based on conceptual rather than empirical studies (Hallikas and Lintukangas, 2016; Thekdi & Aven, 2016). Table 1 presents a summary of the supply and manufacturing risk and respective performance areas in supply chain literature.

**Table 1** Categories of supply and manufacturing risk performance from supply chain management literature

<b>SCRM performance areas</b>	<b>Authors</b>
Supply risk management performance	Hoffmann et al., 2013; Hallikas and Lintukangas, 2016; Ho et al., 2015; Indrawati et al., 2014
Supplier orientation	Cigolini and Rossi, 2010; Bronzo et al., 2013
Supplier dependency	Aberdeen Group, 2013; Hallikas and Lintukangas, 2016; Zhao et al., 2013;
Systemic purchasing	Hallikas and Lintukangas, 2016; Epp and Price, 2011; Aberdeen Group, 2013
Customer orientation	Hallikas and Lintukangas, 2016; Zhao et al., 2013
Maturity of SCM process	Hoffmann et al., 2013; Ho et al., 2015; Indrawati et al., 2014; Isoherranen et al., 2015
Firm size	Hallikas and Lintukangas, 2016
Culture	Jia and Zsidsin, 2014; Cheng et al., 2012
Manufacturing risk management performance	Lamarre et al., Be et al., 2015; Hong et al., 2014; Ellinger et al., 2015; Cheng et al., 2012; Jia and Zsidsin, 2014; Li et al., 2015
Production Flexibility	Hoffmann et al., 2013; Isoherranen et al., 2015; Harrison, 2014



Maturity of manufacturing process	Hallikas and Lintukangas, 2016; Hoffmann et al., 2013; Ho et al., 2015; Indrawati et al., 2014; Isoherranen et al., 2015
HR management	Yeung, 2012; Cheng et al., 2012

Understanding how China manages and responds to supply and manufacturing risk will have a significant impact on global trading, especially considering that China has been reported to account for one-fourth of the global gains on the import side and 30% on the export side (Hillberry & Zhang, 2018). Athukorala (2011) noted that LPI is also a useful measure to consider as it ranks 160 countries and focuses on trade-related logistics provisions. According to the LPI, ranking China positioned itself on 27th position, moving towards ease of trades compatible to European counterparts such as Spain (World Bank, 2016).

A plethora of studies have uncovered differences in the cultural and society contexts of Chinese organisations compared to their Western counterparts and impacts on organisational/management practices (Chen et al., 2015; Farh et al., 2004; Ma and Tsui, 2015). Very little however, if any, have attempted to do so in terms of supply and manufacturing risks simultaneously, and their impact on business performance. Hence, we would like to understand how ‘guanxi’ and other cultural/institutional pressures, that are unique to China, may affect how supply and manufacturing risk impacts business performance in this context.

As noted by Zsidisin et al. (2005), a firm is constrained and influenced by the environment in which it operates within. Thus, how Chinese manufacturing firms respond to and are influenced by supply and manufacturing risk may be different to other country contexts. Hence, the institutional theory provides a useful lens in which investigate these country contextual issues, examining how external and internal pressures can influence organizational actions and performance (Sarkis et al., 2011). Although supply chain risk literature embedded the use of institutional theory (Zsidin et al., 2005; Wang et al., 2015; Su et al., 2008), these studies focused only on single activities in the Chinese context (Su et al., 2008; Liu et al., 2010). Therefore, the inclusion of a quantitative survey of manufacturing firms in China provides a richer context in terms of institutional theory and its practice. With this understanding the following hypotheses were developed.



### *Supply risk management performance*

According to Hoffmann et al. (2013: 200) “the development of ....supply risk management procedures and capabilities is proposed to increase supply risk management performance”. Although the relationship between supply risk and performance observed, there are different risk factors associated with supply and manufacturing risk (Hoffmann et al., 2013; Hallikas and Lintukangas, 2016; Ho et al., 2015; Lamarre et al., 2009). For instance, upstream supply risks in a global supply chain, within China, who is a major product manufacturer and exporter, could result in disruptions affecting the manufacturing process (both in China and elsewhere), such as supplier bankruptcy and product quality issues and will thus affect the availability of inventory for manufacturing, leading to customer delivery failures and stock outs further down the supply chain, for instance in the UK, US or Europe consumer markets (Huang et al., 2013; Jia and Rutherford, 2010). In contrast, downstream supply risks, such as the inability to deliver on time, resulting from long supplier lead times, may result in a high level of inventory holding cost within the manufacturing process. In addition, technological changes in manufacturing may contribute to an inability to meet customer delivery requirements. In addition, the differences between industry sectors and their contextual settings have an impact upon the supply risk and its business performance (Bak, 2018; Ho et al., 2015). Therefore:

*H1 Supply risk management performance within a Chinese manufacturing context influences business performance*

### *Manufacturing risk management performance*

According to Das and Lashkari (2015), manufacturing risk is of critical importance since it is under the control of the company, and can involve factors and events that affect the ability of companies to produce goods and services, quality and timeliness of production activities, and profitability (Wu et al., 2006). Previous studies indicated that manufacturing risk has significant impact upon supply chain performance (Li et al., 2015; Ellinger et al., 2015; Hong, Kwon and Li, 2014; Cheng et al., 2012; Jia and Zsidisin, 2014). A number of contributions have focused on the assessment and management of manufacturing risks (Zsidisin et al., 2004; Kwon and Li, 2014; Tomlin, 2006). However, there is limited understanding on the impact on performance in the Chinese manufacturing industry context. In this context, given the challenges faced by

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3 the manufacturing sector and the key role played by manufacturing and export for  
4 China's competitiveness, the research identified a high correlation between  
5 manufacturing risk management and business performance (Ellinger et al., 2015; Li et  
6 al., 2015). Especially, from an institutional theory perspective, it is also important to  
7 understand how China, one of the biggest exporters, manages and responds to  
8 manufacturing risk, as this will have a significant impact on global trading. Similarly, Liu  
9 et al. (2007) identified the risks in Chinese manufacturing industry and proposed  
10 corresponding mitigation strategies whilst taking account of the cost, which could assist  
11 supply chain organizations to select appropriate mitigation strategies with less cost.  
12 Hence, we hypothesise that:  
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19 *H2 Manufacturing risk management performance influences business performance*  
20 *within a Chinese manufacturing context*  
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#### 23 *Supplier orientation*

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26 Supplier orientation refers to the relationship between customer and supplier and can  
27 have positive impact on the management of disruptive risks. For instance, during the 9.0-  
28 magnitude earthquake in Japan in 2013, the production of Nissan Motor Company Ltd  
29 and its suppliers recovered from the disaster much faster than their competitors did. One  
30 of the key factors to Nissan's strong resilience in the supply chain was the flexible supply  
31 chain model structure. The flexibility and close orientation with suppliers allowed its  
32 supply chain structure to be decentralized and transfer to centralization when required  
33 (PwC, 2015). However, supplier orientation is also directly linked to the development of  
34 relationships with suppliers, including the integration of the information and physical  
35 flows across the supply chain enabling collaborative planning and forecast with suppliers  
36 for joint plans for process improvement (Bronzo et al., 2013). Hong, Kwon and Li (2014)  
37 claim that the perception of partnership and risk has significant impact on business  
38 performance. Studies also highlight that specific risk setting -such as guanxi in China -  
39 can affect the performance of SCRM (Jia and Zsidisin 2014; Cheng et al., 2012). Jia and  
40 Zsidisin (2014) claim that the supply chain relationship management with guanxi is  
41 prominent for western firms to manage the risks among the outsourcing activities to  
42 China. Hence, Hallikas and Lintukangas (2016) suggest that supplier orientation is based  
43 on the theory that supplier-development activities can positively influence supply chain  
44 management. It mainly concerns the collaboration with suppliers in the field of  
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3 evaluation, common goals, new collaboration space and formulating joint business  
4 processes. From a Chinese manufacturing perspective, the guanxi culture and importance  
5 on relationships in Chinese business (Wang et al., 2015) may have an impact on supplier  
6 orientation and on supply risk management. Furthermore, from an institutional theory  
7 perspective, isomorphic pressures may affect how Chinese manufacturers orient with  
8 their suppliers. Therefore:  
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13 *H3 Supplier orientation in a Chinese manufacturing context influences the result of*  
14 *supply risk management*  
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#### 17 *Supplier dependency*

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20 Supplier dependency means supplier's reliance on a customer in a deeper relationship or  
21 vice versa. Some customers may choose to place all of their business with one supplier,  
22 while others will dual, triple or use multiple sources. Dependency on sole suppliers,  
23 while it allows for developing deep relationships and potential integration with the aim to  
24 manage risks in the supply chain, on the other hand it can expose businesses to higher  
25 levels of risk related to the availability of sourced materials. In addition, the dependency  
26 on sole suppliers, who are contractually bound, can mean increased transaction costs,  
27 which in turn lead to an increase in the cost of raw materials for manufacturing,  
28 generating risk and affecting customer satisfaction and market share (Hallikas and  
29 Lintukangas, 2016). Other risks generated from supplier dependency include  
30 nonconformity or quality issues of products from suppliers, which may result in  
31 manufacturing incidents. The manufacturing incidents with supply chains are getting  
32 more complex, bringing a high level of interdependency requiring the assessment of the  
33 performance (Bak, 2018). After the 2008 recession when the economy recovered, many  
34 western companies, which relied solely on Chinese manufacturers, expected the same  
35 from Chinese manufacturers, to resume at the previous manufacturing capacity levels,  
36 but they discovered that China has reduced capacity to export in these areas. This  
37 resulted in major supply issues for developed nations. This represents a good example of  
38 how isomorphic pressures, such as a coercive force by the Chinese government, can  
39 influence supply chain risk in global supply chains. Therefore, we can hypothesise that:  
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53 *H4 Supplier dependency in a Chinese manufacturing context influences the result of*  
54 *supply risk management*  
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### *Systemic purchasing*

Systemic purchasing means to purchase potentially diverse products and services in an integrated manner, in order to achieve efficient and economic targets. Disruptions from purchasing can affect supply chain financial performance and can cause disruptions in production (Hallikas and Lintukangas, 2016; Aberdeen Group, 2013). Hallikas and Lintukangas (2016:492) pinpoint the interconnectedness of purchasing performance and SCRM by iterating that "...suppliers in a buyer company increases its ability to perform risk management in its purchasing function." The understanding that systematic purchasing is interrelated to supply risk performance has been noted by Kamann et al. (2016:155) stating that "'purchasing' has transformed into an aspect-system connecting or involving all sub-systems [of supply chains]". Similarly, Hallikas and Lintukangas (2016) also found that there was a significant positive correlation between supply risk performance and systemic purchasing. However, they also acknowledge the presence of very limited empirical research in the systemic purchasing arena (Hallikas and Lintukangas, 2016). The above discussion leads us to propose the following hypothesis:

*H5 Systemic purchasing within a Chinese manufacturing context influences the result of supply risk management*

### *Customer orientation*

Customer orientation can effectively reduce manufacturing risks such as product obsolescence. Moreover, customer value orientation is still essential for the supply chain to perform proactively in identifying customer needs and adapting rapidly to changes (Hallikas and Lintukangas, 2016; Reiner, 2005). For instance, by working closely with customers and understanding their business better, such as customer seasonal demand, new customer onboarding, mergers and acquisitions, new product introductions, suppliers can flex their operation, plan and meet the customer's expectations. The world recession of 2008 is a great example of this. In fact, when customer demand fell during the recession, many of the Chinese factories were closed and workers were incentivised by government to work in agriculture to support the economy. The customer orientation and activities involved creating collaborative platforms to potentially mitigate the risks (Christopher and Peck, 2004). Therefore:

*H6a Customer orientation influences the result of supply risk management*

*H6b Customer orientation influences the result of manufacturing risk management*

### *Maturity of SCRM process*

Hoffmann et al. (2013) indicated that the SCRM process has the strongest positive influence on the performance of SCRM. From a holistic perspective of the supply chain any disruption in either supply or manufacturing will impact overall supply chain (Ho et al., 2015; Indrawati et al., 2014). Furthermore, as asserted by Isoherranen et al. (2015) process maturity is vital for manufacturing firms to achieve operational excellence, as the maturity level of processes has significant impacts on risk management. For instance, automation in manufacturing has numerous advantages, such as: improving quality, reducing dependency on labour and improving safety, which reduce the risk of product quality and production disruption (Harrison, 2014). Therefore, we can hypothesise that:

*H7a Maturity of SCRM process influences the result of supply risk management*

*H7b Maturity of SCRM process influences the result of manufacturing risk management*

### *Production Flexibility*

Lamarre et al. (2009) stressed that production flexibility is a critical component for organizations in responding to the changing environment and mitigate the related manufacturing risk. Their study indicated that flexibility can be presented in four forms: the ability to adjust the capacity according to demand and profitability; the ability to alter the production capacity to fulfil product diversity; the capability to shorten lead times or to postpone production as a response to competitors; the ability to allocate the production in different nations or facilities, in order to achieve low cost or avoid risks such as strikes. This theory concentrates on risks related to productivity, market, labour, inventory factors. Nevertheless, it does not concern the factors such as technology, design and quality. Production flexibility can be enhanced by better collaboration, communication and coordination in the supply chain, which can, help to avoid scenarios such as excess stock in the supply chain generated by the bullwhip effect (Datta and Christopher, 2011). Therefore, we can hypothesise that:

*H8 Production flexibility influences the result of manufacturing risk management*

### *Maturity of manufacturing process*

Hoffmann et al. (2013) noted that the maturity of SCRM process has vital impact on the performance of SCRM. A mature risk management process means the processes need to be well established, defined and controlled, as without developed processes, the risk management actions are likely to be spontaneous and non-systematic. Isoherranen et al. (2015) noted that mature manufacturing processes can positively improve firms' operational performance, which include managing manufacturing risks. The maturity of the manufacturing process refers to perfect procedures, adoption of advanced information technology (IT) software and automatic production. Harrison (2014) asserts that automation can efficaciously reduce risks from production, such as quality issues, dependency on labour and safety issues. Therefore, the above discussion leads us to propose that:

*H9 Maturity of the production process influences the result of manufacturing risk management.*

### *Human Resource (HR) management*

People are one of the key ingredients for a supply chains' performance and can play a vital role in managing and mitigating supply chain risk. Thus, how people are managed through human resource (HR) processes (training, performance incentive, KPIs, disciplinary procedures) will have an impact on business performance (Mangan and Christopher, 2005). Furthermore, labour factors, incidents or situations, such as employee strikes, accidents, absence and lack of experience can influence supply chain performance. Therefore, it can be assumed that within a Chinese manufacturing context:

*H10 HR management influences the result of manufacturing risk management*

### *Firm Size*

Firm size is regarded as a factor influencing corporations' risk management performance as large-scale enterprises are found to be performing better in distributing information and utilizing knowledge (Hallikas and Lintukangas, 2016). The firm size is considered as a main factor impacting an enterprise's risk management capability, since large organizations are found to have better information distribution and perform better in



utilizing knowledge (ibid). Therefore, it is proposed that within a Chinese manufacturing context:

*H11a Firm size influences the result of supply risk management*

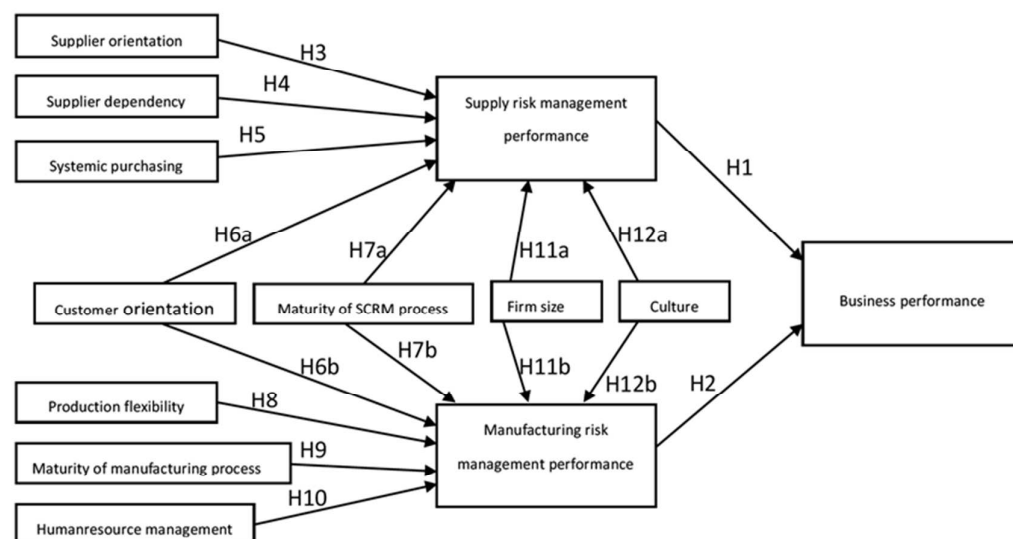
*H11b Firm size influences the result of manufacturing risk management*

### *Culture*

Li et al. (2015) assert that supply chain relationships are essential in enhancing risk information sharing and risk sharing mechanism, which are vital SCRM practices affecting the financial performance of the supply chain. Cultural differences are widely recognized to have influence on business performance (Jia and Zsidisin, 2014; Cheng et al., 2012). According to Cheng et al. (2012), Chinese culture characteristics such as guanxi (guanxi refers to relationships in Chinese culture) might have an impact on the performance of management of supply chain risk. Guanxi can be utilized to promote the effectiveness of communication and trust in supply chain relationships, which will result in reducing supply chain risks. Since China has its distinctive culture influencing the relationship as well as communication in supply chain management, it is proposed within a Chinese manufacturing context that:

*H12a Culture influences the result of supply risk management.*

*H12b Culture influences the result of manufacturing risk management.*



**Figure 2.** Conceptual Framework



## Methodology

To assess the impact of supply and manufacturing risk on business performance and to achieve an in-depth understanding of the research issue (Mangan et al., 2004), this study adopts a mixed methods based approach. The first phase of the study was deductive involving a survey questionnaire issued to chief executive officers, managing directors, general managers and senior supply chain practitioners through personal contacts and LinkedIn. Whereas, the second phase of the research was inductive and involved six semi-structured interviews with Chinese manufacturers to explore and explain the results emerged from the first phase.

The target population included all manufacturing firms within China. Since there are thousands of manufacturing enterprises in China, there are different perspectives of determining sample size from several authors. Based on the conceptual framework (Figure 2) developed in the literature review, a structured survey questionnaire with closed questions was adopted following Dillman et al. (2009)'s guideline. The questionnaire was also developed following the work of Wieland & Wallenburg (2012) and Hallikas & Lintukangas (2016). The survey questionnaire was pilot tested prior to issue (see Appendix).

In total 353 respondents from Chinese manufacturing organizations were contacted to complete the survey., which resulted with 103 valid responses, a response rate of 29%. Although the sample size of 103 is relatively small, many studies have indicated that achieving high responses is always challenging and have hence reported lower survey responses (Freise and Seuring, 2015; Trkman, Oliveira and McCormack, 2016; Sharma and Bhat, 2014). For instance, Freise and Seuring (2015) used a survey of 92 companies to investigate social and environmental risk management in supply chains. A study by Trkman, Oliveira and McCormack (2016), used a combination of six case studies and a survey of 89 companies to conduct the study of value-oriented SCRM. Hence, the shortage of samples can be compensated by using combination of methods. In this study, to compensate for the smaller questionnaire sample, six semi-structured interviews were conducted to ensure theory saturation (Strauss and Corbin, 1994). Six respondents from six manufacturing companies were randomly selected as a subset of the survey questionnaire sample to interview. This enabled the researcher to gain an insightful understanding of the problem and to validate the survey questionnaire results. The

respondents included a supply quality engineer, two planning managers, two purchasing managers and a project manager from two small, two medium and two large Chinese manufacturing businesses. The different job functions of the interviewees provided different perspectives toward the research under investigation. The data from the interviews were audio recorded, transcribed and coded into themes according to the research objectives.

### 3.1 Scale development

Multiple items were used for the measurement of each of the constructs, as summarized in Table 1, with constructs being defined based on literature review (Wong et al., 2012). Second, measurement items were generated which captured the construct as defined by using a panel of five expert academics in the field of supply chain management was consulted. For quantitative data analysis, Pallant (2010) noted that it is important to examine the reliability of scales. For scales, the reliability mainly concerns their internal consistency, which refers to the degree of accordance of items that make up the scales.

To measure the reliability of the scales Cronbach alpha test was conducted. The value of Cronbach alpha was over 0.7, with the highest value of 0.932 and least value of 0.765 (Table 2). To test the convergent validity and discriminant validity, we have computed Average Variance Explained (AVE), Composite Reliability (CR), Maximum Shared Variance (MSV), and Average Shared Variance (ASV). For convergent validity, AVE should be  $> 0.5$  and the Composite Reliability (CR) should be  $> .70$ . As evident from Table 2, AVE values for all the constructs were higher than 0.5 and CR values are higher than 0.70, thus confirming the convergent validity. For discriminant validity MSV should be  $< AVE$  and  $ASV < AVE$ . As evident from Table 2, all the values are within the acceptable ranges, thus also confirming the discriminant validity of the constructs (Tarhini, Teo, and Tarhini, 2016; Fornell and Larcker, 1981).

**Table 2.** Reliability, Convergent Validity and Discriminant Validity

Constructs	No. of Items	AVE	Composite Reliability (CR)	Cronbach's Alpha ( $\alpha$ )	MSV	ASV
Business performance	6	0.537	0.873	0.844	0.389	0.201
Supply risk management performance	6	0.502	0.801	0.833	0.501	0.347
Manufacturing risk management performance	5	0.583	0.755	0.799	0.498	0.274

Supplier orientation	5	0.515	0.841	0.855	0.508	0.388
Supplier dependency	3	0.529	0.771	0.829	0.352	0.213
Production flexibility	3	0.555	0.713	0.822	0.174	0.089
Maturity of manufacturing process	2	0.554	0.723	0.757	0.515	0.265
HR management	3	0.544	0.781	0.871	0.396	0.225
Customer orientation	3	0.592	0.813	0.897	0.540	0.315
Maturity of SCRM process	4	0.649	0.880	0.932	0.577	0.34
Culture	3	0.545	0.705	0.765	0.540	0.365

AVE > .50; CR > .70; Cronbach's Alpha > .70; MSV < AVE; and ASV < AVE.

The exploratory factor analysis (EFA) of the survey results indicated that all item factor loading values were greater than 0.6 with a sample size of 103, which can be considered as significant (Field, 2013). There are four major indicators that can be used to test the construct validity in EFA: the accumulative total of variance, factor loading, Kaiser-Meyer-Olkin (KMO) value and Bartlett's test. According to Field (2013), the accumulative total reflects the degree of effective explanation of common factors for scales. Lastly, KMO value and Bartlett test are used to indicate the extent of the integrated concept of the whole variables or scales. Table 3 presents the result of factors analysis for variables described in the paper. Apart from systemic purchasing (single item, hence excluded in the analysis) and maturity of manufacturing process (not suitable for KMO test with two sub-items), the KMO values of other 10 variables are all above 0.6, and the Bartlett's test of Sphericity is significant ( $p < 0.01$ ). The results indicate that the validity of variables used in this research is acceptable.

**Table 3.** Kaiser-Meyer-Olkin (KMO)

Variables	KMO	Chi-Square	Df
Business performance	0.771	307.336	15
Supply risk management performance	0.837	216.039	15
Manufacturing risk management performance	0.819	146.651	10
Supplier orientation	0.784	250.020	10
Supplier dependency	0.721	112.924	3
Flexibility	0.719	108.317	3
Maturity of manufacturing process	0.500	47.575	1
HR management	0.689	165.058	3

Customer orientation	0.715	200.889	3
Maturity of SCRM process	0.848	345.514	6
Culture	0.619	99.867	3

### Findings

The survey questionnaire resulted in 103 valid responses. Initially, respondents were asked about the business performance, the supply risk management performance and manufacturing risk management performance and asked to rank the items using a five point Likert scale. The responses achieved 3.67 and 3.70 average means, with supplier dependency and systemic purchasing relatively low with 3.26 and 3.31, indicating that in general the constructs (business performance, the supply risk management performance and manufacturing risk management performance) were relevant to supply chain practices and can/or are partially applied to the surveyed organizations in general (See Table 4).

**Table 4:** Mean value of variables

Research variables	N	Min	Max	Mean	SD
Business performance	103	1.50	5.00	3.73	0.80
Supply risk management performance	103	1.00	5.00	3.67	0.72
Manufacturing risk management performance	103	1.00	5.00	3.70	0.76
Supplier orientation	103	1.20	5.00	3.68	0.89
Supplier dependency	103	1.00	5.00	3.26	1.14
Systemic purchasing	103	1.00	5.00	3.31	1.16
Flexibility	103	1.00	5.00	3.80	0.91
Maturity of manufacturing process	103	1.00	5.00	3.52	1.13
HR management	103	1.00	5.00	3.79	0.98
Customer orientation	103	1.33	5.00	3.83	0.89
Maturity of SCRM process	103	1.00	5.00	3.46	1.06
Culture	103	1.00	5.00	3.72	0.89

The correlation analysis has been divided into three parts following the conceptual model. Part one (see Table 5) investigated the correlation between the major constructs of business performance, supply risk management performance and manufacturing risk management performance. Part two investigated the correlation between supply risk management performance and the other aforementioned factors influencing it (see Table 6). Part three investigated the correlation between manufacturing risk management performance and the aforementioned factors influencing it (see Table 7). The correlation

coefficient between business performance and supply risk management performance was found to be 0.569, whereas correlation between business performance and manufacturing risk management performance was found to be 0.624. Both correlation coefficients are significant at a  $P < 0.01$  level. Therefore, it can be concluded that business performance has a substantial and close correlation with supply risk management performance and manufacturing risk management performance respectively. Additionally, the correlation between supply risk management performance and manufacturing risk management performance is noteworthy. The correlation coefficient value was found to be 0.706 significant at  $P < 0.01$  level, reflecting that the two variables have a high positive correlation.

**Table 5.** Correlation analysis - Part one

	Business performance	Supply risk management performance	Manufacturing risk management performance
Business performance	1		
Supply risk management performance	.569**	1	
Manufacturing risk management performance	.624**	.706**	1

\*\* . Correlation is significant at the 0.01 level (2-tailed).

As shown in Table 6, apart from the variable of firm size, supply risk management performance has significant and positive correlation with the other six variables. Surprisingly, the correlation between supply risk management performance and supplier dependency is positive. As expected, supplier dependency is considered as a factor increasing supply risk (Hallikas and Lintukangas, 2016). However, this may be because companies heavily dependent on suppliers are conscious of the related supply risk but they feel they have in place an effective process of supply risk management to counteract it. Turning to firm size, the correlation coefficient is close to zero, and it is not significant. Therefore, there is no association between supply risk management performance and firm size.

**Table 6.** Correlation analysis Part two

Variables	1	2	3	4	5	6	7	8
Supply risk management performance	1							
Supplier orientation	.722**	1						
Supplier dependency	.463**	.539**	1					
Systemic purchasing	.306**	.299**	.418**	1				

Customer orientation	.660**	.760**	.469**	.263**	1			
Maturity of SCRM process	.663**	.734**	.594**	.370**	.704**	1		
Firm size	.021	-.072	.231*	.144	-.065	.166	1	
Culture	.531**	.605**	.391**	.199*	.529**	.590**	.087	1

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\*. Correlation is significant at the 0.05 level (2-tailed).

As shown in Table 7, the association between manufacturing risk management performance and firm size is not significant, which indicate there is no correlation between the two variables. Apart from firm size, the other six variables have prominent and positive correlations with manufacturing risk management performance.

**Table 7.** Correlation analysis Part three

Variables	1	2	3	4	5	6	7	8
Manufacturing risk management performance	1							
Flexibility	.497**	1						
Maturity of manufacturing process	.396**	.354**	1					
HRM	.515**	.419**	.594**	1				
Customer orientation	.568**	.640**	.463**	.685**	1			
Maturity of SCRM process	.517**	.564**	.630**	.735**	.704**	1		
Firm size	.015	-.236*	.345**	.149	-.065	.166	1	
Culture	.449**	.516**	.518**	.617**	.529**	.590**	.087	1

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\*. Correlation is significant at the 0.05 level (2-tailed).

In the linear regression analysis, supply risk management performance is analyzed as a dependent variable, while culture, firm size, systemic purchasing, supplier dependency, customer orientation, maturity of SCRM processes, supplier orientation are analyzed as independent variables. The regression coefficient of supplier orientation was 0.312, significant at  $P < 0.01$ , indicating supplier orientation has a positive and significant influencing relationship with supply risk management performance. Similarly, the regression coefficient of customer orientation was 0.149 significant at  $P < 0.01$ . The results also reflect a positive and respectably significant influencing relationship between customer orientation and supply risk management performance. The regression coefficients of the other five variables were not significant. Hence, they have no influencing relationship with supply risk management performance. Secondly, manufacturing risk management is regarded as a dependent variable in the model and the seven independent variables are flexibility, maturity of manufacturing processes, HRM, customer orientation, the maturity of SCRM process, firm size, and culture. The



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3 coefficients indicate that flexibility has a positive and significant influence on the  
4 performance of manufacturing risk management, with a regression coefficient of 0.175  
5 significant at  $P < 0.1$ . Similarly, the results reveal that customer orientation is  
6 significantly and positively influencing the result of manufacturing risk management  
7 (coefficient 0.206). However, the results of the other five independent variables indicate  
8 that they have no significant influence on the performance of manufacturing risk.  
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13 The findings predicted that supply risk management influences business performance  
14 (H1), as the result of supply risk management has significant and positive impact on  
15 organization's business performance. In turn, it demonstrates the importance of supply  
16 risk management for Chinese manufacturers. The interview findings also supported this  
17 finding as all six respondents in the interviews strongly agreed on hypothesis (H1).  
18 Similarly, manufacturing risk management influences business performance (H2), as the  
19 Chinese companies indicated that those who manage manufacturing risk well are likely  
20 to perform better than competitors with respect to efficiency and effectiveness. In  
21 general, interviewees agreed that the risks in manufacturing could result in direct and  
22 significant losses to the corporations. As one of the respondents stated, "We just suffered  
23 from a serious quality issue in last year that caused us huge financial and reputation  
24 loss." In turn, it reveals the significance of manufacturing risk management performance  
25 to Chinese manufacturers. Another interesting finding is that supplier orientation  
26 influences supply risk management performance (H3). This indicates that from the  
27 perspective of a buyer company, the orientation towards suppliers enhances its capability  
28 to manage risks coming from the supply side. All interviewees agreed that supplier  
29 orientation is essential for them to manage supply risks. As one of the respondents  
30 mentioned, "The activity of supplier orientation is just like bringing the suppliers into  
31 our management system, which is useful for reducing supply risks." Moreover, one SCM  
32 expert emphasized that supplier orientation can facilitate the development of supplier,  
33 and the improvement of suppliers will result in reducing supply risks.  
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48 Another positive assertion was that customer orientation influences both supply risk and  
49 manufacturing risk management performance (H6a, H6b). It indicates that concentrating  
50 on customer requirements can contribute to the reduction of risks in both supply and  
51 manufacturing stages of the supply chain. One of the interviewees asserted that customer  
52 orientation is a major challenge faced by most enterprises as it affects a range of supply  
53 chain risks. Similarly, another respondent said, "customer orientation not only has  
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3 positive impacts on reducing supply chain risks, but also helps to improve our  
4 management.” This is reinforced by the fact that the study indicates that production  
5 flexibility influences the performance of manufacturing risk management (H8). Within  
6 the Chinese manufacturing companies, the reacting and adjusting capabilities of  
7 production increase the firm’s ability in reducing manufacturing risks. The interview  
8 findings also showed that production flexibility is more significant to organizations with  
9 unstable demands than to firms with stable needs. One of the respondents from an auto  
10 enterprise said, “Flexibility is quite important for us. As our sales decline dramatically  
11 recently, we are able to put four different cars in the same production line, so that the  
12 production cost can be maintained at a reasonable level.”  
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20 On the other hand, despite the supplier dependency is extensively regarded as a threat to  
21 business, it does not have influences on the performance of supply risk management  
22 (H4). The interview findings also did not support this notion and most interviewees  
23 indicated that they do not have concerns about supplier dependency since there are  
24 adequate alternative resources in the market, in line with Hallikas and Lintukangas  
25 (2016). However, the systemic purchasing activities such as centralized purchasing  
26 indicated no impact upon the performance of managing supply risk in Chinese  
27 manufacturing companies (H5) in contrast to the findings of Hallikas and Lintukangas  
28 (2016). However, this hypothesis was partially supported in the interview findings. One  
29 of the supplier quality engineer argued that systemic purchasing is meaningful for  
30 reducing quality risks from supply side, and improving suppliers’ service level. Another  
31 interviewee stressed that systemic purchasing is significant for organizations to simplify  
32 its categorization of buying items, therefore, inventory risks and other risks arise from  
33 complicated product mix can be reduced. Hypotheses 7a, 7b were not supported  
34 indicating that the maturity of SCRM process does not influence the performance of both  
35 supply and manufacturing risk management. The survey findings show that maturity of  
36 production has no impact on manufacturing risk management performance in the Chinese  
37 manufacturing companies (H9), notwithstanding the fact that the maturity level of  
38 manufacturing processes is often regarded as an essential factor for reducing risks of  
39 quality, disruption and dependency on labor. However, unlike survey findings, the  
40 interview results are consistent with the literature (Harrison, 2014; Isoherranen, 2015).  
41 Most respondents recognized the significance of process maturity in managing  
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3 manufacturing risks. One of the respondents mentioned, “We are threatened by serious  
4 quality issues due to the lack of mature manufacturing processes.”  
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7 The role of HR management is recognized in the literature as closely linked to the  
8 performance of manufacturing risk management; however, both the survey and interview  
9 findings indicated that the capability of HR management has no impact on manufacturing  
10 risk management performance (H10). Another expected finding was a positive impact  
11 between culture and supply and manufacturing risk performance since the Chinese  
12 culture is widely regarded as a critical factor affecting business relationships. However,  
13 the study indicated that there is no significant impact on the performance of supply and  
14 manufacturing risk management (H12a, H12b). Likewise, the interview findings present  
15 a similar view. All respondents denoted that Chinese culture characteristics (i.e. guanxi)  
16 have no significant impacts on supply and manufacturing risk management  
17 performances. Neither firm size seemed to influence the performance of supply and  
18 manufacturing risk management (H11a, H11b).  
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## 26 27 **Discussions**

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29 In the Chinese context, the correlation between business performance and manufacturing  
30 risk management performance was higher than the one between business performance  
31 and supply risk management performance. To better understand this result, the research  
32 also investigated the factors influencing the performance of both supply and  
33 manufacturing risk management.  
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### 38 *Factors affecting supply risk management performance*

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40 The literature review indicated three factors affecting the performance of supply risk  
41 management, i.e. supplier orientation, supplier dependency, and systemic purchasing.  
42 According to Hallikas and Lintukangas (2016), supplier orientation involves supplier-  
43 development activities that can positively influence the performance of supply risk  
44 management. Similarly, Giunipero and Eltantawy (2004) noted that supplier-  
45 development activities could assist in reducing the uncertainties and supply chain risks.  
46 This is important as “the identification and management of risks for the supply chain,  
47 through a co-ordinated approach amongst supply chain members, to reduce supply chain  
48 vulnerability as a whole” (Jüttner et al., 2003, p. 201). Thun and Hoenig (2011: 246) also  
49 note that the complexity of supply chains can be managed through “certified suppliers in  
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3 order to guarantee high quality and a high on-time delivery ratio.” Hallikas and  
4 Lintukangas (2016) claimed that supplier-development activities could effectively and  
5 efficiently reduce the risks coming from the supply side of the supply chain. This  
6 argument is supported by survey results. In fact, the regression analysis confirms the  
7 significant and positive influence of supplier orientation on the performance of supply  
8 risk management, a view that was also supported by interviewees.  
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13 Moreover, in the case of outsourcing, supplier dependency will result in a higher risk of  
14 losing internal resources and capabilities, which are critical for the competitiveness of the  
15 buying firm. However, the study findings do not support this point of view in the Chinese  
16 manufacturing context. The limited concerns regarding supplier dependency may be due  
17 to the presence of adequate alternative resources in the Chinese market. Hallikas and  
18 Lintukangas (2016) illustrated the concept of supplier dependency from the perspective  
19 of transaction costs. They pointed out that a high reliance on suppliers can result in  
20 higher transaction costs. The high reliance also may correlate to the increased number of  
21 global customers outsourcing their products to China (Lin and Zhou, 2011). Therefore, it  
22 can be concluded that supplier dependency does not affect the performance of supply risk  
23 management in Chinese manufacturing context.  
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32 Finally, according to Hallikas and Lintukangas (2016) and Giunipero and Eltantawy  
33 (2004) systemic purchasing can have a direct impact on supply risk management  
34 performance. Through systemic purchasing companies reduce the number of suppliers  
35 and thus improve their ability to control quality and manage their supplier base. Our  
36 findings acknowledged the role of purchasing but indicated no correlation between  
37 supply risk performance and systemic purchasing. In addition, systemic purchasing  
38 concentrated the buying volume on certain suppliers, which enable organizations to  
39 negotiate for better service level with suppliers. However, the survey results denote that  
40 systemic purchasing has no impact on supply risk management performance. Further  
41 research needs to be conducted to understand whether systematic purchasing has become  
42 less important as the Chinese manufacturing supply chains possess a more co-ordinated  
43 approach amongst supply chain members (Jüttner et al., 2003) or whether the findings  
44 can be an indicator to manufacturing companies resources and resource dependency  
45 (Thun and Hoenig, 2011).  
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### *Factors affecting manufacturing risk management performance*

According to Lamarre et al. (2009), production flexibility is essential for manufacturers in the current turbulent and unpredictable market environment. The capabilities to adjust production volume, product mix, and lead-time enable manufacturers to reduce manufacturing risks, such as loss of market share, high inventory, and high production cost. This view is confirmed by the survey results as well as interviews, which indicate a positive influencing relationship between production flexibility and manufacturing risk management performance. In the context of Chinese manufacturers, production flexibility is in fact recognised as a major challenge since their products are customized, hence the importance of being able to quickly adjust production when demand changes. Literature suggests that the impact of production flexibility is dependent on sectors (Lamarre et al., 2009) and consequently this opens further avenues for future research to highlight the role and impact of production flexibility on risk management in specific sectors.

Isoherranen et al. (2015) stated that the mature manufacturing processes can positively improve firms' operational performance, including managing manufacturing risks. Nevertheless, the survey findings did not support this argument. Although the correlation analysis showed there is an association between the maturity of manufacturing processes and manufacturing risk management performance, the regression analysis indicated there is no influencing relationship between them.

Finally, according to Mangan and Christopher (2005) HR management has a crucial impact on business performance, including the performance of manufacturing risk management process. For example, the capability of HR management has an influence on reducing risks such as strike, safety issues, and dependencies on specific employees. However, the survey results indicated that there is no influencing relationship between HR management and manufacturing risk management performance. Hence, it would be opportune to further explore this relationship to complement the results of our investigation in other geographical contexts.

### *Factors affecting the performance of both supply and manufacturing risk management*

The literature review indicated four factors that influence the performance of SCRM, namely customer orientation, firm size, the maturity of SCRM process and culture.

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3 Consequently, it was assumed that these factors affect the performance of both supply  
4 and manufacturing risk management.  
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7 As argued by Hallikas and Lintukangas (2016), customer value orientation is critical for  
8 firms as it allows them to react to demand changes rapidly and in a proactive manner. As  
9 a result, customer satisfaction can be promoted and thus, risks connected to customer  
10 needs can be reduced. This argument receives supports from survey results. In fact, they  
11 reveal a significant and positive influencing relationship between customer orientation  
12 and both supply and manufacturing risk management.  
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17 Firm size is regarded as a factor influencing organisations' SCRM performance since  
18 large companies are found to be performing better in managing information and utilizing  
19 knowledge for risk management purposes (Hallikas and Lintukangas, 2016). However,  
20 results from survey did not confirm this argument. The findings indicated that there are  
21 no associations between firm size and supply risk and manufacturing risk management  
22 performance.  
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28 As raised by Hoffmann et al. (2013), the maturity of SCRM process is strictly connected  
29 with its performance. Surprisingly, this relationship is not supported by the survey  
30 findings. The regression analysis result indicated that there is no influence relationship  
31 between the maturity of SCRM processes and supply risk and manufacturing risk  
32 management performance. This may be also in line with Cheng et al.'s (2012) research  
33 whereby the supply chain risk woven within the supply chain risk practices as it has been  
34 seen as an integrative element within the Chinese organisations supply chain.  
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40 Company culture is widely recognized in the literature to have influences on businesses  
41 (Jia and Zsidisin, 2014; Cheng et al., 2012). Chinese culture characteristics such as  
42 guanxi can be utilized to promote the effectiveness of communication and trust in supply  
43 chain relationships, which will result in a reduction of related supply chain risks and  
44 better performance of SCRM process (Cheng et al., 2012). Even if survey results  
45 identified a correlation between culture and risk performance, the regression analysis  
46 revealed there is no relationship between these elements.  
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### 52 **Conclusions, implications, limitations, and future research**

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54 The result of the study reveal both types of risks management are essential to Chinese  
55 manufacturing firms, as they are playing vital roles in those organizations' business  
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3 performance. In particular, the findings of the study indicated that supply orientation was  
4 found to be effective in managing supply risk, while supply dependency indicated no  
5 significant influence on it, thus leading to rethink Chinese manufacturer's strategy  
6 accordingly. However, the customer orientation was found to have positive effects on  
7 manufacturing and supply risk.  
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11 Another interesting finding was that not all the relationships identified in the literature  
12 were confirmed. Therefore, the study included interesting findings contradictory to  
13 previous research, such as that there is no relationship between the maturity of SCRM  
14 processes and supply risk and manufacturing risk management performance. Hence, the  
15 contextual setting and manufacturing sector may be different within country and industry  
16 settings (Lin and Zhou, 2011).  
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22 The study provides important theoretical and practical contributions. Firstly, our findings  
23 contributes to the existing body of knowledge by providing empirical evidence on the  
24 relationships between supply risk, manufacturing risk and business performance in  
25 Chinese context as well as through utilizing the institutional theory lens added to the  
26 limited body of empirical knowledge in the area. Our study further challenges the  
27 existing notion that supplier dependency affects the supply risk management process, as  
28 this relationship is context dependent, as we did not find any evidence of this in the  
29 Chinese context. Moreover, this study used a combination of quantitative and qualitative  
30 methods, which is often limited in this area. Findings of the study are also of great  
31 importance for manufacturing organisations operating in China or seeking to operate in  
32 the region. Manufacturing companies can greatly benefit from the understanding of the  
33 dynamics between the various factors that can influence their business performance  
34 particularly the supply and manufacturing risk management. Although the findings are  
35 applicable across all manufacturing firms, the sampling from Chinese context limits its  
36 generalisability beyond China. Therefore, future research should focus on data collection  
37 beyond the Chinese manufacturing context and perhaps expand the study regionally or if  
38 possible on a global scale. Future studies should target larger survey responses that could  
39 be complemented with further interviews with practitioners/experts. Future investigation  
40 could also focus beyond manufacturing and supply risks, and explore other risks (e.g.  
41 demand risk, infrastructure risk) that also have considerable impact on the industry.  
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This work is one of the few efforts to investigate supply or manufacturing risk in supply chain practices in China, therefore our investigation and the findings of the study are relatively exploratory in nature. We believe a longitudinal investigation based on the findings of this work can help to identify patterns of long-term manufacturing and supply chain risk and how they are managed, and whether this performance has an impact upon the economic direction of society over the next few decades. In addition, we believe that future research should try to tease out various variations between regions, to see the level of manufacturing and supply risk observed.

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