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Building resilience in SMEs of perishable product supply chains: enablers, barriers and risks

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ABSTRACT

Small and medium enterprises (SMEs) of perishable product supply chains (PPSCs) are critical to sustaining fresh food supply and global economy. However, these firms face immense challenges due to the nature of their operations. Surprisingly, the literature demonstrates limited research on distinct intra and inter-organisational factors intertwined to build resilience in PPSCs. From the semi-structured interviews conducted with 30 managers of a PPSC in Australia, we developed a holistic framework to build resilient PPSCs. The findings offer new insights in research and practice including an optimal portfolio of enablers as well as crucial barriers and risks towards building resilience. An analysis of internal and external risks shows that the majority of risks faced by the firms emerge internal to the supply chain, thus necessitating strong collaboration among the supply chain partners. The level of resilience, risks and barriers varies considerably within SMEs depending on their size (small vs. medium) and the location of the node in the supply chain. Interestingly, the SMEs with consortium support demonstrate better resilience and performance.

Keywords: SMEs; supply chain resilience; enablers; barriers; risks; case study

1. Introduction

Strong competition and a fast-changing business environment can leave firms within a supply chain being exposed to higher internal and external risks (Lavastre, Gunasekaran, and Spalanzani 2014). This exposure is often compounded by the barriers which are both internal and external to the supply chains (Rauer and Kaufmann 2015; Fawcett, Magnan, and McCarter 2008). In addition, as more integrated supply chains become with the higher level of interdependencies, the firm's susceptibility to the risks and barriers increases not only from their own operations but also from the activities of their supply chain partners (Anastasiadis, Poole, and Wagner 2015; Cigolini and Rossi 2010). Disruption to the flow of material or information caused by such issues can reduce firms' financial, market and operational performance (Crum et al. 2011; Wagner and Bode 2008). Correspondingly, research on supply chain resilience (SCR) has been gaining attention from the academics and practitioners alike.

Despite several advances, the recent literature clearly shows the scarcity of research on the phenomenon of resilience in SMEs (Kamalahmadi and Parast 2016) involving PPSCs (Shukla and Jharkharia 2013). The PPSCs are involved in the production and distribution of fresh and processed foods from the point of production to the point of consumption. They are significant contributors to the global economy and social well-being. For instance, their contribution to gross domestic product (GDP) is 4.8% in America, 2.4% in Australia, 5.2% in Brazil, 9.2% in China and 17.8% in India (World Bank 2016). Likewise, their contribution to employment accounts for 9.3% of the total employment in America, 31% in Australia and 5–10% in some European countries (World Bank 2016). However, they are highly vulnerable to disruption due to shorter shelf-life and increased weather-related uncertainties (Ali and Shukran 2016). For instance, supply chain disruption caused by the 2016 flood in New South Wale, Australia, resulted in a loss of AUD 500 million fresh food supply (Australian Broadcasting Corporation (ABC) 2016). Given the globalisation, domestic PPSCs are now part of global supply chain network. Therefore, disruption at a point in the supply chain would have detrimental effects on the food supply for many other regions of the world. These circumstances highlight the need to build more resilient PPSCs.

With the growth in the literature on SCR, multiple enablers to building SCR appeared including flexibility, redundancy, visibility and agility; among many others (Hohenstein et al. 2015; Kamalahmadi and Parast 2016). However, most of the exiting enablers are either in large

firms or based on generic studies. In real business world, still many PPSCs either fail or are very slow in truly embracing resilience. Clearly, this implies the presence of barriers to achieving the desired goals (Fawcett, Magnan, and McCarter 2008; Tan, Smith, and Saad 2006). These barriers can emanate from both internal and external environment, and their understanding is indispensable to exploit the full benefits (Fawcett, Magnan, and McCarter 2008; Dora, Kumar, and Gellynck 2016) of being resilient. However, an empirically driven framework that could help to discern the potential barriers impeding some firms, particularly SMEs of PPSCs, in building resilience is yet to be found.

Additionally, the formation of the consortiums is seen increasingly in various industry sectors, specifically in SMEs of PPSCs. A consortium is an association of related business (for example Citrus Australia Limited), which provides a platform to the member firms for sharing knowledge and professional expertise so that they complement each other. The member firms can discuss various challenges and their solutions in a common forum. Although some studies recognise the moderating role of government support in building resilience and maintaining firm performance (Sheu 2015; Urciuoli et al. 2014), the research on moderating role of consortium support is unexplored so far.

Therefore, this paper uses SMEs of PPSCs in Australia to supplement the knowledge gaps in current literature. The main objective of the paper is to identify various factors involved in building resilient PPSCs. To achieve this objective, this article addresses the following four research questions (RQs): (1) *How do the SMEs of a PPSC build resilience and safeguard performance in a turbulent business environment? (2) Do the SMEs belonging to a consortium exhibit better performance than others? (3) Why some of the SMEs within a supply chain are unable or less likely to enhance their resilience? (4) What are the major sources of disruption in SMEs; if the level of disruption varies among participants of the SMEs, then what are the major factors contributing to this variation?*

In order to address aforesaid questions, the remainder of the paper is organised as follows: Section 2 discusses the relevant literature and the need for this study. Section 3 outlines the research methodology and analysis. Section 4 derives research findings. Section 5 outlines practical implications. This paper is concluded by discussing its contributions, limitations and avenues for the future research in Section 6.

2 Literature review

2.1 Supply chain resilience

The term resilience has been discussed in diverse disciplines including ecology (Walker et al. 2002), psychology (Barnett and Pratt 2000), metallurgy (Callister and Rethwisch 2003), and management (Hamel and Valikangas 2003). In the context of the supply chain, the most widely accepted and theoretically integrated definition of SCR is offered by Ponomarov and Holcomb (2009, 131). By integrating concepts from the different fields of the study, they define SCR as,

> the adaptive capability of the supply chain to prepare for unexpected events, respond to disruption and recover from them by maintaining continuity of operations at the desired level of connectedness and control over structure and function.

2.2 Enablers to resilience

Drawing upon the concept of resilience in the context of the supply chain, prior studies suggest a range of elements or enablers (both terms are used synonymously in the literature) to build

resilience. For example, many researchers offer a generic (non-industry specific) classification of enablers such as redundancy and flexibility (Bode et al. 2011; Pettit, Fiksel, and Croxton 2010; Ivanov, Sokolov, and Dolgui 2014; Purvis et al. 2016), visibility (Brandon-Jones et al. 2014; Fiksel et al. 2015), and collaboration (Pettit and Fiksel 2010; Roberta Pereira, Christopher, and Lago Da Silva 2014; Burnard and Bhamra 2011; Scholten, Scott, and Fynes 2014). Others offer industry-specific approaches such as flexible contracts, portfolio diversification, transportation planning and safety stock for building resilience in oil and gas supply chains (Urciuoli et al. 2014); strategic and operational flexibility for textile and fashion supply chains (Pal, Torstensson, and Mattila 2014); switching suppliers, flexible supply base and total supply chain visibility for automotive supply chains (Azevedo et al. 2013); flexibility and redundancy for construction supply chains (Wedawatta, Ingirige, and Amaratunga 2010); and low inventories, using information technology (IT), redundant supplier for electronic industry (Sodhi and Lee 2007).

Although SCR is an emerging research direction, the current literature shows the paucity of empirical evidence on specific enablers of resilience for PPSCs which are dominated by SMEs. One possible reason for this scarcity could be that the previous literature on firms in PPSCs primarily focused on food quality management in the context of cold chain logistics. For example, Bogataj, Bogataj, and Vodopivec (2005) and Stringer and Hall (2007) emphasis on temperature control to avoid fresh food quality deterioration. Rong, Akkerman, and Grunow (2011) also advise temperature adjustment to control quality degradation. On the other hand, Scudder and Blackburn (2009) propose supply chain coordination as an enabler to mitigate the quality decline in perishable products' transportation. Epelbaum and Martinez (2014) propose innovation in food traceability to maintain quality. Others also stress on temperature monitoring and control (Kuo and Chen 2010; Ali et al. 2013; Aramyan, Kooten, and Vorst 2007) or offer a conceptual framework (Shukla and Jharkharia 2013). As such, the attention of prior research on firms (SMEs) in PPSCs remains unidimensional – quality deterioration due to food perishability – and thereby lacks the holistic perspective of enablers to build resilient PPSCs.

2.3 Barriers to resilience

Barriers refer to the forces that inhibit the firms from accomplishing long-term goals (Park and Ungson 2001; Magnan and Fawcett 2008). They can emanate from misalignment of objectives within and among the partnering firms (Park and Ungson 2001). Barriers can obstruct firms from a quick reaction to disruption (Roberta Pereira, Christopher, and Lago Da Silva 2014) and deemed daunting to success (Park and Ungson 2001). Therefore, understanding and controlling the potential barriers is indispensable to achieve the essential objective (Fawcett, Magnan, and McCarter 2008) of being resilient.

While literature in the area of strategic management highlights the impeding effect of barriers in achieving strategic goals (Park and Ungson 2001; Nyuur 2015), the literature in SCR lacks comprehensive empirical studies on barriers to building resilience. We believe, the study by Roberta Pereira, Christopher, and Lago Da Silva (2014) is the pioneer to describe barriers such as lack of visibility, collaboration and trust in building resilient procurement system. However, their research lacks empirical rigour and limited to specific context—procurement activities. Thus, the literature lacks broad empirical evidence on potential barriers in building resilience, particularly in SMEs of PPSCs.

2.4 Potential risks

Most of the studies in the field of supply chain risk management (SCRM) consider risk as a probability of occurrence of an event with negative consequences (Manuj, Esper, and Stank 2014; Wagner and Bode 2008; Matook, Lasch, and Tamaschke 2009; Manuj and Mentzer 2008b). As such, the focus of SCRM research largely remains on identification and quantification of risks (Fiksel et al. 2015; Hohenstein et al. 2015). Nonetheless, the recent research reveals that in reality, it is not possible to quantify or predict all the risks stemming from a turbulent business environment (Scholten, Scott, and Fynes 2014; Fiksel et al. 2015). Therefore, firms need to consider both quantifiable (predictable) and unquantifiable (unknown) incidents in order to ensure continuity of operations in the dynamic business environment (Fiksel et al. 2015). Consistent with this, for the purpose of this study, we use the term 'risk' to address both predictable and unpredictable risk faced by the SMEs of PPSCs.

While the literature on supply chain risk classification is growing, a review of previous studies (Table 1) highlights the need for further contributions considering PPSCs.

Insert Table 1 about here

As seen in Table 1, most exiting research on risk classification either offers a generic view point or focuses on non-perishable industries. Some categories of risks such as supply-side risks, demand side risks, environmental risks have been extensively discussed. Comparatively, little is empirically and holistically understood on other risk categories including logistic/ transportation, financial, climatic and supply-demand mismatch risks, specifically in the context of PPSCs.

Christopher and Peck (2004) advise that risk can emerge from three main levels; internal to the firm, internal to the supply chain, external to the supply chain. A comprehensive understanding of risks thus needs to consider all three sources, simultaneously (Christopher and Peck 2004). While current literature on supply chain risk has made significant contributions, much still remains to be learnt empirically and holistically on risks emerging from all these three sources and particularly on PPSCs.

3 Methodology

Consistent with the research questions of this study, an exploratory case study was employed to explore various factors involved in building SCR. The exploratory case study is considered an appropriate tool to gain the in-depth insight of a unique phenomenon in a real-life setting, where the focus of the study is mainly on what, why and how questions (Yin 2009).

3.1 The industry setting

The case study focuses on SMEs in Australian citrus industry (ACI). The citrus industry entails production, processing and distribution of a range of perishable products including mandarins, oranges, grapefruit, lemons and their juices and jams (HIAL 2014). These food products are considered as one of the top industry exports (USDA 2015). The citrus industry contributes to the economy and society not only in Australia, which is one of the major citrus producers and exporters in Southern Hemisphere, but also in many other countries of the world such as, Brazil, USA, Italy, Spain, China and India (USDA 2015). The ACI is dominated by a large network of SMEs including citrus producers, packers, processors (juice and jam

manufacturers), wholesalers and retailers (CAL 2013; HIAL 2014). The SMEs in Australia are defined as consisting two main entities: small size firms, which have 5 to 19 employees; and medium size firms, which have 20 to 199 employees (ABS 2001) with the exception of producers (farmers), which are characterised by estimated value of agricultural operation which is between AUD 22400 to AUD 49,000 for small businesses (ABS 2001). This is because most of the producers' employee seasonal workers and cannot be defined in terms of number of employees (ABS 2001). The ACI has global supply chain operations (HIAL 2014). However, tough market and supply chain conditions have led to businesses exiting the industry (ABS 2013). An action plan (2012-2017) by the Australian Government emphasises research on supply chain related issues within this industry (HIAL 2014). Therefore, SMEs from the ACI were found an interesting case to explore various factors involved in building a resilient PPSC.

3.2 Data collection

The data was collected through in-depth semi-structured interviews. Grounded in the literature, an interview protocol was developed, following Creswell (2013). The interview protocol had a standard set of questions that were organised under the main topic, open-ended questions and probes to instil detailed information on potential risks, enablers and barriers to resilience and firm performance. The questionnaire was pilot tested with four executives of the firms within the ACI and improvements were incorporated as advised by Creswell (2013).

Interviews were conducted between January and April 2015. Initially, contacts of participants were obtained from a national citrus industry association. In order to collect additional contacts, two industry forums were used to explain the objectives of this research and exchange contact information with the managers. All contacts were pooled, and knowledgeable respondents were selected using purposive (expert) sampling method as of Creswell (2013). The interview process started with the first interview and continued until no new information was forthcoming as advised by Strauss and Corbin (1990) and Yin (2009). This process led to 30 interviews at each level of a supply chain including 9 producers, 5 packers, 4 wholesalers, 3 processors, 5 retailers. One interview was conducted with (each of) representative of the industry association, government department, consultancy firm and a transport service company (see Appendix A). All interviews were recorded except for four, where the participants were reluctant to recording, hence, extensive notes were taken as advised by Creswell (2013). The interviews with respondents lasted between 30 and 60 minutes till the saturation point as advised by Yin (2009). Also, company reports and websites were used for the purpose of triangulation as suggested by Yin (2009).

3.3 Data analysis

The data was analysed using content analysis. The unit of analysis was at a firm level within the supply chain. The ability to investigate a sub-unit that is embedded within a large case is the powerful method and better corroborate with a phenomenon (Baxter and Jack 2008). The interviews were transcribed verbatim and themes were analysed using open, axial and selective coding following Strauss and Corbin (1990). In order to hasten the analysis process and observe the relationship between categories more vividly, the content analysis was conducted using NVivo 10 software. An inductive approach, following an iterative bottom-up process to data analysis, was adopted as of Creswell (201) and Myers (2013). As suggested by these authors, the textual data was sorted into codes and categories/ constructs. The relationships between various constructs emerging from the data analysis were presented through the theoretical framework and propositions. In order to ensure trustworthiness of the findings, the four principles of Guba (1981) and Guba and Lincoln (1994) were followed:

1. Credibility: the participants were asked to review the interview transcripts and provide feedback on any misunderstandings or omissions;
2. Transferability: diverse participants were chosen to represent variations in the type of positions, responsibilities and regions. Besides, this study clearly provides all information including number of organisations, number and type of participants, data collection procedure and interview period;
3. Dependability: the codes developed were compared with the codes by the other researchers for the same transcripts. The inter-code comparison was found satisfactory with 82% similarity; and
4. Conformability: the findings were supported by quotes, regular review of data and analysis procedures to avoid judgmental bias.

4. Research findings and discussion

The analysis of interview data unravels the details on resilience enablers (proactive and reactive elements), barriers and potential risks faced by SMEs in a PPSC. The findings of the study address RQs 1-4 and also led to the development of a theoretical framework and 10 testable propositions.

4.1 Enablers to building SCR

A resilient supply chain can reduce the vulnerabilities and risks in both proactive and reactive manners (Hohenstein et al. 2015; Ponomarov and Holcomb 2009). The proactive elements help to prepare for and resist negative impact or changes; whereas reactive elements enable a response and recovery to an original or even a better state (Hohenstein et al. 2015; Ponomarov and Holcomb 2009). Congruent with this understanding, the following section analyses an optimal portfolio of proactive and reactive elements adopted by the firms in this study in order to build resilience and safeguard performance. In doing so, this section addresses RQ1: How do SMEs build resilience facing a turbulent business environment.

4.1.1 Proactive elements

Business Certifications. Giacomarra et al. (2016) and Massoud et al. (2010) argue that business certifications ensure that a business meets the requirements of the governing industry standards. Pursuit of these certifications reinforce the commitment to continuous improvement thus reducing risks in production and demand disruption (Giacomarra et al. 2016) and reduce trade barriers (Massoud et al. 2010) for firms. The analysis of the interview data shows positive impact of business certifications on firms' resilience. For instance, many progressive upstream firms (Firms 1 to 13) acquired certifications including Hazard Analysis and Critical Control Point (HACCP), FreshCare, Good Manufacturing Practices (GMP) and Good Agricultural Practices (GAP). These certifications were found essential to ensure compliance with the food safety standards and improve credibility of production and distribution systems (Firms 1 to 13); thereby, enabling supplies in both domestic and international markets. The mangers of Firms 2 and 8 stated that, 'the domestic (Australian) supermarkets including Coles and Woolworths demand HACCP and FreshCare'. The general manager of Firm 11 reported that, 'international markets ask for GMP, HACCP and GAP'. As such, proactive investments in these business certifications allow firms with a flexibility not only to access divergent markets, but also reduce potential threats of consignment rejections and inventories obsolescence.

Globalisation. Although globalisation increases complexity (Shukla and Jharkharia 2013; Manuj and Mentzer 2008b), it offers opportunities for the business growth (Shukla and

Jharkharia 2013; Narasimhan and Talluri 2009) by removing trade barriers. Entry into global markets not only allows the domestic suppliers to resist the monopoly of local buyers and but also enable them to improve learning of new technologies and knowledge through interaction with international partners (Shukla and Jharkharia 2013; Narasimhan and Talluri 2009).

The findings of this study suggest a positive impact of globalisation on firms' growth and adaptation—resilience. For instance, given the stiff competition in local markets, numerous packers (Firms 10 to 13) and wholesalers (Firms 15 and 16) reported that they have developed strategic alliances with the international markets such as America, China and Japan and every year they export products to these countries. In addition, due to the seasonality of production systems, when domestic supplies of products become unavailable in the off-seasons (Firms 13, 16 and 28), many domestic packers and wholesalers import products from international markets, thereby ensuring continuity of supply to the consumers around the year (Firms 12 and 18). The operations manager of Firm 16 stated that, 'trade liberalisation led to the emergence of new standards and legal conditions for our businesses. The owner-manager of Firm 17 lamented that, 'failure with compliance often results in heavy penalties and tarnished customer trust'. As a result, some progressive firms have started to invest in modern production and packing technologies in order to meet the international standards (Firm 28). These developments, in turn, have led to more customer satisfaction and resilience to the consignment failures.

Vertical integration. Vertical integration is a strategy where a firm buys other businesses in a supply chain (Chong et al. 2014; Gualandris and Kalchschmidt 2015). For a producer, forward integration attains control of a distributor; whereas backward integration entails control of suppliers. The analysis of interviews illustrates that firms in this study use both forward and backward vertical integration to avoid the influence of intermediaries. Some producers (Firms 8 and 11) have acquired their own packing plants (forward integration) and directly distribute their products to the retailers. Likewise, the operations manager of a processor (Firm 25) reported that they have purchased a farm and a packing plant (backward integration) to save cost and time delays. Vertical integrations thus allow firms to acquire redundant capacity, reduce risks stemming from multiple layers of intermediaries, opportunism, supply-demand mismatch, delivery delays and transaction costs (Firms 8, 11, 25 and 28).

Training and development. Training is indispensable to develop the skills of the employees (Aguinis and Kraiger 2009), whereby skilled employees are the key drivers of the change and productivity (Blackhurst, Dunn, and Craighead 2011). The analysis of interview data reflected the positive impact of training on workers' skills and efficiency, thereby enhanced the capability to dealing with adverse operational events such as machine breakdowns and wastes. Most of the upstream firms (producers and packers) were found to be machine reliant, and therefore, skilled workers were critical to avoiding potential disruptions due to equipment damage. Given the inherent scarcity of financial resources in SMEs, national industry associations in collaboration with government departments organise intensive training and education programs for these workers, leading to enhanced workers' skills and firms' productivity (Firms 28 and 29).

Quality Management. Due to increasing media focus on the issues related to the public health and safety, consumers are more quality conscious (Trienekens and Zuurbier 2008). Quality management is therefore essential to maintain quality and safety of food in the supply chain (Wognum et al. 2011). The results of this study show that quality management is strictly adhered to the firms. One of the major quality-related issues considered by the respondents was the maximum residual limit (MRL), which is the maximum tolerable level of pesticides in

treated products. MRL of more than 1mg/kg is extremely hazardous to public health (World Health Organization 2013). In order to ensure that the products conform to MRL and are free from chemical hazards, the general manager of Firm 10 reported that, 'each batch of product is tested prior to being released to customers'. The National Measurement Institute (NMI), which is an Australian Government facility, offers quality tests for a wide range of perishable products (Firm 29). The general manager of Firm 11 reported that, 'we get quality test from the NMI to reduce the chances of consignment failure'. Many respondents (Firms 1 to 12) reported that they have been regularly obtaining product quality tests from NMI prior to delivery. As such, these firms avoid the potential risks of demand failure.

4.1.2 Reactive elements

Responsiveness to customers' needs. It is difficult to persuade the customers to buy what the firms are offering, unless they have clear understanding of customers' needs (Sashi 2012). Firms need strong collaboration and flow of information back from the point of sale to quickly adapt to the changing needs of customers (Kamalahmadi and Parast 2016). Our findings demonstrate a positive relationship of responsiveness to customers' need for firms' resilience. The respondents mentioned that colour, flavour, texture and packaging of food are the critical factors to consumers' acceptance (Firms 16 to 22). Correspondingly, some successful firms have established strong coordination mechanism with the downstream supply chain partners, whereby information on changing customer requirements flow swiftly from the point of sale (retailers) back to the upstream chain (wholesalers, processors, packers and producers). Such visibility in the chain enables firms to continuously update the products, processes and systems (Brandon-Jones et al. 2014). The operations manager of a processor (Firms 25) reported that, 'given the changing customers demand, we have been continuously upgrading flavour of juices and jams'. Likewise, some packers (Firms 13 and 14) were seen more focused on grading and improving packing system to enhance the products' aesthetic value. Many producers (Firms 3, 5, 7 and 11) reported that, reacting to consumers' needs, they have been introducing seedless and sweeter varieties of the citrus fruits. These responsive strategies, make them more agile in the rapidly changing competitive environment.

Responsiveness to competitors' strategies. To be resilient the firms need to be flexible, continuously adapt and move forward (Fiksel et al. 2015; Rice and Caniato 2003; Singh and Sharma 2014) to the change in competitors' strategies. The findings of our study indicate that many successful firms are vigilant and react quickly to the competitors' strategies, thereby enhancing their performance. The respondents stated that Chile and South Africa are amongst the major competitors in the international markets (Firms 12 and 16) and with their cheap labour they are able to offer products at lower prices. This creates very challenging conditions to the Australian firms. To overcome this challenge, many Australian firms have adopted a niche market strategy to some Asian markets including China and the Middle East by offering premium quality products and gaining a competitive advantage on quality instead of cost (Firms 12 to 16).

Multi-sourcing. Multi-sourcing is an approach in which a firm sources the material from more than one supplier (Tang 2006b; Burke, Carrillo, and Vakharia 2007). This strategy allows a focal firm to quickly switch to an alternate source when the flow of material from the primary supplier is disrupted (Tang 2006b). The findings of this study show that some progressive firms use multi-sourcing strategies to be resilient against potential supply disruptions. Primarily, three drivers of multi-sourcing were identified: 1) when a primary supplier fails to conform

quality specifications; 2) when natural disasters occur in some regions of the country (Firms 6, 7 and 28); and 3) when domestic products become unavailable in off-seasons (Firm 18 to 20).

Public–private collaboration. Collaboration has been identified as a building block of resilience (Fiksel et al. 2015). Collaboration between parties leads to improved flexibility and performance (Fiksel et al. 2015; Scholten, Scott, and Fynes 2014). This study establishes a positive effect of collaboration with public agencies on SMEs resilience. It is found that many upstream firms are susceptible to the risks emerging from unpredictable weather conditions (e.g. floods, droughts and diseases outbreak). Therefore, these firms coordinate with government departments (such as meteorological services) to regularly receive updates on weather conditions including humidity and rainfall patterns (Firms 2, 4, 12, 16 and 29) and correspondingly make changes in their daily operations. Also, the role of public–private collaboration was observed in the wake of disruption caused by floods and storms, where government agencies render financial and moral support to firms in recovering from the crises.

Overall, our findings show that SCR is an outcome of investment in both proactive and reactive elements, which is also in line with the conceptualisation of Hohenstein et al. (2015). Given its proactive and reactive dimensions, SCR can be contended as a multi-dimensional variable. A multidimensional variable (i.e. SCR) is modelled as a second-order construct to represent two seemingly different, but actually related concepts (i.e. proactive and reactive) in an abstract form (Hagger and Chatzisarantis 2005; Polites, Roberts, and Thatcher 2012) or more synergistically. A second-order construct permit more theoretical parsimony, which is difficult to gain by a single dimension alone (Hagger and Chatzisarantis 2005). Hence, building on existing literature and interview findings, we propose the following two propositions:

P1. Supply chain resilience is a second-order construct resulting from two seemingly different but interrelated sub-constructs; proactive and reactive elements.

P2. Supply chain resilience enables firms (SMEs) to resist and adapt to the potential risks and barriers, thereby maintaining the performance.

4.2 Consortium support

Responding to RQ2, the role of consortium support was examined through interviews. Interestingly, consortium support emerged as a critical moderator to positively enhance the performance of firms in this study. The marketing manager (Firm 28) of the Citrus Australia Limited (CAL), which is a consortium, reported that around 250 firms from the industry are their registered members. As such, CAL provides support to the participating firms in dealing with emerging market challenges. This consortium regularly arranges industry forums where business experts exchange their experiences and knowledge to anticipate emerging markets and technological dynamics (Firms 2, 5, 6, 9 and 11). Besides, this consortium provides impetus to develop the collaborative solution to the external challenges such as trade agreements, exchange rates, regulatory matters, and tax rates (Firms 8 to 15). These issues are critical to the success of firms, but difficult to address at the individual level (Firms 28 and 29). Further, the CEO of Firm 30 reported that, ‘in the wake of major disruptive events such as floods and droughts the CAL (Consortium) provides moral, technical and financial support to recover’. Likewise, the owner-manager of Firm 7 stated that, ‘the executives of the CAL have access to different world markets and keep us up to date on new opportunities and market dynamics’. The consortium (CAL) also liaises with member firms in developing strategic alliances with international markets (Firms 12 to 18). Hence, consortium support provides

additional opportunities, help and prepare the member firms to cope with emerging challenges, thereby enhancing operational performance of these firms.

Given the dynamic and emergent operational issues, growth in the formation of consortiums can be seen in a range of industry sectors. These consortiums raise substantial funds from their member organisations and also liaise with industry sector to achieve funds and projects from government agencies. However, the literature lacks broad empirical evidence on the effectiveness of the consortiums in growth and development of industries. During our interviews, some policy-makers (Firms 29 and 30) and firms' managers (Firms 5, 9, 11, 13 and 16) showed the keen interest in analysing the outcome of the consortium's role. They deemed this investigation very important towards their decisions on investments in consortiums. As such, this study undertakes consortium support as an independent variable to test its moderating role in reducing risks, developing resilience and enhancing firm performance. Therefore, the following proposition is proposed:

P3. A consortium's support positively moderates the relationship between firm's resilience and performance.

4.3 *Barriers to building SCR*

While SCR offers promise in dealing with growing uncertainties and risks (Scholten, Schilder, and Wagner 2015), some factors (barriers) prevent firms to exploit the benefits of being resilient. Addressing RQ3, following section discusses three potential barriers impeding some of the SMEs' ability to develop resilience.

4.3.1 Lack of managerial autonomy

Autonomy is the level of independence and authority given to the employees (Morgeson, Delaney-Klinger, and Hemingway 2005; Wrzesniewski and Dutton 2001). Managerial autonomy is integral to the change within an organisation (Wrzesniewski and Dutton 2001); however, its absence could obstruct the process of change and adaptability (Schein 1992). Consistent with the extant literature, our findings identified over interference of top management and lack of managerial-autonomy in some medium-size-firms (Firm 15, 19 and 25), which have highly formalised hierarchical structure. Some lower level managers reported that they have been given less autonomy to participate in substantive decisions and openly communicate new ideas, thereby felt less authority for change and adaptability in day-to-day operations. For instance, from the perspective of the operations manager of Firm 25, 'it is hard to take initiatives under a set-up where every action needs formal approval and justifications'. This lack of autonomy creates barriers for the managers of SMEs when they attempt to introduce changes in operations, thereby obstructing the firms' goals of being resilient. Therefore, we derive the following proposition:

P4. Lack of managerial autonomy is a potential barrier to effectively build resilience, particularly in medium-sized firms with a more formalised hierarchy.

4.3.2 Inadequate investment in R&D

Investment in research and development (R&D) is crucial to be innovative (Clegg et al. 2013). Innovative firms avoid conventional practices and demonstrate higher capabilities to adapt and leverage new ideas (Song, Cao, and Zheng 2016). They can effectively develop new processes and products with changing customers' preferences. Therefore, investment in R&D and resulting firm's innovativeness is deemed as a crucial capability (Lin, Lee, and Hung 2006) to build resilience (Tan, Smith, and Saad 2006). Our findings establish inadequate and insufficient

investments in R&D by many SMEs mainly due to budget limitations, thereby inhibiting these firms in achieving resilience. There is also a dearth of continuous learning, innovation, and improvement opportunities at a firm as well as supply chain level. As such, many firms are still following conventional production and processing systems. These issues hinder many SMEs' capabilities in demonstrating flexibility and adaptation with the changing market conditions. Therefore, we derive the following proposition:

P5. Lack of investment in R&D due to financial constraints is a potential barrier to building resilience in SMEs.

4.3.3 Lack of IT integration

Information technology (IT) is critical in building resilience (Scholten, Schilder, and Wagner 2015; Arora, Arora, and Sivakumar 2016). IT integration enables firms to think outside of their own realm and provides higher visibility to the operations (Scholten, Schilder, and Wagner 2015). It enables firms to have real-time information on the production schedule and inventory level, thereby reducing wasteful activities (Devaraj, Krajewski & Wei 2007; Mora-Monge, Azadegan & Gonzalez 2013). Our findings witnessed a lack of IT integration, in some SMEs, as a perplexing barrier to building resilience. Specifically, numerous small sized firms in the upstream chain noted limited knowledge on the long-term benefits of IT integration including visibility and responsiveness (Firms 2 to 9). For instance, from the perspective of owner-manager of Firm 4, 'these systems might deliver some benefits. Honestly speaking, we never felt the need for such systems'. As such, they still use conventional systems, such as phones and personal visits in business transactions. None of these firms felt the need to practice e-procurement, radio frequency identification (RFID) or electronic data interchange (EDI) systems. Therefore, these firms have shown the inability to access real-time information on downstream chain activities. Hence, we derive the following proposition:

P6. Lack of IT integration is a potential barrier to building resilience in some SMEs (particularly small-sized) in the supply chain.

4.4 Supply chain risks

This section addresses RQ4: What are the major sources of disruption in SMEs; if the level of disruption varies among participants of the SMEs, then what are the major factors contributing to this variation?

4.4.1 Transportation risks

Given their shorter product life cycle, the perishable products require a highly sophisticated cold chain transportation system (Kuo and Chen 2010). Despite its potential benefits, the cold chain transportation of perishable products is found to be highly challenging due to special temperature adjustments (Bogataj, Bogataj, and Vodopivec 2005). For instance, the CEO of Firm 26 stated that:

> We have to ensure cold sterilisation in treatment. It is to maintain the temperature between 2–3oC with 95% humidity for 1–2 days in domestic and 20-22 days in international transportations. The containers are sealed in the presence of a government inspector, who inspect the temperature and all the documents related to the product quality and safety.

Temperature related breakdown is one of the major disruptions reported in the perishable product supply chains, leading to loss of food quality and flavour (Stringer and Hall 2007). Temperature needs to be carefully and regularly monitored at all stages of cold chain

transportation (Hsu and Liu 2011). Nonetheless, managers of Firms 12, 15 and 17 frequently mentioned that in sea transportation, when containers move towards the equator the external temperature becomes a lot hotter. At this stage, operators need to monitor and adjust the internal temperature of the container, vigilantly. However, negligence in the temperature adjustment or poor knowledge level of operators causes product spoilage, leading to the recall of the whole consignment.

In cold chain transportation, a good quality packaging is essential for maintaining the desired level of food quality, thereby avoiding the food waste and economic loss (Bourlakis et al. 2014). However, managers of Firms 15, 16 and 26 highlighted the concerns on packaging quality. They reported that the substandard packaging material often cannot control decay caused by the extremely low temperature and high humidity inside the containers, causing quality deterioration and tarnished customers' satisfaction. The fresh product can lose value rapidly due to delays in cold chain transportation at the different stage of the supply chain (Ali et al. 2013; Scudder and Blackburn 2009). Therefore, an efficient transportation mechanism is important to maintain the value of fresh food products (Aramyan, Kooten, and Vorst 2007). However, according to owner-manager of Firm 17, 'post-harvest delivery delays at the farm level are quite common'. Such delays often result in decreased overall shelf-life of fresh products and increased risk of quality and value loss. The general manager of Firm 13 added that delivery delays also result from floods, storms and breakdown of infrastructures: He stated that, 'delivery delays caused by floods, heavy rains and broken infrastructure often spoil fruit quality'. Cold chain transportation was thus found highly vulnerable to delivery delays caused by storms and infrastructure breakdowns, thus leading to the reduction in quality of the perishable products.

The managers of Firms 12, 15 and 16 reported that the cold chain transit is very expensive, thereby profit margins are reducing. The operations manager of Firm 15 stated that 'freight, bulk handling and port charges account for around 25 percent of the total cost of production'. Therefore, government subsidies on cold chain transportations were urged (Firms 12, 15 and 16). Table 2 summarises the potential sources of transportation risks faced by the SMEs on different nodes within PPSCs.

Insert Table 2 about here

The data in Table 2 is based on the analysis of interview transcripts using NVivo 10. The percentage is based on the number of firms impacted on each node of the supply chain. For instance, Table 2 shows 45 percentage for 'temperature fluctuations' under the business category of 'producer'. This percentage was calculated as: the number of producers being affected by 'temperature fluctuations'/the total number of producers participated in the interview *100. The information on the number of producers being affected by 'temperature fluctuations' is extracted from the interview transcripts, while information on the total number of producers is retrieved from Annexure-A. A similar percentage calculation procedure is adopted for each risk source under the respective business category (Tables 2 to Table 4). The results show that percentage of transportation related risks for packer and wholesaler (75 to 80 percentage) is higher than any other node in the supply chain. This is because these entities are the main traders of the products outside the country borders. Increased spatial distance and varied regulations by the global markets make them more vulnerable to the disruptions. Therefore, we derive the following proposition:

P7. Transportation risks are the potential cause of disruption for SMEs in the supply chain. However, exporters (packers and wholesalers) are more vulnerable than other nodes in the supply chain.

4.4.2 Financial risks

Financial risks are associated with potential economic losses, such as the high cost of doing business, bad debts, price volatility and currency rate changes (Fischl, Scherrer-Rathje, and Friedli 2014; Banks 2005; Chong et al. 2014).

The findings of this study establish that financial risks are among the major challenges faced by the SMEs. These risks emerge from a wide range of sources. The respondents stated that their businesses are highly labour intensive and cost of labour is very high in Australia (Firm 2 to 7). For example, the owner-manager of Firm 7 commented that:

> Our businesses are labour intensive. The machines operated on the farms or in the packing houses can't be operated fully automated, and labour cost is higher as compared to our competitors such as South Africa and Chile, thereby making our businesses more challenging.

Although skilled labour is recognised critical to the performance and profitability of perishable food supply chains (Bogataj, Bogataj, and Vodopivec 2005; Bourlakis et al. 2014), managers of Firms 8, 13 and 15 reported that availability of skilled labour becomes a major problem during the peak production season. They stated that due to the seasonality of production system, most of the labour force is hired on short contract bases. The contractual workers easily switch from one firm to other with the money (wages) as the main driver behind, leading to the shortage of skilled labour and delays in business operations. The owner-manager of Firm 3 stated that:

> Given the seasonality of the business, it is very hard to retain labour around the year, and therefore availability of skilled labour becomes another challenge during the peak business season. As a result, our firms hit the hardest.

Likewise, managers of Firms 8 and 9 stated that the price fluctuates are very often, specifically during harvesting season they touch the bottom, which makes us unable to cover even production cost. Farm Manager of Firm 9 commented that 'This situation makes our business vulnerable to the risk of failure to repay the debts to the loan providers, leading to credit defaults'.

Delays in payment by the buyers was another issue of concern. Given the small business size and turnovers, delays in payment are deemed most likely to influence cash flow of firms in food supply chains (Swinnen and Gow 1999). Particularly, managers of Firms 3, 4, 5, 8 and 10 reported that some downstream customers, especially wholesalers and retailers, create delays in payment, resulting in negative cash flow for them. This negative cash flow, in turn, has detrimental impacts on the availability of finance to run daily business operations (Firms 3, 5 and 10). Table 3 portrays potential sources of financial risks faced by SMEs.

Insert Table 3 about here

The analysis of Table 3 reveals that financial risks exist at organisational and supply chain level. Although all firms are vulnerable to these risks, the producers and packers are more

affected (55 to 100%) mainly because of higher labour dependency. Therefore, we derive the following proposition:

P8. Financial risks are the potential cause of disruption for SMEs in a supply chain. However, upstream firms (producers and packers) are more vulnerable than other nodes in the PPSC.

4.4.3 Climatic risks

Climatic risks emerge from climate change and can be seen as crucial to the global economies (Nikolaou, Evangelinos & Leal Filho 2015). Change in climate influences intensity of monsoon (Palmer & Räisänen 2002) and rainfall patterns (Chowdhury & Moore 2015) resulting in natural disasters such as droughts, floods, storms and diseases outbreaks. The general manager of Firm 28 reported that:

> Due to heavy rainfalls, the intensity of floods has been increasing. During 2013 and 2014, two serious floods occurred in Queensland. These floods seriously damaged the infrastructures, leading to the severe economic losses to the fresh food business.

Given the variability in the climate changed and resulting higher temperature, the issues of severe droughts are emerging (Chowdhury & Moore 2015). Managers of Firms 4, 5, 6 and 17 stated that a long-lasting drought occurred in Australia from 2006-2010, leading to the extreme deficiency of water. This drought resulted in the loss of 200 firms mainly including producers and packers. The owner-managers of Firms 4 and 5 mentioned that due the change in climate, the number of days for extreme heat stress have been increasing. Thereby, issues such as early fruit ripening, sunburns and bush fires have been increasingly experienced in the past one decade.

Change in climate can reduce the producers' productivity by increasing pest and diseases attack (Chowdhury & Moore 2015; Pautasso et al. 2012). For instance, managers of Firms 11, 12 and 15 reported that due to high rainfall and humidity new diseases and pest (e.g. citrus canker and *huanglongbing* caused by citrus psyllid) have emerged over the past few years. These diseases once happen, can destroy the whole fruit orchard (Firms 11, 12 and 15). Table 4 below demonstrates major sources of climatic risks:

Insert Table 4 about here

The analysis of Table 4 shows that climatic risks are mainly external to supply chain and directly cause disruption primarily in the upstream SMEs (producers and packers). Alternatively, the wholesaler, processor and retailer have the least impact of climatic risks due to multiple supply sources. Therefore, we derive the following proposition:

P9. Climatic risks are a major cause of disruptions for upstream SMEs, which are having direct exposure to the climatic changes.

4.4.4 Supply-demand mismatch

Supply and demand mismatch is attributed to the variability in expected and actual supply-demand situation (Hendricks and Singhal 2013). The traditional measures of make-to-order or inventory back-up are not applicable to the perishable products (Ali et al. 2013). Therefore, they face distinctive supply-demand mismatch issues. The analysis shows that producers felt the need for early demand information from the packers; the packers, in turn, needed information from the wholesalers and retailers. However, in reality, many wholesalers and retailers do not find it necessary to establish win-win alliances with producers and packers. As such, they opportunistically withheld important information. The lack of information exchange can result in forecasting errors (Cohen and Kunreuther 2007) and a mismatch between supply and demand, thereby effecting firm's performance (Chen and Sohal 2013). A higher than actual forecast can lead to excess inventory or oversupply (Sodhi and Lee 2007). By contrast, a lower than actual forecast can result into supply shortage and failure to meet customers demand (Chen and Sohal 2013). For instance, the operations manager of Firm 19 stated that:

> The communication system is very poor. The producers don't know about the future demand from the wholesale market. Similarly, wholesalers and retailers don't have much information about the quantity of produce in a particular season. This lack of coordination results in over or short supply.

The farm manager of Firm 2 commented that:

> We do agree that the communication system is not perfect, but we do work on it. I think there should be early forecast information from wholesalers to packers and from packers back to growers and this is the area that needs further attention. The timely availability of information is extremely important to save any unforeseen losses.

Given the increasing health issues, consumers are becoming more conscious of product quality (Collins, Sun, and Li 2012) and flavour (Aung and Chang 2014; Biji et al. 2015). However, the operations manager of Firm 16 argues that due to older varieties Australian growers are not producing premium quality and flavoured fruits. A lower level of sweetness badly affects the demand of the products (demand fluctuations). Therefore, a need to replace the older variety of plants with new sweeter ones was highlighted. Another factor contributing to product quality issue was harvesting of premature fruits. The owner-managers of Firms 4 and 5 stated that to get the early market price and share, some producers harvest the fruits before it completely ripens. This kind of opportunistic behaviours tarnishes overall image of the fruit quality in the market, leading to less than expected demand. Table 5 summarises potential sources of supply-demand mismatch faced by different firms within the supply chain.

Insert Table 5 about here

The analysis of Table 5 reveals that supply and demand mismatch is a supply chain risk (i.e. internal to supply chain) affecting all nodes in the supply chain. However, a closer look reveals that producer and packers are more vulnerable (77 to 100%) than other nodes in the supply chain. Thus, we derive the following proposition:

P10. Supply and demand mismatch is the potential source of disruption for SMEs in a supply chain. However, upstream firms (producers and packers) are more vulnerable than other nodes in the supply chain.

Insert Figure 1 about here

5. Practical implications

The dynamic and complex nature of supply chains impacts heavily on SMEs, which have limited financial and knowledge capital compared to larger organisations. Being the member of complex supply chain requires the managers of SMEs to understand the need for resiliency to either mitigate or reduce the impact of uncertainty and vulnerability in their organisations as well in supply chains. As such, our framework will enable the managers of SMEs to understand potential risks, barriers and a portfolio of proactive and reactive capabilities that can be used to build resilience, thereby enhancing market, operational and financial performance. This paper provides managers of SMEs with a resilience thinking to anticipate, prepare for, adapt to and recover from a disruption. In order to be competitive in dynamic markets, the managers need to focus not only their individual firms but also attempt take benefits of synergy effect by collaborative relationships with their supply chain partners. We believe that if firms collaboratively monitor potential risks and barriers, SCR can result as a source of competitive advantage not only for their own firms but also for the supply chain as a whole. Particularly, our findings highlight the need for IT integration, investment in R&D and a decentralised governance structure in SMEs in order to build resilience at firm and supply chain levels.

The SMEs in the supply chain are highly interdependent, and therefore barriers faced by individual firms can have the ripple effect for the whole supply chain, thus necessitating coordination to overcome barriers. Further, the analysis of this study shows that food safety regulations and market conditions are changing rapidly, worldwide. However, many firms' managers lack familiarities to these changes (e.g. Firms 3, 12, 13 and 15). In this context, we believe that collaboration and coordination with an industry consortium can offer the opportunity for SMEs to overcome these issues and the challenges that are peculiar to SMEs of PPSCs only. This paper derives various proactive and reactive elements adopted by some successful SMEs, thus providing an opportunity to the others to review their current plans and adopt more robust strategies. We highlight the need for strong coordination between industry, universities, government agencies and consultancy firms in order to deal with the contemporary challenges.

6 Conclusion

Current literature shows that a holistic framework, which is exploring the link between diverse actors involved in building a resilient supply chain, particularly for SMEs of PPSCs, is not yet found. Based on an exploratory case study, this paper examines the concept of resilience in SMEs and provide empirical research findings using SMEs of PPSC, which are under pressure due to the nature of their operations, as a basis for the analysis.

Responding to the four RQs, the findings of this paper offers nine significant contributions to the extant literature. First, while there are a few generic frameworks emerging on resilience, this paper introduces a unique empirically-driven framework (see Figure 1) with ten testable propositions linking enablers to resilience, barriers, risks, and firm performance for SMEs. These links are to be tested with theoretical viewpoints to develop a resilient supply chain. Second, there is an ongoing debate among scholars on the reactive vs. proactive nature of SCR; this paper contributes to the debate by arguing that SCR is an abstract phenomenon resulting from the combination of proactive and reactive elements. The proactive SCR elements act *ex-ante* and constitute, but are not limited to, business accreditations,

globalisation, vertical integration, quality management, and training and development. While reactive elements act *ex-post* and comprise adaptation to the changing customer needs, multi-sourcing, adaptation to the competitors' strategies and public–private collaboration. By identifying proactive and reactive enablers, the paper responds to RQ1 that is how SMEs of PPSCs build resilience while operating in a turbulent environment. Third, for the first time, we propose SCR as a two-dimensional second-order reflective construct, which is a novel notion. Fifth, addressing to RQ2, this paper finds that lack of managerial autonomy, inadequate investment in R&D and lack of IT integration are among the critical three barriers obstructing SMEs capabilities to achieving the desired level of resilience and performance. As such, we open up a new debate in the literature related to barriers impeding SMEs capabilities to building resilience. Sixth, this study is perhaps the first step to identify the moderating role of consortium support between resilience and firm performance. Addressing to RQ3, we argue that firms belonging to a consortium exhibit more resilience to the adversities and uncertainties, leading to the better performance. Four, this paper finds variation in the level of resilience, barriers and risk exposures within SMEs participants and the two important factors causing this variation: SMEs size and node location in the supply chain. The results show that small sized upstream firms are more vulnerable to disruptions and barriers and less resilient. Seventh, this paper is among the few that holistically and empirically analyses divergent sources of risks into three distinct categories: internal to the firm; internal to the supply chain; and external to supply chain. Our findings establish that most of the risk sources faced by these SMEs are internal to the supply chain (63% in this case). This clearly implies that risks within a network are interconnected, where a disturbance at a single node potentially extends through the supply chain and impact other firms, thus requiring the high level of visibility and collaboration among the partners. In doing so, the paper also addresses RQ4. Eight, by adopting a whole of the chain approach, this paper responds to the repeated calls in literature for expanding analytical unit beyond dyadic relationships (Klein and Rai 2009; Kembro and Näslund 2014). As such, this paper extends the research on resilience from the specific organisational and buyer-supplier relationships into a more complex supply chain. Nine, our framework establishes that SCR can safeguard performance only when firms holistically identify enablers, barriers and risks and level of enablers exceeds the barriers and risks.

The sampling, geographical and cultural limitations suggest special cautions in extrapolating the findings of this study. Notwithstanding, this study opens up new avenues for future research. Specifically, the proposed framework (Figure 1) and propositions need to be tested through a quantitative research. Also, our proposition SCR as a second-order reflective construct needs to be validated thorough quantitative research. Given the scarcity of research models on barriers to overcome resilience, future research should explore the role of resilience culture to thrive in a turbulent business environment. While this study investigated the consortium support in citrus industry in Australia, the moderating role of the consortium support in other industries, large organisations and other countries needs to be explored further in a future study. This paper explores a range of enablers and barriers to building resilience in SMEs, which can be tested through a large-scale quantitative analysis on a supply chain network. A future research can collect data from the entire supply chain, the data can be grouped into various categories and tested using multivariate data analysis advised by Hair (2010). Further, the risks such as climatic risks and transportation risks are common and may also exist in enterprises with various scales (e.g. large organisations in the non-perishable industry); therefore, we suggest a new empirical study to validate the findings of our proposed scheme for those enterprises.

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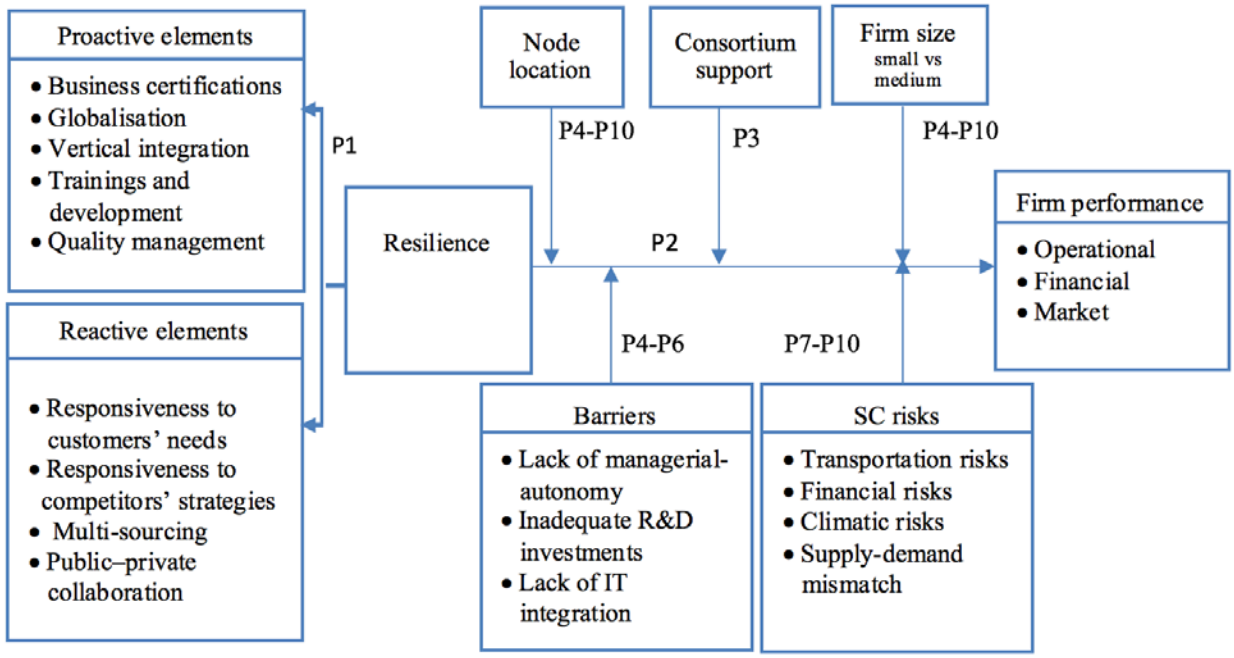


Figure 1. A framework to build a resilient supply chain, particularly in SMEs of PPSCs

Appendix A. Interview participants' information

Codes	Firm type	Respondents' position	Firm size
Firm 1	Producer	Chairman producers' association	Small
Firm 2	Producer	Farm Manager	Small
Firms 3 to 7	Producer	Owner-manager	Small
Firms 8 & 9	Producer	Farm Manager	Small
Firms 10 to 13	Packer	General Manager	Small
Firm 14	Packer	Plant Manager	Small
Firms 15 & 16	Wholesaler	Operations Manager	Medium
Firms 17 & 18	Wholesaler	Owner-manager	Small
Firm 19	Retailer (supermarket)	Operations manager	Medium
Firm 20	Retailer (supermarket)	Sales Manager	Medium
Firm 21	Retailer (supermarket)	Sales Manager	Small
Firm 22	Greengrocer	Owner-manager	Medium
Firm 23	Greengrocer	Owner-manager	Small
Firm 24	Processor	Managing Director	Medium
Firm 25	Processor (juices and jams manufacturer)	Operations Manager	Medium
Firm 26	Processor (juices and jams manufacturer)	CEO	Medium
Firm 27	Transporter	General Manger	Medium
Firm 28	Industry Association	Marketing Manager	Medium
Firm 29	Department of Agriculture	Research Officer	Medium
Firm 30	Consultancy firm	CEO	Small

Table 1. An overview of the existing literature

Author (year)	Risk classifications	Focus of study
Ho et al. (2015)	Macro and micro risks	General
Samvedi, Jain, and Chan (2013)	Supply side, demand side, process and environmental risks.	Textile and steel industry
Christopher et al. (2011)	Environmental risks, supply side risks, demand side risks, process and control risks.	Multiple industries excluding PPSC
Lockamy and McCormack (2010)	External risks, operational risks, and network risks.	Automotive industry
Rao and Goldsby (2009)	Organisational risks, industry risks, environmental risks, problem-specific risks and decision-makers risks.	General
Manuj and Mentzer (2008a)	Supply risks, demand risks, security risks, macro-risks, policy risks, competitive risks and resources risks.	General
Wagner and Bode (2008)	Demand side risks, supply side risks, regulatory, legal and bureaucratic risks, infrastructure risks and catastrophic risks.	Automotive industry
Ritchie and Brindley (2007)	External environment, industry specific, supply chain configuration, partner specific and node specific risks.	Multiple industries excluding PPSC
Tang (2006a)	Disruption risks and operational risks.	General
Kleindorfer and Saad (2005)	Operational risks and disruption risks.	General
Cavinato (2004)	Physical risks, financial risks, relational risks, informational risks and innovation risks.	General
Chopra and Sodhi (2004)	Delivery delays (transportation), forecast, intellectual property, receivable, procurement, inventory and capacity.	General
Jüttner, Peck, and Christopher (2003)	Environmental risks, organisational risks and network-related risks.	General

Table 2. Transportation risks

		Producer	Packer	Wholesaler	Processor	Retailer
		Percentage of respondents impacted				
Temperature fluctuations	Internal to SC	45	60	75	-	20
Packaging material quality	Internal to SC	55	80	50	33	40
Delivery delays	Internal to SC	67	80	75	33	20
Natural disasters	External to SC	45	80	75	33	20

SC = Supply chain

Table 3**.** Financial risks

		Producer	Packer	Wholesaler	Processor	Retailer
		Percentage of respondents impacted				
Shortage of skilled labour	External to SC	88	80	10	50	40
High labour cost	Internal to firm	100	100	75	80	75
Credit defaults	Internal to SC	55	60	25	40	-
Delays in payment	Internal to SC	67	80	50	30	-

Table 4. Climatic risks

		Producer	Packer	Wholesaler	Processor	Retailer
		Percentage of respondents impacted				
Floods, fires	External to SC	100	60	50	33	20
Droughts	External to SC	67	40	25	15	25
Diseases outbreak	External to SC	88	20	25	25	20
Sunburn	External to SC	77	20	25	25	25

Table 5. Supply-demand mismatch

		Producer	Packer	Wholesaler	Processor	Retailer
		Percentage of respondents impacted				
Forecasting errors	Internal to SC	77	60	25	33	20
Opportunism	Internal to SC	100	80	50	33	20
Information asymmetry	Internal to SC	100	80	25	20	40
Demand fluctuations	Internal to SC	88	60	50	20	-

Note: Tables 2 to 5 Source: Authors' own content analysis of interviews using NVivo10

Building resilience in SMEs of perishable product supply chains: enablers, barriers and risks

7 Notes on contributors



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