An Empirical Investigation of the Impact of Cloud Computing on Container Supply Chain Agility: A Dynamic Capability Theory Perspective

by

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Submitted in fulfilment of the requirements for the degree of Master of Philosophy

January 2020

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The research associated with this thesis abides by the National Statement on Ethical Conduct in Human Research of Australia and is approved (Ref: H0018189) by the Social Sciences and Human Research Ethics Committee of the University.

Ali Shakourloo, 4rd February 2020

ACKNOWLEDGEMENTS

This dissertation could not have been completed without the encouragement and support of people, to whom I would like to express my thanks.

First and foremost, I am highly indebted to my primary supervisor Dr G. Reza Emad for his support, inspiration and guidance through the research process. This thesis would not have been completed without his generous support, advice and encouragement. I also acknowledged my co-supervisor Associate Professor Peggy Shu-Ling Chen for her feedback and understanding. Her help and insightful advice were incomparable.

I am immensely grateful to Director of the National Centre for Ports and Shipping Dr Prashant Bhaskar and my Graduate Research Coordinator Dr Behrouz Enshaei and all scholars in Connell building specifically my colleagues Ali Alavi, Arman Marhamati, Eduardo Batalha De Magalhaes, Douglas Potts and Mohammadali Abedini Sanigy for extending their kind supports during my research process.

I am grateful to my wonderful wife, Sahar, for her patience, understanding and sacrificing herself throughout my study period. I would never be able to repay her love and support.

ABSTRACT

A container supply chain is an integrated network of companies which carry out different operations such as transport, loading, discharging and transhipment of the containers. Companies within the container supply chain system need diverse capabilities to perform container operations efficiently. One of these capabilities is managing the ever-changing, unexpected and unpredictable container supply chain environment. Agility is a capability that can enable organisations to manage these environmental changes.

Based on dynamic capability theory, agility is the ability of sensing, seizing and transforming. Sensing is organisations' capability in identifying opportunities and threats in their environment. Seizing is the capability of organisations in implementing their works in a way to preserve responsiveness and transforming is the capability of organisations to reconfigure their resources to adapt to change and achieve agility. Agility can be developed by boosting these three areas of capabilities and utilising different enablers such as information technology.

Information technology is an important agility enabler, which can facilitate agility in different aspects of the system, such as sensing market changes and responding accordingly. Employing agility has encouraged organisations to select and replace traditional information technologies with new agility-enabling information technology innovations. However, in extreme competition, restricted budget and an unstable economy, investment in information technology may not necessarily lead to an improvement in agility unless it is cost-efficient and flexible. Cloud computing is an IT opportunity that has provided access to a modern and powerful information system at a low cost. Cloud computing is a type of technology that provides on-demand hardware

and software services to clients throughout a network in a self-service mode independent from their location and devices.

To date, there is no empirical research which has studied cloud-enabled capabilities, supply chain agility and the relationship between these two constructs in the context of the container supply chain. Understanding cloud-enabled capabilities and its impact on container supply chain agility are critical to the improvement of the container supply chain capability in addressing the changing environment. To cover this gap, the main objectives of the current thesis was to: 1) exploring container supply chain agility dimensions from dynamic capability theory perspective 2) examining created capabilities via cloud computing application 3) investigating the impact of cloud-enabled capabilities on container supply chain agility dimensions.

A quantitative approach utilising a web-survey instrument was adopted to conduct this research. Data were collected from 737 most influential Australian organisations which were active in the container supply chain, including freight forwarders, container logistics companies, shipping companies/agencies and port service providers.

After data collection, the exploratory factor analysis (EFA) was applied to implement the model modification. Thereafter, convergent and discriminant validities of constructs were assessed by employing suitable statistical methods. In the next stage, confirmatory factor analysis (CFA) was applied to evaluate and improve model fit criteria. Next, structural equation modelling (SEM) was employed to explore the relationships between cloud-enabled capabilities and container supply chain agility dimensions. The key findings are:

- Cloud computing application can create two capabilities of integration and flexibility in the context of the container supply chain.

- Information sharing is the most crucial factor that can create cloud integration among organisations in the container supply chain network.
- Access to cloud computing service providers with a low cost has a significant impact on improving cloud flexibility.
- Container supply chain agility mainly contains two dimensions of transforming and proactive sensing, which the last one is a combination of sensing and seizing capabilities.
- The most powerful capability to improve proactive sensing is the capability of organisations in setting an optimal capacity in a way that makes them able to respond to the sudden changes in customers' needs.
- Organisations' capability to cooperate with new partners to achieve operational efficiency is the most influential factor that can improve transforming capability in the container supply chain context.
- Created integration and flexibility through cloud computing application in organisations within the container supply chain can help to improve proactive sensing capability as one of the container supply chain agility dimensions.

Also, contributions of this research and possible managerial usages are:

- A valid and reliable instrument was developed to measure cloud-enabled capabilities in the container supply chain context through statistical processes of exploratory and confirmatory factor analysis.
- An instrument to measure supply chain agility was provided in the context of the container supply chain based on dynamic capability theory.
- The influence mechanism of cloud computing on container supply chain agility was discovered.

- A richer and more in-depth understanding of dynamic capability theory was provided through implementing an empirical study.
- A framework was presented to provide a better understanding of areas that cloud computing can be leveraged to enhance container supply chain agility.
- The areas that managers can focus on improving their supply chain agility were highlighted.
- Useful guidelines were provided to aid the better decision making about cloud computing adoption based on agility.

The findings of this research indicate that cloud computing as a tangible resource can create integration and flexibility in organisations which are active in the container supply chain, and these two capabilities have a positive impact on supply chain agility.

GLOSSARY

AMC: Australian Maritime College

AMOS: Analysis of a Moment Structures

ASC: Agile Supply Chain

AUD: Australian Dollar

AVE: Average Variance Extracted

CFI: Comparative Fit Index

CFA: Confirmatory Factor Analysis

CR: Composite Reliability

CSC: Container Supply Chain

CSCA: Container Supply Chain Agility

DC: Dynamic Capability

EBS: Enterprise Business System

EFA: Exploratory Factor Analysis

EM: Expectation Maximisation

ERP: Enterprise Resource Planning

FA: Factor Analysis

GDP: Gross Domestic Product

GFI: Goodness of Fit Index

HREC: Human Research Ethics Committee Network

IaaS: Infrastructure as a Service

IoT: Internet of Things

IT: Information Technology

NFI: Norm Fit Index

NS: National Statement

NVOCC: Non-vessel Operating Common Carrier

PaaS: Platform as a Service

PCA: Principal Component analysis

RFID: Radio-frequency Identification

RMR: Root Mean Square Residual

RMSEA: Root Mean Square Error of Approximation

SaaS: Software as a Service

SC: Supply Chain

SCA: Supply Chain Agility

SCM: Supply Chain Management

SEM: Structural Equation Modelling

SPSS: Statistical Package for the Social Science

TEU: Twenty-foot Equivalent Unit

UTAS: University of Tasmania

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Chapter One: Introduction

1.1 Overview

Today's business environments are changing quickly, and organisations need to adjust to these changes effectively. Thus, managers need the capability to equip their organisations against these turbulent environments. Agility is defined as the capability that can empower organisations against environmental changes. Among agility enablers, information technology (IT) has a significant place. Cloud computing is a specific type of IT that its application can enhance agility in SC's activities of organisations. Recently cloud computing technology has been utilised by some organisations involved in container logistics in Australia. Cloud computing helps these organisations to act more agile in their activities related to container logistics. Considering the significance of agility and cloud computing technology, this research intended to explore the impact of cloud computing on the container supply chain agility in Australia, and this chapter is organised as follows.

In the followings section 1.2 provides a brief explanation of research backgrounds, section 1.3 discusses the container supply chain, section 1.4 explores the significance of the container supply chain in Australia, section 1.6 discusses the role of cloud computing application in empowering the container supply chain, section 1.7 elaborates the existing gap in the literature and motivations for implementing this study, section 1.8 explains proposed research questions and the research objectives, section 1.9 examines the contributions of this research, and section 1.10 provides the structure of the thesis.

1.2 Research background

A supply chain (SC) is defined as a network of facilities in which different operations including procuring materials, transforming these materials into finished products, and distributing the products to customers are carried out (Hugos 2018). SCs' environment is becoming more complex, and organisations confront growing challenges such as reduced product life cycle, increased market volatility, unforeseeable demand, and unstable supplies (Wang & Cruz 2018). Moreover, customers demand better products and services in the shortest possible time and at a low price. As a result, the competition was shifted from organisational to SC orientation (Wang & Cruz 2018).

Inter-organisational relationships are the cornerstone of the SC orientation as well as supply chain management (SCM) (Dhaigude & Kapoor 2017). Due to the necessity of these relationships, in the early 1980s, the SC concept was introduced to address severe competition among companies (Stevens & Johnson 2016). Over time, because of the growing need for close cooperation among corporations, managers realised that they must integrate their operations with their partners rather than managing them separately. As a result, the concept of a linear SC was introduced (Govindan, Fattahi & Keyvanshokooh 2017). Later, due to the redundancy of resources and relationships between SC's members, researchers changed their views from defining a SC as a linear flow of materials to a network of activities and began to explore SCs beyond dyadic relationships (Carter, Rogers & Choi 2015).

Today's SCs are complex networks consisting of organisations with complex interactions between them (Dittfeld, Scholten & Van Donk 2018; Hearnshaw & Wilson 2013). This complexity can cause unexpected situations for SCs in different areas such as demand. Thus, SCs should be able to manage these unpredictable situations (Braunscheidel & Suresh 2018; Giannakis & Louis 2016). To cope with an ever-changing environment, organisations need a capability to make them able to adapt to changes and provide quick response throughout the entire SC (Martinez-Sanchez & Lahoz-Leo 2018). Agility is an important capability that can enable SCs to respond to environmental changes. Agility was defined as SC's capability to exploit its resources in responding to environmental changes in a timely and flexible manner (Sangari, Razmi & Zolfaghari 2015). The concept of agility can be traced back to manufacturing and is recognised as an influential capability that can empower SCM against a turbulent environment when responding to customers' needs (Sharma et al. 2017).

With the emergence of agile manufacturing in the 1990s, researchers acknowledged the significance of agility in dealing with changing environments, and this concept was disseminated to SC (Siddhartha & Sachan 2016). Compared to an individual organisation that some of the processes are rendered invisible due to competitive priorities, SC provides a more transparent platform for exploring and understanding agility (Fayezi, Zutshi & O'Loughlin 2017). Moreover, businesses compete within the context of SCs rather than a single organisation (Wang & Cruz 2018). The benefits of agility are identified in a variety of SC domains such as performance (Sabegh et al. 2019). For example, supply chain agility (SCA) has a positive impact on customer service effectiveness and cost efficiency, and it can improve the financial performance of organisations throughout a SC in areas such as return on assets, market share and profit margins (DeGroote & Marx 2013; Gligor, Esmark & Holcomb 2015). Moreover, SCA can enhance operational performance via improving customer service and mass customisation abilities (Um 2017). Therefore, SCA is the capability that can enable the SC to respond to environmental changes and can ultimately lead to higher levels of performance (Martinez-Sanchez & Lahoz-Leo 2018).

The establishment of SCA is a challenging task and depends on different factors such as virtuality which means a SC should be based on information rather than inventory (Gligor, Holcomb & Stank 2013). Moreover, coordination and network-based integration are among factors that can help to achieve SCA (Sangari, Razmi & Zolfaghari 2015; Siddhartha & Sachan 2016).

The role of information in improving all the mentioned factors is an undeniable fact. Sharing information can improve cooperation between alliances in a SC network (Huang, Ho & Fang 2017), and it can also lead to more integration in SC's processes (Stevens & Johnson 2016). Moreover, without information transactions, establishing a virtual SC is not possible (Ross 2016). Hence, the significance of IT in facilitating information exchange capabilities and establishing SCA is quite evident. IT can enable organisations throughout the SC to sense changes in the market and improve the response speed to market changes (Ghasemaghaei, Hassanein & Turel 2017; Liao, Hong & Rao 2010). Improving agility has encouraged organisations to select and replace traditional ITs with new agility-enabling applications (Queiroz et al. 2018). Furthermore, organisations should reinvent themselves to respond to environmental changes, and this improvement can be made in the area of IT.

Selecting, adapting and using suitable IT tools have been challenging issues in SCM area (Jede & Teuteberg 2015) where organisations invest a large number of resources in implementing an IT-enabled SC (Liu et al. 2013). However, investment in the IT may not necessarily lead to the improvement in agility (Lu & Ramamurthy 2011) and extreme competition, restricted IT budget, and unstable economy force organisations to explore cost-efficient and flexible solutions for the IT infrastructure (Luo et al. 2018). One of these solutions is to apply an IT system that is aligned with an organisation's strategies to achieve needed IT capabilities such as reconfiguration capability to improve agility (Gong et al. 2017). IT reconfiguration refers to an organisation's ability to recombine IT resources for implementing its business purposes (Rai & Tang 2010). Various ITs exist in the market and organisations should select the most suitable IT based on their requirements, and ITs' features.

Among various ITs, cloud computing is an opportunity that has provided the advantage of having access to a modern and powerful information system at a low cost (Makhlouf & Allal-Chérif 2019). Cloud computing makes it possible to provide on-demand hardware and software services to clients throughout a network in a self-service mode independent from location and devices that use the cloud computing (Ali, Warren & Mathiassen 2017). Such an on-demand service provides this opportunity to organisations that use this technology to take advantage of new developments in IT at an affordable cost (Sultan 2011). Moreover, cloud computing includes specific features such as elasticity, scalability, shared resources, pay per use and a shared environment which can provide more economical and flexible IT solutions and enable organisations to deal with a changing environment (Liu et al. 2018). Cloud computing is not just about cheap computing; it is also about the application of rapid and scalable computational tools to achieve a more agile business (Marston et al. 2011). During the last decade, cloud computing has been applied by many organisations involved in container transport.

1.3 Container supply chain

The introduction of containers in the mid-1950s was a significant innovation in transport since it led to more efficiency by allowing automation in cargo handling, facilitating the connection between sea transport and intermodal inland transport, and reducing spoilage (Coşar & Demir 2018). After the introduction of the container, the container supply chain (CSC) was emerged and became an important aspect of a traditional SC. It was defined as an integrated system, including different processes such as transportation, packing, container storage, container loading and discharging, container transhipment and container unpacking. The CSC is essentially a logistics service SC (He, Huang & Chang 2015). Containerisation has facilitated organising commodities in SCs and assists to broaden the geographical scale of businesses (Hu et al. 2010).

As a consequence, global container trade accounts for 60 per cent of global seaborne trade and more than 1.7 billion tones of cargo that is loaded in more than 180 million twenty-foot equivalent units (TEUs) and carried by sea (Yang et al. 2018). Different stakeholders such as shipping company, transport company, port, freight forwarder, shipping agency, non-vessel operating common carrier (NVOCC) and custom play a role in container carriage from its origin to a destination. Therefore, today's CSCs are networks of parties which create value for customers by implementing tasks related to container operations (Fransoo & Lee 2013). Due to the complexity of the container transport industry (Caschili & Medda 2012), organisations throughout the CSC should be able to deal with complexity, and the agility may help them to achieve such a goal. Establishing agility was identified as an essential prerequisite of an efficient CSC (Charłampowicz 2018). Agility has been studied in different areas of the CSC. For example, agility was considered as one of the most significant success measures of port performance in the CSC (Panayides & Song 2013). CSC in Australia has an important place.

1.4 Container supply chains and Australia

As a result of globalisation, cheap and efficient transport is a necessity. Companies set up their manufacturing plants in the countries where production costs are low. For example, China as a developing country plays a significant role as a manufacturing hinterland. It imports raw materials and exports manufactured containerised products. On the other side, developed countries such as Australia are good consumption markets for containerised cargoes (Suk-Fung 2012). Australia is an island country, and its main exports and imports rely on seaborne transport, where a high percentage of transported cargo is containerised (Suk-Fung, Sun & Bhattacharjya 2013). Thus, parts of logistics' costs pertain to container operations. In Australia, organisations operate in a competitive environment with a low-profit margin and downward pressures on prices (Pateman, Cahoon & Chen 2016). It means they seek to perform their logistics operations efficiently at a low cost.

Moreover, Australia is an integral part of the global CSC (Meng & Wang 2011) and has been experiencing growth in the traffic of containers (WB 2019). It is also suggested that improving logistics performance in a country can increase international trades and result in competitive advantage (Ekici, Kabak & Ülengin 2016). Different parties are engaged in providing services related to the container operations in Australia, and cloud computing is an important technology which is vastly applied by Australian companies. In the next section, some crucial areas that cloud computing can be applied in the CSC are discussed.

1.5 Cloud computing technology

Organisations need to access various resources that are virtualised and geographically dispersed (Novais, Maqueira & Ortiz-Bas 2019). Moreover, organisations require to achieve information from the external environment (Cegielski et al. 2012). Both resources and information can be accessed on an on-demand basis by applying internet-based technologies such as web in the new business IT provisioning models (Novais, Maqueira & Ortiz-Bas 2019). Cloud computing facilitates information sharing and accessibility to resources by providing three different types of service models including platform as a service (PaaS), software as service (SaaS), and infrastructure as a service (IaaS) (Patidar, Rane & Jain 2012). IaaS involves IT infrastructure that can be used in issues such as storing and sharing data; PaaS associates with providing a complete platform for developing an IT application, and SaaS entails applying online software in an on-demand service basis. These service models can be organised in four categories including public cloud; community cloud; private cloud, and hybrid cloud. The private cloud is for exclusive use by a single organisation; the community cloud is a shared cloud system among a group of business partners that have shared concerns; the public cloud is for open use by the general public; and the hybrid cloud is a combination of public and private clouds (Mell & Grance 2011). Different categories of cloud computing services are used by organisations which are active in the CSC (Novais, Maqueira & Ortiz-Bas 2019; Randall & Ulrich 2001; Ulrich & Yeung 2019).

1.6 Application of cloud computing in container supply chain

Cloud computing can revolutionise logistics. It can provide a collaborative environment and help to build cross-border e-logistics services among all users and increase agility by enabling reliable and immediate information sharing possibility (Dellios & Papanikas 2014). Cloud computing services play a significant role in different areas of logistics (Joszczuk–Januszewska 2012). For example, it can help to develop a unified platform which is a single entrance point for all data and documents (Joszczuk–Januszewska 2012). The application of cloud computing is not limited to documentation, specifically with the growth of container traffic, logistics have largely benefited from digital technologies, and footprints of cloud computing can be observed in constructing digital systems (Fruth & Teuteberg 2017).

Cloud computing can be applied in different parts of the CSC. For example, in a port, it can help to implement cargo management services and provide e-documentation and e-information systems to perform the container operations more efficiently (Dellios & Polemi 2012). It can also be used to run an autonomous control system in the logistics of containers (Schuldt et al. 2010). Further, cloud computing technology is vastly applied by organisations which are active in the CSC inside Australia (Gong, Morandini & Sinnott 2017; Kozhirbayev & Sinnott 2017). Hence, considering the application of cloud computing by different members of the CSC network in various activities, and the significance of agility for organisations engaged in the CSC, it is a good opportunity to study the impact of cloud computing on CSCA. In the next section, the motivations for conducting this research are explained.

1.7 The motivation for this research

This section addresses the existing gaps in the literature that motivated the researcher to conduct this study. The business world is complex, and the competition is between SCs rather than organisations (Luo, Shi & Venkatesh 2018). This complexity means organisations face with the main challenge of an uncertain environment (Probst & Bassi 2017). To resolve this main challenge, companies throughout the SC need to utilise their resources and build some capabilities such as agility. Agility is an important and expanding topic, and more research needs to study SCA (Braunscheidel & Suresh 2018, Swanson et al. 2018). IT has a great impact on improving SCA, and cloud computing is a type of IT that has been adopted by many organisations (Safvati, Sharzehei & Mesbahi 2017; Senarathna 2016; Yigitbasioglu 2015). Cloud computing can improve different aspects of agility (Liu et al. 2018), since it enables organisations to exploit on-demand IT services with the latest technological innovation and reduces the time needed to supply IT resources (Son et al. 2014).

In the realm of agility, there are two groups of studies in the literature. Some scholars studied SCA dimensions (Gligor, Holcomb & Stank 2013; Li, Goldsby & Holsapple 2009). Also, some researchers focused on enablers of SCA (Agarwal, Shankar & Tiwari 2007; Blome, Schoenherr & Rexhausen 2013; Kumar Sharma & Bhat 2014; Sangari, Razmi & Zolfaghari 2015). Cloud computing technology as a type of IT can play a role as a SCA enabler. Also, agility is a dynamic capability (DC) (Teece, Peteraf & Leih 2016, Teece, 2007), and three dimensions of sensing, seizing and transforming were determined for DCs (Teece, DJ 2007). Cloud computing may improve DC's dimensions and lead to SCA. However, to the best of author's knowledge, there is a lack of research to study the impact of cloud computing on SCA from the lens of DC theory, Figure 1-1 illustrates the research gap. Furthermore, this research is the first empirical study that investigates the impact of cloud computing on CSCA. Hence, some questions are proposed to fill existing gaps; they are discussed in the next section.

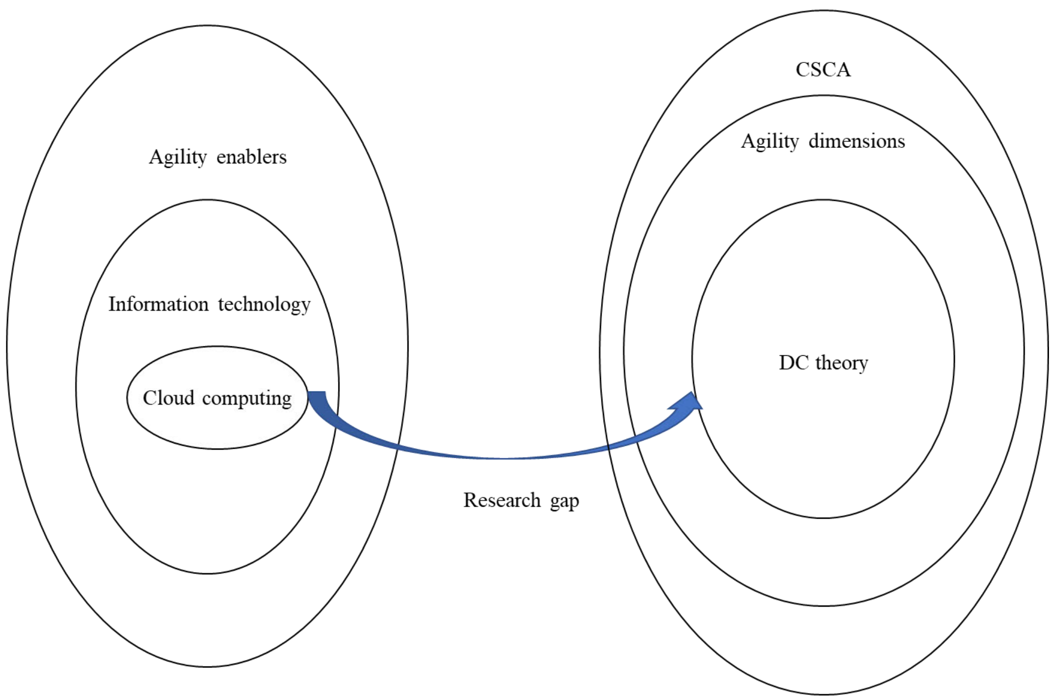


Figure 1-1: The research's gap illustration

1.8 Research questions and objectives

Compared with traditional ITs, cloud computing encompasses some significant characteristics. These are controlled interface, location independence, sourcing independence, ubiquitous access, virtual business environment, addressability, traceability, and rapid elasticity (Iyer & Henderson 2010; Safvati, Sharzehei & Mesbahi 2017). These features may impact on organisations within a CSC and improve CSCA. Thus, the primary research question (PRQ) of this study is:

PRQ: How does cloud computing impact CSCA?

The objective of this question is to explore the impact of cloud computing on the CSCA and to understand which CSCA dimension is impacted more by cloud computing application. To achieve this objective and answer the primary research question, it is also necessary to determine CSCA constructs (dimensions). Therefore, the first subsidiary research question (SRQ1) is:

SRQ1: What are the CSCA dimensions?

The objective of this subsidiary research question is to examine the dimensions of the CSCA. Answering this question can also help to define the CSCA more accurately. It may also assist in establishing a measurement system to measure the CSCA more accurately. To answer the primary research question, it is also crucial to explore capabilities that cloud computing application can create in organisations; therefore, the second subsidiary research question (SRQ2) is:

SRQ2: What are the capabilities that cloud computing application can create in organisations within the CSC?

The objective of this subsidiary question is exploring the capabilities that cloud computing utilisation can establish in organisations within the CSC. Thus, answering this question can determine to what extent the application of cloud computing can lead to a more capable organisation. Answering SRQ1 and SRQ2 can pave the way to answer the third subsidiary research question (SRQ3).

SRQ3: What is the relationship between achieved capabilities through cloud computing application and CSCA dimensions?

The objective of this subsidiary question is to examine the relationship between the capabilities that cloud computing application can create and CSCA dimensions. By answering the thesis's questions, the main research question is addressed. This research also has some contributions which are discussed in the next section.

1.9 Contributions of this study

This research makes contributions in two areas, namely contributions to the SCM literature and managerial contributions. While past researchers have highlighted the impact of cloud computing on different aspects of organisational agility such as partnering agility, this research develops knowledge about the CSCA concerning cloud computing as an enabler. Furthermore, this research explores new agility measurement criteria which have not been investigated.

Moreover, according to DC theory, organisations integrate and reconfigure their resources to respond to environmental changes (Teece, Peteraf & Leih 2016). All organisations can have the same access to cloud computing technology; therefore, the strategic value of cloud computing does not rely on whether the service is used or not, but in how the service is used (Luo et al. 2018). Cloud computing as a technology is a tangible resource, while SCA and created capabilities via cloud computing application are intangible resources of an organisation. This research intends to clarify how the configuration of tangible and intangible resources can establish SCA as a DC in organisations. Therefore, the results of this research can be used as empirical evidence to explain the DC theory in the CSC context. Moreover, agility is considered as a DC (Blome, Schoenherr & Rexhausen 2013), and this research intends to explain how agility can be improved considering its constitutive elements.

In terms of possible managerial usage, the results of this research provide empirical evidence about the impact of cloud computing on the CSCA. Hence, it can help managers to understand whether the adoption of cloud computing affects the SCA. Moreover, organisations which have not adopted this technology and intend to improve their SCA can use the results of this research to decide whether cloud computing is useful to be adopted or not. Furthermore, this research can help organisations throughout the CSC to measure their SCA and gain knowledge about their weaknesses in this area. Thus, it can provide the opportunity to recognise which CSCA dimension needs to be boosted.

1.10 Thesis structure

This thesis is organised into six chapters and follows a conventional structure. The current chapter is the introduction and explains the research motivations, questions, objectives and contributions. Chapter Two discusses CSC, agility and cloud computing. In this chapter, the literature of SCA, cloud computing and the impact of cloud computing on SCA are explored. Chapter Three introduces the research methodology and explains the types of data that are used for this study, the data collection process, sampling techniques, and sample size. In Chapter Four, data analysis is discussed. Chapter Five elaborates summaries of the findings resulted from the analysed data. Chapter Six concludes the study and discusses the limitation of research and provides recommendations for future research.

Chapter Two: Literature Review

2.1 Overview

This study aims to explore the impact of cloud computing technology on CSCA. Achieving this goal needs to review the literature about related areas. Thus, firstly, CSC is explained. Then, the concept of agility is discussed to achieve a better understanding of SCA and organisational agility. The SCA is a multidimensional capability, and different constituents construct this capability. Hence, in the next step, these constituents are discussed in the context of the CSC. Additionally, the SCA has some enablers and studying these enablers can provide a better understanding of the SCA. Thus, the literature on the most important SCA enablers such as IT is explored. In this research cloud computing technology is a specific IT infrastructure with unique features, which can act as an enabler of the SCA. Therefore, in the remainder of this chapter, cloud computing technology and its application in the CSC are examined. Then the conceptual framework of this research and proposed hypotheses are explained, and this chapter is concluded by providing a summary. Also, this chapter is organised as follows, and Figure 2-1 illustrates some important headlines and flow of literature.

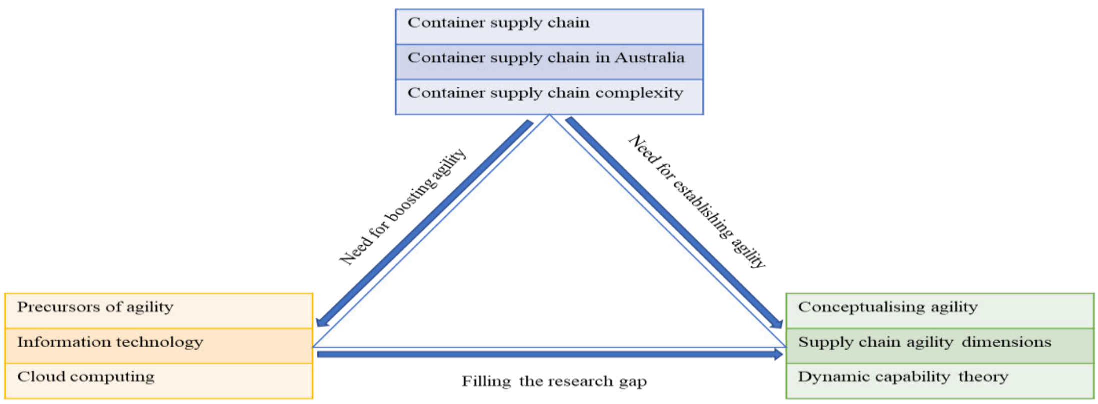


Figure 2-1: Some important headlines and literature flow

Sections 2.2 to 2.5 discuss containerisation and the CSC; section 2.6 discusses agility; section 2.7 explores SCA dimensions; section 2.8 discusses the DC theory; section 2.9 examines SCA enablers (precursors); section 2.10 discovers cloud computing technology; section 2.11 provides the conceptual framework and proposed hypotheses of this research; section 2.12 provides a summary.

2.2 Containerisation and its significance

Before the introduction of a container, loading and discharging cargo of ships were labour intensive, and goods transport was expensive (Levinson 2016). Containerisation changed the industries' economics as drastically as the invention of the steam machine changed sailing a century ago (Donovan & Bonney 2006). The use of container triggered significant changes in the shipping industry and associated transport systems (Andrews 2016). One of the critical reasons that the shipping industry moved towards using the container was its advantages. Containers are made in standard sizes, and it allows organisations around the world to design associated technologies based on this standard. The standardisation of the container has resulted in the standardisation of technology and automation in the transport process (Lee & Song 2017). The container can also protect the cargo from damage and theft and increase the security of goods in the transport process (Parker 2013).

Other benefits of the containerisation are removing the bottlenecks in freight transport processes in crucial sea-land interfaces, improving the efficiency and speed of cargo handling, pressuring ports and inland transport companies to develop the capacity of their container distribution (Bernhofen, El-Sahli & Kneller 2016). Apart from the mentioned benefits, containerisation has also facilitated SCs efficiency by utilising intermodal transport. In the intermodal transport, the same container with the same cargo can be carried via different transport modes during its journey from an origin to a destination (Neise 2018). Moreover, this intermodalism contributes to the digitalisation of the logistics process throughout SCs (Levinson 2016), which has improved integration and impacted SCs' performance (Sklyar et al. 2019). Australia also has benefited from containerisation, and its transport industry relies on the container.

Australia is an island economy that strongly benefits from its closeness to markets such as China and Japan, the destination of 35% and 14% of exports of Australian commodities are respectively China and Japan (OEC 2019). In 2017, Australia exported 234B AUD and imported 199B AUD (OEC 2019). In Australia, the substantial part of trades is seaborne. Due to growth in Australian international trades and population, the volume of containers handled by seaports has risen over past decades (Ghaderi, Cahoon & Nguyen 2016) and container transport is implemented through CSC which is a network of companies across the world, and parts of them are located in Australia.

2.3 Container supply chain

Understanding the CSC needs knowing about the container cycle. In sea transport; containers move through a chain based on a hub-and-spoke system. This system was a significant development in the container shipping industry. In this system, larger container ships are used to transport a container between large hubs, while smaller vessels (feeder vessel) are used to tranship the container from hubs to a destination port and vice versa (Fransoo & Lee 2013). However, it should be considered that it is just one part of the container transport process.

When there is a demand in exporting products from an origin to a destination, the demand for a container may occur. A request for an empty container is sent to a provider by a shipper. The provider can be a freight forwarder company, a shipping line, or a non-vessel operating common carrier (NVOCC). After confirmation of the request, the required empty container is delivered to a predefined place. Then, it is stuffed and carried to the closest spoke port to be delivered to a shipping line. In the next step, the shipping line tranships the container to a hub port, and an ocean container vessel carries the container to a hub port close to the destination. Then the container is transhipped to a possible nearest spoke port by a smaller container vessel. In the next stage, it is carried to the destination to be delivered to a consignee. After the container is unstuffed by the consignee, it is carried to the nearest depot. Figure 2-2 illustrates this cycle. In this cycle, a container is transported in a transport chain with a combination of at least two modes of transport. In this system, a container may be travelled by ocean-going vessel, inland waterway, rail, and road. In this system, different parties are engaged, and a high level of coordination is necessary to manage the container flow (Meng & Wang 2011). The container transport chain and intermodality are critical factors to define the CSC.

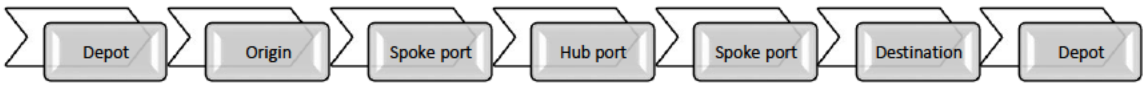


Figure 2-2: Container transport process

Source: Author

The CSC is an integrated network of companies which carry out different operations required to deliver a container from a shipper to a consignee. These operations include transport, container loading, container discharging and transhipment. The CSC is mainly a logistics service SC (Huang & Chang 2015), where different parties play various roles. Ocean carriers invest heavily on ships and container assets, and their ocean vessels are deployed on main shipping lines and serving hub ports. Feeder companies employ small ships to serve feeder ports which their capacities are not large enough to justify direct calls (Meng & Wang 2011). Port authority is another vital member of the CSC. The application of the hub-and-spoke system and development in container ship sizes resulted in the expansion of ports' hinterland. Container ports have an important position in the determination of container transport costs and are linkage among members of the CSC (Wang & Cullinane 2015). Apart from ports and shipping lines, freight forwarders have a pivotal position in the CSC. More than 80 per cent of container traffic in the global market is handled by ocean freight forwarders (Ho et al. 2017). The main tasks of freight forwarders are coordinating and organising the delivery of cargo from a shipper to a consignee. After a customer employs a freight forwarder, the freight forwarder may take charge of the entire transport process by itself or outsource parts of it (Bock 2010). Freight forwarders are also responsible for delivering containers timely. Thus, they constantly track the location of containers and coordinate other parties in the CSC (Pavlo, Svitlana & Ninel 2016). All abovementioned types of companies are also active in Australia as a part of the global CSC.

2.4 Container supply chain in Australia

Containerised seaborne trade has been growing at an approximate rate of 8.1 per cent annually in Australia. The containerised trade is expected to be a dominant form of business due to population growth and increasing globalisation (kemp et al. 2019a). The CSC network is a global SC where ports are points of connection between sea and land. Thus, parts of CSCs are extraterritorial, and parts of it have been extended across the country. For example, Figure 2-3 exhibits hub and feeder ports in the CSC network of

Asia-Europe-Oceania. In Australia, the main ports of Sydney, Melbourne, Brisbane, Adelaide and Fremantle are primary interfaces of sea and land. In Australia, ports play a vital role in the export and import of containers. According to the world bank report, the traffic of the container in Australian ports was 7,693,643 twenty-foot equivalent unit (TEU) in 2017 (WB 2019). Figure 2-4 illustrates the number of TEUs handled by Australian ports in wharf sides. To transport a container from a port hinterland to an inland place and vice versa from a point in an inland place to a port, intermodal transport is needed. Australia is a vast country, and the container transport is done by using main and secondary rail and road freight routs. Australian freight routes are depicted in Figure 2-5. The blue lines in the picture represent road fright routs, the black lines exhibit rail routes, and green lines illustrate secondary road routes.

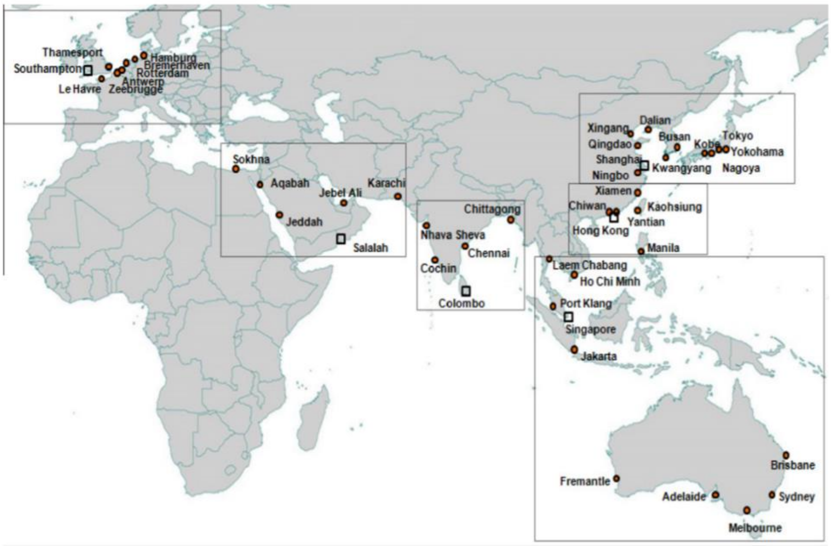


Figure 2-3:Asia- Europe-Oceania liner shipping network

Source: Meng & Wang (2011, p. 698)

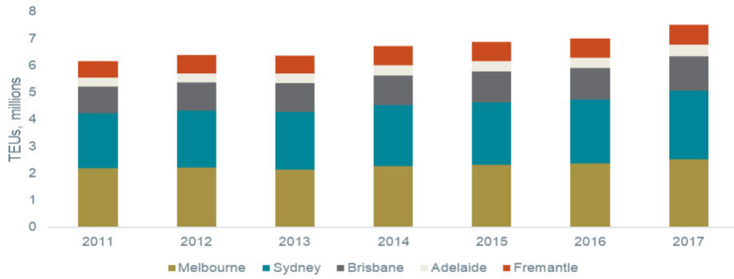


Figure 2-4: TEUs handled by Australian ports

Source: kemp et al. (2019b, p. 15)

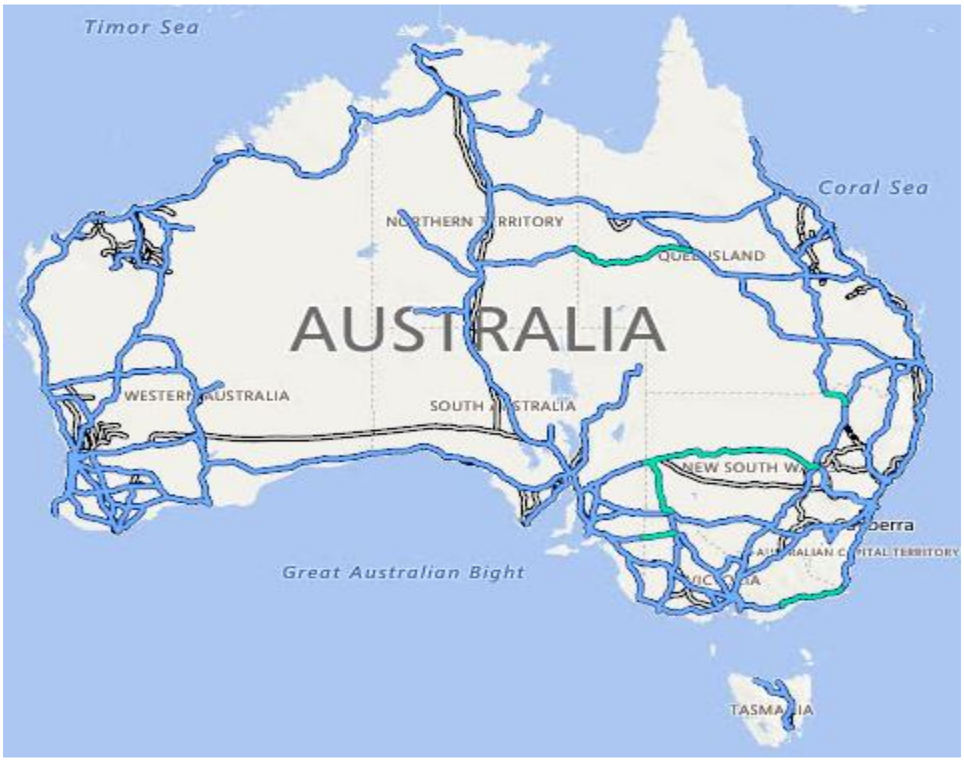


Figure 2-5: Australia freight routs

Source: Australian government website (2019)

The CSC is a global SC. It means that it is spread across a vast geographical area. Thus, a small change in a part of this large network can impact the whole network. Operation of a container throughout the CSC is associated with different issues such as container scheduling, stowage and terminal operation which make the CSC a complex network

(Cheng, Tahar & Ang 2010; Choi et al. 2012; Tierney, Pacino & Jensen 2014). Some of the main reasons for CSC complexity are discussed in the next section.

2.5 Container supply chain complexity

Reasons for complexity in the SC network are the existence of different nodes and multiple relationships between nodes (Cheng, Chen & Chen 2014; Hearnshaw & Wilson 2013). In the CSC, various stakeholders such as shipping company, transport company, port, freight forwarder, shipping agency, non-vessel operating common carrier (NVOCC) and custom play a role in container carriage from an origin to a destination. Also, the relationship between stakeholders can be in different ways. For example, a shipper may contract a third party to carry out container shipment; it may be a third or fourth-party logistics service provider. Also, a container terminal may contract with a liner company and in some cases with a non-vessel operating common carrier (NVOCC). This multiplicity of engaged parties and their dispersal across geography cause different challenging issues such as coordination, pricing, competition and capacity management (Fransoo & Lee 2013).

Additionally, the CSC network is dynamic, and members face challenges such as alliance formation and vertical integration which have impacted important issues such as port calling patterns and involvement of shipping lines (Notteboom et al. 2017). The range of existing problems and severe changes force organisations to think about managing different variabilities such as transit time and alleviate the negative impacts (Harrison & Fichtinger 2013). Although, because of the CSC complexity, just parts of existing uncertainty can be managed by adopting appropriate risk mitigation strategies (Teece, Peteraf & Leih 2016). Hence, the CSC environment is entirely unpredictable, and organisations should be able to react quickly to the changes. Also, competition has aggravated the condition and caused more ambiguity.

There is some evidence that shows fierce competition in the CSC environment. For example, some shipping lines mislead their competitors by sending wrong pricing signals (Lee & Song 2017), or shipping companies consolidate to reduce cost, improve service flexibility and surpass competitors (Crotti, Ferrari & Tei 2019; Panayides & Wiedmer 2011; Rau & Spinler 2017). This existing competition causes irregularity and hardship for organisations such as shipping agencies and freight forwarders, and consequently, necessities market-orientation (Tseng & Liao 2015). This competition will be even more intense in the future.

Container trade grew much faster than the overall trade throughout the world before and after the world financial crises. As a result, some sectors such as electronics, medicines, and apparel were entirely containerised, and others stayed somewhere in the midrange. Thus, achieving container-trade growth higher than the growth of GDP and overall trade will be harder in the future; therefore, more competition is expected (Saxon & Stone 2017).

Moreover, the structure of the container market may undergo some changes. For example, China tries to build the Regional Comprehensive Economic Partnership by drawing collaboration of Australia, New Zealand and India. This formation may result in structural changes in the international trends, volume and flow of cargo (Lee & Cullinane 2016), and emerging new markets. In such a complex and competitive market, different threats and opportunities exist, and organisations throughout the CSC should be able to deal with threats and capture opportunities. Agility is a capability that can make organisations able to achieve such a goal. Moreover, agility as a capability may empower them to deal with environmental changes.

2.6 Conceptualising agility

Understanding agility needs exploring its origin and how it is linked to the SC concept. Agility was first introduced to manufacturing, and extensive research exists about agile manufacturing (Sharifi & Zhang 1999; Sharifi & Zhang 2001; Yusuf, Sarhadi & Gunasekaran 1999; Zhang 2011). Later, a series of research highlighted the needs of agility in other organisational issues, which the most important areas are information technology (Overby, Bharadwaj & Sambamurthy 2006; Sambamurthy, Bharadwaj & Grover 2003; Tallon et al. 2018; Weill, Subramani & Broadbent 2002), and human resources (Alavi & Wahab 2013; Breu et al. 2002; Crocitto & Youssef 2003; Qin & Nembhard 2010, 2015; Van Oyen, Gel & Hopp 2001).

Moreover, the knowledge around organisational agility has been developed from different perspectives such as agility enablers (Aravind Raj et al. 2013; Potdar & Routroy 2018; Tseng & Lin 2011), and agility dimensions (Tsourveloudis & Valavanis 2002; Wendler 2016). Researchers describe organisational agility considering two notions, which one of them considers organisational agility as a strategic decision (Arbussa, Bikfalvi & Marquès 2017; Weber & Tarba 2014) and the other one recognises it as an operational capability (Akhtar et al. 2018; Huang et al. 2012; Huang, Pan & Ouyang 2014). Table 2-1 presents some of the organisational agility definitions.

Table 2-1: Organisational agility definitions

Studies	Proposed definition
Holbeche (2018)	Agility is an organisation's ability to respond and adapt quickly to thrive in a changing environment.
Thao (2012)	Agility is an ability to quickly adapt to a business environment and adjust the internal structure to respond to changes in the environment.
L'Hermitte et al. (2015, p.211)	"Agility is the adaptive capability of an organisation to build strategic capabilities that support operational responsiveness and flexibility in order to manage existing or arising risks, uncertainties, and opportunities in the logistics and supply chain environment."
Carvalho et al. (2019)	An agile organisation is able to respond to any unexpected changes in the environment both rapidly and efficiently, reacting quickly and effectively to changing markets driven by customised products and services.
Lee et al. (2015)	Agility is an organisation ability to sense and respond to market changes continuously.
Worley and Pillans (2019, p. 122)	"Agility is defined as the ability to make timely, effective, and sustained changes when and where it confers a performance advantage."

The organisational agility is defined based on two important organisational capabilities. Firstly, it is the ability of sensing environment; secondly, it is the competency of an organisation to exploit its resources to make a quick response to environmental changes. It was realised that no individual organisation possesses all the resources needed to take advantage of every opportunity, and organisations need to align themselves with their partners and cooperate to achieve agility beyond the scope of organisational boundaries. Thus the concept of agility was developed to the SC realm (Fayezi, Zutshi & O'Loughlin 2017).

The concept of agility in SC is described by applying two terms in the literature, agile supply chain (ASC) and supply chain agility (SCA). The ASC explains agility considering the whole SC, and the SCA describes agility in SC considering the ability of organisations in their SC's activities (Sharma et al. 2017). Table 2-2 exhibits different definitions of agility in SC context provided by previous studies.

Table 2-2: Definitions of supply chain agility

Studies	Proposed definition
Chan, Ngai and Moon (2017)	SCA is the capability of SC's members to realign their operations and network to respond quickly to the market changes and dynamic customers.
Sangari and Razmi (2015)	SCA is the alertness of a SC to change within as well as its surrounding environment and capability to respond to changes.
Giannakis and Louis (2016)	SCA is the ability of organisations through a SC to respond quickly to unplanned changes of external circumstances as well as the ability to adapt to variation in the environment by using collaboration as a tool.
Aslam et al. (2018)	SCA is the ability of firms through a SC to respond to short term fluctuations in demands and adjust to market changes such as variation in demand patterns.
Tse et al. (2016)	SCA is the ability of a firm to respond to its customers' needs and fulfil demands by having a joint plan with its partners in a SC.
Dubey et al. (2018)	SCA is the ability of organisations to adjust operations and tactics aligned with its SC to respond to changes, opportunities, and threats.
Fayezi, Zutshi and O'Loughlin (2017)	A strategic capability that helps organisations to quickly sense and make a response to internal and external uncertainties by utilising effective integration and relationship in a SC network.
Sabegh et al. (2019)	Agility in a SC is the ability of firms to rearrange their resources based on market changes.

Regarding presented definitions about SCA, scholars used almost the same definitions for SCA compared with organisational agility with three differences. Firstly, they used the term of the SC instead of organisation in explaining SCA (Sabegh et al. 2019; Sangari, Razmi & Zolfaghari 2015). Secondly, they emphasised on the necessity of collaboration with SC's partners in establishing SCA (Fayezi, Zutshi & O'Loughlin 2017; Tse et al. 2016). Thirdly, they focused on organisations' ability to act agilely in their SC's activities (Chan, Ngai & Moon 2017; Dubey et al. 2018).

Moreover, the literature indicates that scholars who studied SCA usually focus on organisations within SCs rather than the whole chain since exploring the entire SC is not possible due to its complexity. Therefore, conceptualising SCA as an organisational ability to implement SC's activities agilely seems more relevant, and in the current study, this notion is adopted as the SCA concept. Further, SCA is a multidimensional capability and achieving a better understanding of it needs to explore these dimensions.

2.7 Supply chain agility dimensions

The concept of SCA was developed by Christopher (2000). He introduced four main elements of market sensitivity, virtual environment, process integration and network-based as required elements to establish the SCA. Later, the SCA was introduced as a capability that the four elements of customer sensitivity, virtual integration, process integration and network integration contribute to its foundation (Van Hoek, Harrison & Christopher 2001). Following this idea, different scholars investigated the SCA as a capability with various dimensions. For example, Yusuf et al. (2004) explored the SCA as a capability based on SC practices such as responsiveness and, Li, Goldsby and Holsapple (2009) introduced the SCA as a capability that can be measured through six dimensions of strategic alertness, strategic response capability, operational alertness, operational response capability, episodic alertness and episodic response capability. Also, Tse et al. (2016) investigated the SCA as a capability that can be measured by three elements of joint planning, demand response and customer response. Therefore, based on the reviewed literature, it can be inferred that the SCA is a multidimensional capability. However, existing variation in defining SCA dimensions shows that the theoretical foundation for understanding SCA is fragmented (Gligor, Holcomb & Stank 2013). The problem is multi-dimensionality of this concept which makes measuring SCA complicated (Gligor & Holcomb 2012). Therefore, it is essential to identify a standardised framework to measure SCA. A theory which helps to understand this capability based on standard elements is DC theory. Also, to the best of author's knowledge, there is a gap in the literature to study SCA based on DC theory. Hence, one of this research's goals is to fill this gap by studying CSCA using DC. In the next section, DC theory is discussed.

2.8 Dynamic capability theory

Since the 1990s, competitive environment has forced organisations to adapt, renew and reconfigure their capabilities. This process is captured in the notion of DCs (Teece, Pisano & Shuen 1997, Teece 2007). The DCs can enable an organisation to achieve a competitive advantage and maintain that in a dynamic environment (Teece 2007). While resources and ordinary capabilities enable an organisation to continue in the present, DCs enable an organisation to alter its routines in alignment with changes in the environment (Matysiak, Rugman & Bausch 2018). Three groups of capabilities construct DCs; they are sensing capabilities (to discern opportunities and threats), seizing capabilities (to grasp opportunities) and reconfiguration capabilities (to maintain competitiveness by reconfiguring intangible and tangible assets) (Teece 2007). These three groups of capabilities contribute to constructing agility in an organisation (Teece, Peteraf & Leih 2016). In the next sections, SCA is explored based on them.

2.8.1 Sensing capability in supply chain

Sensing capability enables an organisation to monitor its environment consistently to explore opportunity and threats (Fang et al. 2014). The sensing capability is a significant part of the learning process of suppliers, customers and competitors. Also, it has a positive impact on different areas of an organisation such as performance and the speed of a new product introduction to the market (Ardyan 2016). To establish the sensing capability organisations should implement environmental scanning, which was defined as achieving and utilisation of information about different issues such as events, trends and organisation's external environments (Song et al. 2015).

An organisation with a good sensing capability may have a high level of alertness and is good at making a logical connection between events and trends. It tends to involve in active searching for new information from both inside and outside of an organisation and applies various analytical frameworks to collect, filter and make sense of an environment (Zhang & Wu 2013). Considering environmental aspects of a SC, sensing capability aims to develop strategies, assess effectiveness and efficiency, codify processes and identify opportunities in customers, demands and market segments (Kırcı & Seifert 2015). In addition to these areas, organisations within the SC need to apply sensing capability for suppliers to be able to reconfigure their network continuously (Aslam et al. 2018). According to Alinaghian (2015), organisations throughout the SC need sensing capability in five areas of network actors, network structure changes, flow of materials and information, governance trends, and services/products architectural changes.

Moreover, in today's competitive environment fulfilling customers' expectations is an opportunity and organisations should be able to accommodate their end-customers' expectations in issues such as refunding and returning products, which means improving sensing capability in the area of customers is a necessity (Min, Zacharia & Smith 2019). Nevertheless, SC managers need the capability of sensing the environment in the first stage to be able to remain synchronised with the changes of environment and facilitate superior value (Aslam et al. 2018). The focus of this research is organisations which are active in the CSC; thus, it is necessary to explore the areas that they should improve their sensing capability.

2.8.2 Sensing capability in container supply chain

Organisations such as shipping agencies and freight forwarders should be highly market-oriented. It means they need to track customers' needs and competitors' tactics and strategies (Tseng & Liao 2015). Competition in the CSC may happen between different actors in this industry. Ports are an important part of the CSC. If a port acts more efficient than its competitors, it will impact the whole CSC. Some of the criteria that determine a port position among its competitors are the port infrastructure and effectiveness (Martínez Moya & Feo Valero 2017). Thus, comparing the port performance with its competitors allows judging its position in the market (Schellinck & Brooks 2016). Also, achieving information by the port about its competitors' strategies may help it to adopt an appropriate strategy to maintain or achieve competitiveness (Notteboom & De Langen 2015).

Competition among organisations in the CSC is not confined to ports. Changes in freight can impact organisations throughout the CSC and cause them to lose their market. Shipping container liners are one of the key parts of the CSC. The customers of the container shipping industry expect shipping lines to offer reliable services with lower freight rates (Lee & Song 2015). Competitors may impede shipping lines to achieve customer satisfaction. For example, some shipping lines are suspected of sending wrong signal price to their competitors to tempt them to increase their freight rates (Lee & Song 2017). This act may mislead competitors to quote uncompetitive rates and lose potential customers. It can be another evidence that gaining information about competitors' strategies is necessary for CSC's members; in this case, it is about freight changes. However, it may be more critical in other areas such as consolidation.

Consolidation between companies is something that often happens in recent years and impacts the whole market. The shipping lines usually consolidate to reduce cost and provide more flexible services (Crotti, Ferrari & Tei 2019; Panayides & Wiedmer 2011; Rau & Spinler 2017). These consolidations can impact the entire CSC. For example, consolidation increases the capacity of consolidated companies and causes a decrease in freight rates. It means the total cost of container carriage drops in specific routes in the CSC network, and it may impact on the competitiveness of other companies in the same market (Crotti, Ferrari & Tei 2019). Achieving information about other competitors in the CSC may help to enhance the sensing capability. Additionally, because of severe competition, the container industry undergoes some changes, which makes it necessary to grasp market trends.

There are limited opportunities in the container transport market because of saturation (Saxon & Stone 2017), and the entrance of gigantic container ships can also cause great impacts on the future of the market. As a result, entities of the container industry prepare themselves for structural changes (Prokopowicz & Berg-Andreassen 2016). For example, ports and stevedores develop their technologies and capacity to align themselves with these changes. Considering undergoing changes in the container market, realising and learning market trends may help organisations to improve their sensing capability.

Moreover, the CSC is mainly a service SC, and the necessity of understanding market trends is emphasised in service companies (Fang et al. 2014); however, it is not enough.

Organisations in the CSC need to collect macro-environment data, including those regarding regulation, government, economics and other environmental forces. These external factors should be taken into account, so that, an organisation can forecast the market systematically (Fang et al. 2014). Furthermore, once a market opportunity or threat is identified, organisations need to address it by providing a new service or modifying an existing one (Teece 2007). Thus, new plans for initiating such changes are required (Pavlou & Sawy 2011). Alongside improving sensing capability, organisations need to preserve agility by improving seizing capability (Teece, Peteraf & Leih 2016).

2.8.3 Seizing capability in supply chain

Seizing is the capability of getting things done while preserving agility. It can be achieved by implementing jobs flexibly (Teece, Peteraf & Leih 2016). It means securing jobs against existing uncertainty as far as it is possible (Angkiriwang, Pujawan & Santosa 2014). To remain competitive, SCs need to deliver products or provide services to customers at a competitive cost, acceptable quality with highly reliable delivery times. Increasing uncertainty has made the task of meeting requirement and satisfying customers more challenging. Seizing is an important SC's capability since volatility in the business environment has increased significantly, and it possibly will continue to be a critical issue of the SC in the future (Christopher & Holweg 2011). From the 1980s to 2000s, flexibility research was limited to how flexible manufacturing and product development could help organisations to deal with environmental uncertainty. After the introduction of the SC in the 1990s, the flexibility concept was gradually expanded to the SC in areas such as manufacturing (Jin et al. 2014).

Flexible manufacturing in a SC should have high-frequency product development cycle time and should be able to manufacture products with a high level of customisation in the lowest time (Merschmann & Thonemann 2011). This flexibility in manufacturing helps SCs to respond to the uncertainty of the environment in different areas. It helps the SC to be able to respond to the uncertainty of demands; it also can enable SCs to provide new products to satisfy customers (Yi, Ngai & Moon 2011). Manufacturing flexibility is indeed an essential factor to establish a flexible SC, but it is not sufficient, and other factors should be considered. For example, the lack of flexibility in upstream can deteriorate manufacturing flexibility. The primary factor that determines suppliers' flexibility is their ability to provide input materials or services in a responsive manner (Malhotra & Mackelprang 2012). It is important since it enables organisations to receive the required materials/services in the promised time and respond to customers' needs (Omar et al. 2012). Achieving flexibility in the supply-side should be a part of an organisation's strategies. Organisations may employ a long-term relationship with their suppliers via mutual planning and consistent improvement of planning (Qrunfleh & Tarafdar 2013). Also, they can consider supplier flexibility factors in their supplier/service provider selection process (Zeydan, Çolpan & Çobanoğlu 2011). Other strategies are improving visibility in information sharing, stocking buffer inventory and applying multiple sourcing (Wang, Gilland & Tomlin 2010). In addition to upstream, flexibility in the demand side is crucial.

If demand increases then an organisation should be able to satisfy it, otherwise the organisation will incur an opportunity cost. It can weaken its competitive position since other competitors will meet occurred demand, and the organisation loses its market share. Conversely, if demand decreases, the organisation loses money since its assets will remain unused, plus if there is no capacity to store produced output, it will be more problematic (Claussen, Essling & Peukert 2018). Therefore, flexibility in the demand-side of an organisation is a fundamental issue. Different strategies are applicable to enable an organisation to react efficiently against demand fluctuation. For examples, organisations can try to improve their forecasting ability, segment demands based on identifying the key customers and product-specific requirement, integrating sale and operation planning, and have a strict adherence to the demand (Rexhausen, Pibernik & Kaiser 2012). Improving visibility is also another strategy, and organisations throughout a SC may try to improve demand visibility in areas such as customers' sales, inventory, forecasts and promotions (Williams et al. 2013). In addition to the aforementioned strategies, two strategies of demand pooling and postponement can be used to improve demand flexibility (Schmitt et al. 2015, Carbonara & Pellegrino 2017).

Risk pooling strategy occurs when inventory is held in a central location to combine demand variance of all distributers. This can reduce the uncertainty of demand. For example, if demand is aggregated across different locations, it becomes possible that high demands from one distributor are offset by low demands from another. This strategy is particularly applicable to retailers (Schmitt et al. 2015). On the other hand, the postponement strategy is about delaying activities until the latest possible point in time. The logic behind this strategy is that this delay will lead to more information about those activities, and hence it can help to reduce or eliminate associated risk (Carbonara & Pellegrino 2017). Multiple strategies can be applied to decrease the uncertainty of demand. Therefore, improving demand flexibility is a great challenge for SCM since it needs great knowledge about the environment, organisational capabilities, SC condition, and strong analytical skill. In addition to demand flexibility, logistics flexibility is another area of flexibility in the SC literature.

Research on logistics identifies that logistics flexibility is a critical strategic capability to react against environmental uncertainty in a SC (Gligor & Holcomb 2012). A logistics system is flexible if it is capable of responding to non-routine requests, manage unexpected events successfully and quickly accommodate customers' requests (Malhotra & Mackelprang 2012). Also, this flexibility is required in both upstream and downstream of organisations throughout the SC (Hopp, Iravani & Xu 2010). In upstream, it includes the ability to provide various inbound transportation, warehousing, and accurate inventory management. In downstream, it entails different abilities such as warehousing, inventory management, and transporting products efficiently to customers (Jafari 2015). In this section, some strategies that can assist organisations in securing themselves against uncertainty and seizing agility were discussed. In the next section seizing capability in the CSC is discussed.

2.8.4 Seizing capability in container supply chain

Enhancing seizing capability in different aspects of the SC such as planning can be gained by improving forecasting capability (Brusset & Teller 2017). In a CSC the forecasting capability is vital for all parties engaged since many critical decisions should be made based on forecasting information. For example, for a shipping line, forecasting about the market demands can impact on critical operational issues such as sailing speed and the number of vessels that should be deployed (AlMarar & Cheaitou 2018). Also, it helps container shipping lines to decide on network design and deployment of ship types (Polat & Günther 2016; Rashed et al. 2018). Forecasting the future of market demands is also a challenging issue for ports since it can influence the decision making about providing a new or additional capacity, which should be supported by growing demand (Rashed et al. 2018). Likewise, forecasting capability is essential for inland logistics companies in issues such as multimodal transport choice (de Bok et al. 2018). Hence, forecasting future market demands is crucial to support effective planning and seize market opportunities. Additionally, improved flexibility via forecasting capability can equip engaged organisations in the CSC to act more potent against different existing macro and micro-environment threats such as unstable weather and insecure information flow (Challinor et al. 2016; Gao et al. 2017). In addition to forecasting capability that can help to act more flexible and improve the seizing capability, organisations which are active in the CSC rely on different service providers and need to exploit the flexibility in this area and capture the seizing capability.

The CSC network encompasses a network of freight forwarders, shipping carriers, logistics companies and ports. Each of these members provides service to other partners and organisations in the CSC attempt to work with members that make them able to satisfy their customers' needs (Yang 2016). Among various factors, service providers' commitment is necessary for each member to act more flexible and deal with uncertainty. Service providers' commitment is specifically crucial in the conditions that there is uncertainty in demands (Chen, Sohal & Prajogo 2016). Failure in achieving service providers' commitment can cause suffering in different issues such as facility maintenance and repair in supporting operations (Wong et al. 2012). Such a commitment is identified with the willingness of service providers to sacrifice their short-term earnings in the pursuit of long-term benefits and can be improved by appropriate relationship management (Yuen et al. 2019). Another approach to implementing jobs more flexible and seizing possible opportunities is by employing the same service from different service providers.

Moving a container from an origin to a destination includes many activities. It needs much operational coordination as well as many decisions to be taken to handover the container from a player to next (Fransoo & Lee 2013). Moreover, multiple service providers such as an ocean carrier, NVOCC, terminal operator, and one or more hinterland transport companies are engaged in the transport of the same container (Willis & Ortiz 2004). In this complex environment, the CSC should be able to satisfy its customers' expectations on issues such as availability of service and expected arrival time (Alharbi, Wang & Davy 2015). Thus, organisations are very sensitive to the services that their partners provide to them. For example, delays in loading and unloading containers and IT infrastructure are among factors that impact the shipping lines to select a port as a service provider (Sanchez, Adolf & Garcia-Alonso 2011). The same condition exists for ports in selecting service and facility providers (Notteboom & De Langen 2015).

Moreover, something that should be considered is receiving consistent, reliable and quality service from their service providers (Han et al. 2018; Thai 2016). Although there is always a risk of failure in the service providers performance, and the notion of multiple sourcing can be employed to mitigate service providers risk (Wang, Gilland & Tomlin 2010). Multiple sourcing is a strategy that can be used to decrease the risk of failure in receiving needed services. Another applicable strategy is to improve flexibility in setting capacity at an optimal level to respond to sudden customers' demands.

Capacity is an important concern for organisations within the CSC. This is specifically critical for ports which are an interface between sea and land and a point of changing transport modality. Low port capacity may cause transport delay and port congestion. In contrast, excessive capacity can impose more costs on the ports (Chang, Xu & Song 2015; Saeed, Song & Andersen 2018). Thus, it is essential to manage port capacity at an optimal level to avoid a mismatch between demand and capacity (Balliauw et al. 2019). It encompasses setting excess capacity to prevent disruption against a sudden increase in demands (Loh & Thai 2015).

In the CSC, freight forwarders play an important role in scheduling transport mode and negotiating with other members such as ports and shipping lines (Yu & Hou 2016). Thus, they need to manage capacity in the most efficient way considering issues such as cost and time of transport. In this area, reserving capacity to fulfil required demand in a freight season is crucial (Lai, Xue & Hu 2019). Moreover, in engineering freight routes, the freight forwarders should consider existing demand and available capacity of other members such as ports (Chen et al. 2017).

Furthermore, for container shipping lines, the availability of capacity is among important decisions. The container shipping lines implement different strategies such as exchanging available capacity with other shipping lines (Lee & Song 2017) or dropping freight rates to utilise available capacity (Viljoen & Joubert 2016). Thus, adopting suitable strategies to utilise existing capacity is an important approach for acting more flexible and seizing opportunities for organisations within the CSC. Along with acting more flexible, for preserving agility, organisations should adjust their resources to meet changes in the market (Dwayne Whitten, Green & Zelbst 2012). Transforming is a capability that can help to achieve such a goal.

2.8.5 Transformation capability in supply chain

Organisations within a SC should adapt themselves with changes in an environment. Regarding the complexity of the environment and variety in customer demands, there is a conflict between recognising economies of scale and satisfying customised demand (Medini 2018). Hence, organisations should not only preserve agility by implementing flexible strategies such as performing a modular approach in service and product design or adopting postponement strategies but also should reconfigure their resources according to customised demand to achieve agility (Liu & Yao 2018). The higher the degree of customised products or services exists, the greater the numbers of resources needed to be added to the platform. Thus, an organisation should decide which resources should be integrated into its SC network and which partner may be appropriate to be integrated accordingly. This process should be consistent since the value of resources that brought success for an organisation may become ineffective, and changes in structure may be necessary to adapt to new condition (Liu & Yao 2018). Therefore, assessment of resources' value and partners are continually necessary tasks (Michalski, Montes-Botella & Narasimhan 2018). Different factors, including supplier's and customers' intelligence that may address technological opportunities and market requirements that provide an advantage, may be considered in the assessment process (Schoenherr & Swink 2015). Transforming capability helps to redesign SCs according to the market changes. It can make SCs able to provide a variety of products and services regarding environmental changes.

2.8.6 Transforming capability in container supply chain

CSC is a complex network, and organisations within the network initiate new coordination to adapt to new conditions (Caschili & Medda 2012). This coordination may lead to more integration or go further by constructing a strategic alliance. The container market is challenging, and container shipping industry members seek to form strategic partnerships to respond to the changes (Rau & Spinler 2017). In container shipping lines, an alliance allows members to suspend a specific sailing or port call to adjust supply according to changes in the environment. It also helps container shipping lines to expand their network by sharing other members' capacity (Hirata 2017).

Moreover, liner shipping companies establish new alliances for reasons such as entering a new region with lower risk and achieving customer satisfaction (Huang 2016). Cooperation is not limited to shipping lines. In some cases, it may happen among ports to save port competitiveness and expand the market in responding to changes in the environment (Xu et al. 2015). Ports can ally in areas such as information sharing, investing in terminal development and mutual decision making (Xiao & Liu 2017).

Furthermore, cooperation may happen among shipping lines, port terminals and logistics companies by providing integrated door to door services or among freight forwarders and ocean carrier depending on market needs (Tan et al. 2018). Thus, different levels of cooperation among organisations within a CSC is necessary to respond to customers' needs and to achieve SCA. Furthermore, customers' expectations have increased, and they expect more quality services from organisations within the CSC, such as shipping lines (Yuen & Thai 2015).

Service providers of an organisation can impact on its customers' satisfaction by quality of their performance. For example, a port plays the role of the inbound and outbound logistics process, and its service quality can impact on the satisfaction of shipping lines' customers which call the subjected port (Thai 2016). Conversely, the service quality of a container shipping line can impact freight forwarders' customers (Wen & Lin 2016). Thus, organisations within the CSC should be able to assess their service providers and change them according to their customers' expectations continuously. Further, operational time is among issues that can impact on customers satisfaction.

The operational time depends on the performance of all CSC's members. Since a container moves between different modes of transport and fluctuation may exist in operational times of any members such as port, shipping lines and logistics companies

(Kim & Lee 2015; Wang, Meng & Liu 2013). Thus, organisations throughout the CSC should be able to adjust their operational times according to changes in other members' operational time. Additionally, organisations within the CSC should be able to modify their capacity in alignment with changes in customers' demands.

In the CSC network, availability of capacity is a determinant element to respond to customers' demand. Thus, organisations should adjust their capacity in different areas such as empty container and slots availability. For example, a container shipping line may decide about allocating slot capacity to its customers regarding their requests, but slot allocation is a dynamic decision which depends on many factors and is prone to change (Meng, Zhao & Wang 2019). The same condition exists for the availability of an empty container and empty container repositioning. Since containers are in different sizes such as 20', 40', 45' and different types such as Reefer, Flat rack, Open top and Standard, setting container balance is a complex problem.

Moreover, variety in customer's demands is dispersed and hard to predict truly. Therefore, it is challenging to maintain a balanced capacity at a given location (Edirisinghe, Zhihong & Wijeratne 2016). Various CSC's members, including ports, shipping lines, and inland logistics companies engage in providing an optimal capacity to customers, and they should adjust their capacity continuously. Capacity adjustment contains issues such as availability of container slot and availability of port capacity and infrastructure (Esparza, Cerbán & Piniella 2017; Fu et al. 2016; Gusah, Cameron-Rogers & Thompson 2019).

Sensing, seizing and transforming are three groups of DCs that can be used as a guide to constructing agility in SC's activities of an organisation. So far, this section discussed three subsidiaries of DCs in the context of SC and CSC. Also, it should be considered that some precursors can also boost SCA's constructs. They are important since they act as stimulants to SCA. In the next section, some of the most important antecedents required to initiate SCA are discussed.

2.9 Precursors of supply chain agility

Understanding the antecedents of SCA will help organisations throughout a SC to control and maintain agility in the desired level (Gligor, Holcomb & Feizabadi 2016). Developing agility in the SC is a complex job where different factors can hinder or facilitate its achievement (Sangari, Razmi & Zolfaghari 2015). Moreover, understanding these factors is important since it can provide a practical guide to develop a truly agile SC. To establish the SCA, organisations within the SC should adopt an agile strategy and perform this strategy in different components of their organisation such as human resources.

Human resources are one of the agility dimensions in an organisation (Saleeshya, Thampi & Raghuram 2012). Organisations need to be able to reconfigure their workforce quickly to align with transitions in the environment and achieve agility. This may include providing update information to their employees and setting flexible infrastructure that can be adapted with the reconfiguration of human resources (Nijssen & Paauwe 2012). Also, employing the right number of employees with the right skills and knowledge is an important issue that should be managed effectively (Qin & Nembhard 2015). In addition to employment strategies, organisations need to execute post-employment practices such as training, performance and reward management to improve agility (Ding et al. 2015). Moreover, becoming more agile needs organisations to develop human resources who can manage and cope with changes. Implementing such a strategy requires an effective training as well as knowledge sharing environment (Muduli 2016; Salehzadeh et al. 2017). Nevertheless, if organisations intend to achieve SCA, their human resources strategy should be aligned with improving human resources capabilities towards SCA (Ngai, Chau

& Chan 2011). Additionally, every organisation should also have mechanisms to establish inter-organisational capabilities such as integration that play an important role in establishing SCA.

Integration as a cornerstone of SC was introduced by Oliver and Webber in 1982. Since then, the context of business was changed, and the limitation of SC models based on the linear flow of materials was exposed. Hence, a new era of network SCs was developed, and internal SC integration transitioned to the external SC integration. Without engaging suppliers and customers, only a limited amount of improvement could be gained (Stevens & Johnson 2016). When organisations deal with changes in the business environment, integration between an organisation and other SC's members can assist them in making a quick response and improving their agility (Danese, Romano & Formentini 2013; Tse et al. 2016). To become agile, an organisation within a SC should conduct integration in both sides of suppliers and customers as one-sided integration may not lead to the best results (Blome, Schoenherr & Rexhausen 2013). One of the factors required to establish integration is information integration. The information integration with suppliers and customers involves consistent information sharing between an organisation and its partners in areas such as inventory level, quality, delivery performance and production plan (Reid, Ismail & Sharifi 2016). This information sharing can enable organisations to establish a more collaborative relationship with their partners (Stevens & Johnson 2016), and collaborative relationship is something that organisations need to act more agile (Sangari, Razmi & Zolfaghari 2015). In addition to integration, organisations may exploit visibility as a tool to improve SCA.

The SC visibility refers to the extent which actors have access to timely and accurate information that they regard it to be useful in their operations (Barratt & Barratt 2011).

Organisations within a SC can benefit from improved visibility in different areas, for example, improved visibility about customers, demands and inventory level enhances accuracy in demand forecast, boosts delivery performance, and decreases inventory level throughout the SC (Somapa, Cools & Dullaert 2018). In addition to performance, visibility can also improve SCA (Brusset 2016). Visibility in the SC can be explored based on two perspectives, firstly; information attributes, secondly; the areas that visibility is applicable in the SC context. To have quality information, it should have some attributes. These attributes are timeliness, accuracy, completeness (Somapa, Cools & Dullaert 2018), and usefulness (Jonsson & Myrelid 2016). Without quality information, visibility will not be attained in information sharing.

Visibility in SC was conceptualised in different areas. Some researchers relate visibility to product-related or inventory monitoring (Brandon-Jones et al. 2014; Rai et al. 2012; Zohaib et al. 2016), while others associate that with visibility in demand (Williams et al. 2013; Williams & Cunningham 2017). Both demand and inventory visibility are important factors to achieve SCA. Demand visibility can improve SC responsiveness by enabling organisations to forecast their customer needs and control their inventory level (Mendes 2011; Williams et al. 2013), and Improved responsiveness can result in more SCA (Gligor, Holcomb & Stank 2013). Inventory visibility in a SC helps to have greater control over SC's operations, and this control can empower organisations within the SC to respond fast to changes and improve SCA (Brusset 2016).

Furthermore, organisations may also intend to think about products' visibility in the whole lifecycle including the beginning, middle and end of life. This is because achieving such visibility can help them to improve their forecast capability in maintenance and act more quickly in reuse and recycling processes (Musa, Gunasekaran & Yusuf 2014). One of the factors that can facilitate the visibility of information is information technology (IT) since it enables organisations to have access to accurate and timely information (Goswami, Engel & Krcmar 2013). IT can be considered as an important SCA enabler since it can impact many of other SCA enablers. For example, it can help to improve human resources capabilities by enabling knowledge sharing ability (Mirzaee & Ghaffari 2018), it can also enhance integration (Vanpoucke, Vereecke & Muylle 2017), and visibility (Lee, Kim & Kim 2014).

2.9.1 Information technology

IT plays a pivotal role in SCM. Firstly, it allows an organisation to manage the complexity of information in communication with its partners. Secondly, it allows providing real-time information such as inventory and production planning. Thirdly, it facilitates the alignment of forecasting and planning between a firm's suppliers and customers (Prajogo & Olhager 2012). Further, it empowers an organisation to discover changes in its environment and continuously improve its products and services. It also can make an organisation able to adjust its internal processes to rapidly cope with market and demand changes (Lu & Ramamurthy 2011). IT has crucial influences on a firm's capabilities such as collaboration, integration and knowledge management (Fawcett et al. 2011; Holtshouse 2013; Prajogo & Olhager 2012). Various current technologies such as mobile and wireless, and integrating technologies (e.g., extensible mark-up language (XML) and Web), business process re-engineering and managerial dashboards (Enterprise resource planning (ERP) systems) that enhanced SC capabilities are all under the umbrella of IT (Ngai, Chau & Chan 2011). IT can create capabilities such as integration and flexibility in organisations. In the next two sections, IT integration and flexibility are discussed.

2.9.1.1 **Information technology integration**

Information is one of the significant resources that can empower SC performance and competitiveness. IT integration is explained as the extent to which information systems are linked, and information is shared between SC's partners (Ngai, Chau & Chan 2011). When different IT systems across organisations in a SC are integrated, it can provide the capability of decreasing imperfect information as well as information asymmetry (Singh & Saini 2016). IT integration can create an ability to share information timely and cause an enhanced decision-making capability (Maiga, Nilsson & Jacobs 2014). IT integration facilitates a connection between distant SC's members (de Barros et al. 2015). IT integration covers different areas such as joint decision-making, monitoring and communication and can improve SCA (Chen 2018). Because of the mentioned benefits, many organisations increasingly applied inter-organisational ITs to strengthen coordination with their partners (Sun & Teng 2012). Another critical IT capability is IT flexibility which is discussed in the next section.

2.9.1.2 **Information technology flexibility**

IT flexibility has a crucial impact on an organisation's capability to manage its SC when operating in a dynamic and complex environment (Tiwari, Tiwari & Samuel 2015). IT flexibility is defined as the capability of IT to adapt to the changing business environment with a minimum cost and effort (Fink & Neumann 2009; Ngai, Chau & Chan 2011). Some researchers defined it more precisely and provided their descriptions based on IT attributes. For example, IT flexibility depends on the extent to which an organisation IT is compatible, scalable, modular and adaptable (Bhatt et al. 2010; Tallon & Pinsonneault 2011).

Furthermore, IT flexibility is explained based on organisational capability and its relationship with its partners. IT flexibility is an organisation ability to change IT-based connections across a SC (Bush, Tiwana & Rai 2010). Also, some researchers associated this with an organisation's ability rather than the IT infrastructure's characteristics. For example, according to Cheng, Chen and Huang (2014) and Liu et al. (2013), IT flexibility refers to an organisation capability to develop technological resources that can provide a foundation for the improvement of IT applications. It means, IT flexibility depends on an organisation capability to offer technological resources that can assist the improvement of IT utilisation, as well as scalability, modularity and compatibility of IT features. IT technology can enhance a firm's ability to coordinate its processes with SC's partners and respond to market changes. Organisations may achieve this ability by utilisation of various ITs such as ERP systems (DeGroote & Marx 2013). Among several IT infrastructures, cloud computing is a type of IT with specific features. Cloud computing is a type of IT resource without direct active management by a user. Cloud computing may impact on SCA.

The application of cloud computing can create two groups of capabilities in organisations. The first group are features of this technology such as scalability. The second group are those created through the application of cloud computing, such as integration. Some researchers such as Iyer and Henderson (2010), Wakunuma and Masika (2017) focused on the first group. Also, some scholars such as Battleson et al. (2016) and Berman et al. (2012) studied the capabilities through cloud computing application. Battleson et al. (2016) investigate created DCs through cloud application, and Berman et al. (2012) examine the created capabilities through cloud computing application in processes and business innovation. However, there is a gap in the literature to study the created capabilities through cloud computing in the CSC context from the lens of DC theory, and this research intends to cover this gap.

2.10 Cloud computing

Cloud computing is a system that has some specific characteristics including on-demand self-service, broad network access, rapid elasticity and measured service. On-demand self-service means, registered resources can utilise the system whenever without any human interference. Broad network access means customers can connect to the system via application of the internet and different applications such as laptops, mobiles or telephones. Rapid elasticity refers to customers' ability to scale their use of resources up or down as their needs change. Measured service means customers' utilisation is measured by factors such as storage usage, CPU hours, bandwidth usage (Puthal et al. 2015). Cloud computing systems have different types, including public cloud, private cloud, community cloud, and hybrid cloud. The public cloud can be accessed by any registered client with an internet connection, and the private cloud is designed with limited access for specific organisations. The community cloud is shared among two or more organisations with similar needs, and the hybrid cloud is a combination of at least two different types of clouds (Huth & Cebula 2011). Every cloud computing system has three different layers.

These layers are infrastructure as a service (IaaS), platform as a service (PaaS) and software as a service (SaaS). IaaS provides computing resources as a service. Examples of IaaS services are Amazon web services of EC2 and S3[5]. PaaS services are abstract layers between SaaS and IaaS. PaaS is the target of software developers. Users can write codes of their application according to the characteristics of a platform without worry for underlying hardware infrastructure. Users can upload their written application codes to the platform that supports their codes, and they can manage development when the usage of the uploaded software grows. Example of successful PaaS cloud system is Google App Engine, which allows running applications on Google's infrastructure. SaaS is software that is owned and managed by one or more providers remotely. SaaS is the most visible form of cloud system for customers because it is the actual usage of the software, and customers pay based on how they intend to use the software (Patidar, Rane & Jain 2012).

2.10.1 Cloud computing as an information system infrastructure

Organisations look for ways to improve their competitive advantage by leveraging their SCs (Barney 2012), and IT solutions have enhanced effectiveness and consequently SC's processes performance (Tatoglu et al. 2016; Wong, Lai & Bernroider 2015). Moreover, IT adoption should complement existing organisation's resources to enhance the organisations' competitiveness landscape (Hazen & Byrd 2012). Therefore, organisations must choose to adopt only those ITs that are in alignment with their SCM strategies and enable them to improve their performance (Wu et al. 2013). One of the critical IT applications in every organisation which impacts on SCM processes is an enterprise business system (EBS). Cloud computing can facilitate the EBS application extensively. An enterprise resource planning (ERP) system is the most important type of EBS which cloud computing technology has had a great impact on it.

The ERP system can enhance the integration of information across an organisation by merging different independent information systems applying in various sections and departments into one central database (Oghazi et al. 2018). Traditional ERP systems relied on central software, and these systems were not flexible enough to support a dynamic environment (Chen, Liang & Hsu 2015). The utilisation of cloud computing technology provides more flexibility to ERP systems, and organisations may use software facilities even provided by SaaS solutions or by partners in the cloud computing environment (Romero & Vernadat 2016). Providers manage cloud ERP system in areas such as installation and upgrade, and it results in less cost in areas such as maintenance issue (Muslmani et al. 2018).

Cloud computing advantages are not limited to EBS systems such as ERP, and wherever organisations need, they can use cloud services to receive IT related services. This feature of cloud computing can assist in creating IT flexibility. The IT inflexibility has always been among concerning issues in organisations which facing technological changes since it is possible that their ITs become isolated and cannot support their strategies (Harrigan 2017; Jorfi, Nor & Najjar 2017). A flexible IT should be compatible, which means it should be designed considering shareable and reusable modules (Cui et al. 2015; Jorfi, Nor & Najjar 2017; Wu et al. 2013). Cloud computing is a technology that can be applied modular based on needs (Mehrsai, Karimi & Thoben 2013). Therefore, the combination of cloud computing with an organisation IT may lead to more flexibility. Cloud computing may also impact IT integration.

By increasing geographical dispersion, SCs environmental complexity was increased. To stay competitive in this complex environment, organisations need to improve their information sharing ability (Cao, Schniederjans & Schniederjans 2017). Cloud computing can provide on-demand access to information across a supply network. This allows organisations to utilise cloud computing to share real-time data between SC channels more integrated (Cao, Schniederjans & Schniederjans 2017). Moreover, cloud computing supports establishing a virtual SC and creates a platform to connect different e-SCMs (Jede & Teuteberg 2016). An individual organisation subscribes to the cloud platform and accesses to cloud computing services jointly with its partners at an affordable cost

(Kochan et al. 2018). Also, it offers better data recovery and fewer breakdowns compared with traditional on-premise e-SCM users (Schniederjans, Dara, Ozpolat & Chen 2016). Thus, the application of cloud computing may promote inter-organisational IT integration and lead to consistent information sharing. The focus of this research is CSC; hence, it is necessary to discuss areas that cloud computing may be applied in the CSC.

2.10.2 Application of cloud computing in container supply chain

Application of cloud computing may resolve many problems in CSC management, including tracking and monitoring containers, container loss, labour efficiency, transport management, warehouse space management, distribution planning, trade imbalance, expendable management, and fleet management (Rajput & Singh 2018). Cloud computing has contributed to constructing e-maritime development. For example, it helped to develop a Port Single Window platform that allows different stakeholders such as logistics companies, ports and government access to real-time application modules (Joszczuk–Januszewska 2012). All three lyres of cloud computing including IaaS, PaaS, and SaaS are applicable in the CSC context. Although the most significant area is SaaS (Dellios, Papanikas & Polemi 2015). SaaS can be utilised to establish different systems such as monitoring vessel status, delivering e-documentation, cargo authentication, e-payment and e-training (Dellios, Papanikas & Polemi 2015).

In the CSC, cloud computing can be used by different organisations such as a port to facilitate SC's activities. A barrier to implementing a consolidated container terminal is a low level of visibility and inappropriate information exchange among CSC's members. Cloud computing is used by a container terminal to construct an architecture to accommodate the substantial amount of data from a multitude of members. It leads to a dynamic container operation consolidation (Tsertou et al. 2016). In the most comprehensive form, cloud computing is applied as a technology to construct an intelligent container port. Such a system can guarantee transparent container logistics and let direct real-time data collection from the terminals of the port (Xisong et al. 2013). Additionally, container ports experience digital transformation, and cloud computing is one of the leading technological grounds. Cloud platforms provide not only cost-efficient scalable IT infrastructure but also facilitate access to several other IT infrastructures which can be integrated with current internal systems (Heilig, Lalla-Ruiz & Voß 2017).

In container shipping area, cloud computing can be utilised to develop a system to gather a large volume of data and improve operations based on data mining techniques. It can be implemented in different areas such as repair predictions, cargo tracking and self-piloting (Cristea et al. 2017). In the case of cargo tracking, cloud computing can be used by CSC's members to improve visibility and integration. It can help to establish a system among CSC's partners to share real-time data about container location and process (Gnimpieba et al. 2015).

Moreover, it can be used as one of the core technologies in combination with other technologies such as RFID to make containers smarter and minimise the unused volumes of the containers (Zhang et al. 2016). Furthermore, it may be applied to establish an auction logistic centre among stakeholders in the CSC network (Arnold, Oberländer & Schwarzbach 2012; Kong et al. 2015). Organisations within the CSC may gain seven important capabilities by applying different layers of cloud computing including controlled interface, location independence, sourcing independence, ubiquitous access, virtual business environment, addressability and traceability, and rapid elasticity (Iyer & Henderson 2010). These capabilities can empower businesses to gain important capabilities of sensing and responding to the environment (Battleson et al. 2016). Thus, the application of cloud computing may improve agility in the CSC.

In the realm of agility, cloud computing has been studied in different areas. Some research studied the impact of cloud computing on IT agility. For example, Sawas and Watfa (2015) studied the impact of cloud computing technology on IT infrastructure agility. They concluded that cloud computing improves business aspects of IT, related to agility. Also, possible structural changes due to cloud computing application can be traced in research by Akbar, Govindaraju and Suryadi (2015). Structural changes because of cloud computing application can impact on agility, which was studied by some researchers. For example, Mircea, Ghilic-Micu and Stoica (2011) explored how the combination of cloud computing and business intelligence can deliver agility; also, Fremdt, Beck and Weber (2013) studied the impact of cloud computing on operational agility. Although there is a gap in the literature to investigate the impact of cloud computing on CSCA, In the next section, the possible impacts of cloud computing on SCA are discussed.

2.10.3 The impacts of cloud computing on organisations

Cloud application may be an indicator of greater inter-organisational attachment between an SC's partners since it reflects a higher level of commitment between SC's partners. It may generate a more trusting and collaborative relationship between organisations within the SC and promote integration (Bruque Camara, Moyano Fuentes & Maqueira Marin 2015). Cloud computing can improve collaboration by standardisation, virtualisation, facilitating data management and platform management (Jun & Wei 2011). By applying cloud computing, SC's members can have access to a standard interface and implement real-time information exchange. It can also put SC's organisations of different interfaces into the same system software in a virtual environment. Also, it can assist in improving data management abilities by providing data storage and computing capabilities. Moreover, it can facilitate platform management by providing this opportunity to eliminate distributed servers in various locations and concentrating them in a certain place. Thus, cloud computing can foster agility by technological integration between SC's members.

Application of cloud computing can lead to integration in different processes of SCM such as forecasting and planning, sourcing and procurement, inventory management, collaborative design, and product development (Tiwari & Jain 2013). For example, in the planning process, the partners of a SC can store information on a cloud platform to perform more accurate demand forecast by applying analytical tools. In the procurement process, cloud computing may result in more integration by developing mutual contracts. In inventory management, wireless systems are integrated by applying the cloud-based centralised data management system. Also, multiple organisations may use a cloud system to develop a new product. In the best complete form, cloud computing may help to create a virtual SC by enjoying compatible interfaces and building virtual clusters of working packages; this virtual environment can enhance collaboration and lead to more integration between SC's members. For example, cloud computing in the manufacturing industry can help to establish a virtual collaborative environment (Mehrsai, Karimi & Thoben 2013).

The role of cloud computing in integrating SC's activities can be even more influential in the era of Industry 4.0. One of the important topics in the SC literature is the concept of the internet of things (IoT) (Caro & Sadr 2019; Li & Li 2017; Luo et al. 2016). The aims of Industry 4.0 is boosting digitalisation and SC integration by employing concepts such as IoT (Ardito et al. 2018). Cloud computing is one of the sub-technologies that plays an important role in the implementation of the IoT concept and improving the SC integration (Druehl, Carrillo & Hsuan 2018). In addition to improving the SC integration, cloud computing also can enhance the visibility of information among organisations within the SC (Truong 2014).

Visibility is one of the troubling issues in SCM. Cloud-based systems can provide visibility by facilitating information sharing in different areas of SCM such as inventory, material shipments, and demand (Tiwari & Jain 2013; YiPeng 2011). This visibility is critical in the information sharing process between an organisation and its customers because it allows organisations to react quickly to demand fluctuations (Kochan et al. 2018). Furthermore, cloud computing can assist in establishing visibility throughout a SC in six stages of plan, source, making, delivering, selling, and service (end-to-end visibility). Such visibility can be created by employing a shared data repository among organisations involved in the SCM's processes and contributes to value creation (Suherman & Simatupang 2017). Further, the application of cloud computing is not confined to visibility; it can help to improve transparency.

Difference between visibility and transparency returns to unite of time between an event happens, and the ability of managers to identify and react to the event. Real-time data can be transferred so quick and enable managers to acknowledge and forecast what customers need instantaneously (Handfield & Linton 2017). Due to swift changes in the environment, prompt response to changes needs a high level of visibility about events (Chen, Preston & Swink 2015). Researchers in the area of real-time data pointed at some critical capabilities including access to pools of big data (Gandomi & Haider 2015; Geisler et al. 2016), and analytic tools (Acito & Khatri 2014; Chen, Chiang & Storey 2012). Cloud computing can provide both of these capabilities and facilitate real-time data access in the SC context (Oliveira & Handfield 2018). For example, cloud computing can be applied to support real-time monitoring of business activities in a highly distributed environment by leveraging big-data (Vera-Baquero, Colomo-Palacios & Molloy 2016). The value of cloud computing reveals when organisations within a SC need to handle big data in their real-time data process. It is because managing big data usually is supplemented with issues such as data variety, data storage and data integration. Cloud computing can help to deal with these issues (Assunção et al. 2015). Improved information sharing between organisations in the SC may also enhance human resource competency, which can affect SCA.

Knowledge is a valuable asset of every organisation and organisations realised that they must develop, organise and utilise their employees’ knowledge (Omotayo 2015). Cloud computing can help to overcome limitations in organisational boundaries by allowing access to contemporary knowledge (Marta, Correia & Neves 2011). It can assist in knowledge management efforts and address existing problems in this area. Cloud computing can help organisations to meet the fluctuating needs of their users and implement knowledge management projects with an affordable cost since cloud computing offers organisations scalable, elastic and economic knowledge management platforms (Sultan 2013). For example, there are many cloud storage applications such as Google Drive, Dropbox, OneDrive, Evernote that organisations can utilise them to support all of knowledge management activities including knowledge preservation, knowledge acquisition, knowledge distribution and knowledge development (Gunadham 2015). Moreover, Cloud computing provides different facilities such as analytical and big data handling tools that can help to implement an intelligent on-demand actionable knowledge management system (Depeige & Doyencourt 2015).

Furthermore, cloud computing provides both educational practitioners and learners with a large number of online applications that can be utilised to support implementing learning scenarios. These applications are available anywhere, anytime and are compatible with different gadgets (Chen-Feng & Liang-Pang 2011). These advantages in the application of cloud can bring good opportunities for organisations to apply cloud computing to enhance SCA. Regarding the reviewed literature, there are some gaps. First of all, there is no research to study SCA from the lens of DC theory which this research intends to fill this gap by studying SCA in the context of CSC. Secondly, to the best of author's knowledge, there is no research to investigate the impact of cloud computing on sensing, seizing and transforming as SCA dimensions in the context of CSC. To fill these gaps, the conceptual framework of this research is discussed in the next section.

2.11 Conceptual framework of this research

This research aims to explore the impact of cloud computing application on CSCA. Development of a conceptual framework is the first stage to identify the relationships between variables of this research. Cloud computing technology contains some features such as on-demand self-service, and the presence of these features may bring some capabilities such as integration and flexibility in the organisations which apply this technology. Furthermore, as it was explained, CSCA could be constructed through the combination of three groups of DCs including sensing, seizing and transforming. Thus, boosting each area of these capabilities may lead to an improvement in CSCA. It is assumed that created capabilities via cloud computing application can improve CSCA dimensions, and Figure 2-6 presents the initial conceptual framework of this research. Further, the explanation of the framework and hypotheses development based on the framework are detailed in the following two subsections.

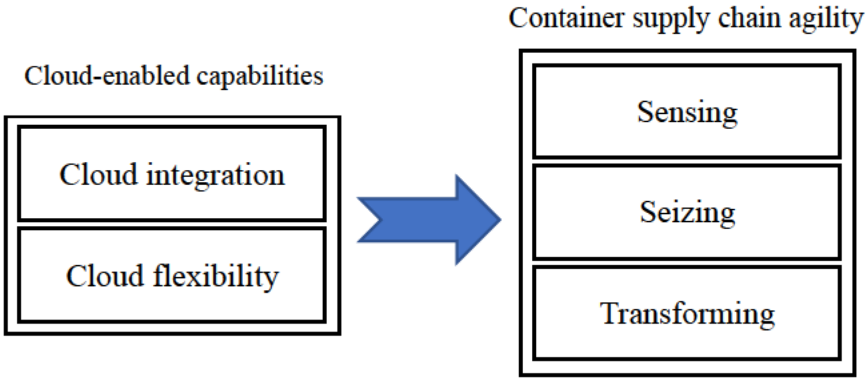


Figure 2-6: The initial conceptual framework of this research

2.11.1 Conceptual framework explanation

Conceptual framework of this research entails two primary constructs of cloud-enabled capabilities and container supply chain agility. Application of cloud computing in an organisation can provide some capabilities such as integration and flexibility. Cloud integration refers to the degree that the application of cloud computing can assist the organisation in enhancing different aspects of integration such as synchronising processes with other partners. Also, cloud flexibility refers to the degree that application of cloud computing can help the organisation to adapt to the changing business environment with minimum cost and effort in areas such as addressing a new business relationship when it is required.

Further, according to DC theory, agility encompasses three dimensions of sensing, seizing and transforming. Sensing capability refers to an organisation capability in monitoring its environment consistently to explore opportunity and threats. Seizing is the capability of getting jobs done while preserving agility. It can be achieved by implementing jobs flexibly (Teece, Peteraf & Leih 2016), it means securing jobs against existing uncertainty as far as it is possible (Angkiriwang, Pujawan & Santosa 2014). Transforming capability is another dimension of this research's conceptual framework. It means organisations should not only preserve agility by implementing flexible strategies such as performing a modular approach in service and product design or adopting postponement strategies but also should reconfigure their resources according to customised demand to achieve agility (Liu & Yao 2018). For, example, organisations should consistently decide which resources should be integrated into their SC network and which partner may be appropriate to be integrated accordingly (Liu & Yao 2018). In the next section, the hypotheses of this research are proposed and discussed.

2.11.2 Hypotheses development

Cloud integrative capability can improve IT infrastructure integration which may progress information sharing among SC's partners (Samreen, Blair & Elkhatib 2019). Also, there is a strong relationship between DCs and knowledge extracted from information, since knowledge positively affects the development of the sensing ability (Nieves, Quintana & Osorio 2016). Thus, cloud computing integrative capability may help organisations to sense the environment and market demands better and ultimately enhance sensing capability. Further, Cloud computing can lead to a greater inter-organisational attachment between CSC's partners since different partners use the same IT environment at the same time. Thus, it may generate a more trusting and collaborative relationship among organisations throughout the CSC and cause integration and better information sharing (Bruque Camara, Moyano Fuentes & Maqueira Marin 2015). Further, organisations within the CSC can access to timely information, accessing timely and quality information can improve DCs (Benitez, Llorens & Braojos 2018). Also, by applying cloud computing, it would be much easier for organisations to integrate data application with their partners which lead to decreasing asymmetry of information among partners and improving sensing capability (Stantchev & Tamm 2012). Agility is a DC, and sensing ability is one of the DC dimensions. Hence, aligning sensing ability with agility aims is necessary, and cloud computing integrative capability may help to improve sensing ability and ultimately agility as a DC, and the following hypothesis is proposed.

H_{1a}: *Cloud computing integrative capability is positively related to sensing ability.*

Cooperation is the strongest source of DCs when aiming to seize opportunities (Ince & Hahn 2020). Organisations rely on collaborative efforts, and they consult each other in strategic decision making for seizing opportunities in financial and social goals (Ince & Hahn 2020). Cloud computing integrative capability can help to close organisations boundaries and enhance their strategic decision making. Further, cooperative goals between an organisation and downstream partners can improve an organisation’s DCs since it promotes customers integration which is positively related to DCs (Yang & Gan 2019). Customers are a significant part of organisations, and organisations always try to promote their responsiveness and seize opportunities in their customers' area (von Falkenhausen, Fleischmann & Bode 2017).

Additionally, information sharing between partners can improve their forecasting ability (Kembro, Näslund & Olhager 2017). Therefore, it can help organisations throughout the CSC to deal with the uncertainty of the environment in issues such as demand uncertainty (Ha, Tian & Tong 2017). Furthermore, integration can enable organisations throughout the CSC to act more flexible and deal with existing uncertainty (Flynn, Koufteros & Lu 2016). Nevertheless, Cloud computing allows organisations to integrate different IT resources dynamically based on business needs and provide on-demand access to configurable IT resources (Battleson et al. 2016). Hence, cloud computing integrative capability may impact on seizing ability, and another hypothesis of this research is proposed as below.

H_{1b}: *Cloud computing integrative capability is positively related to seizing ability.*

A SC's environment is uncertain, and various environmental factors such as technology and customers behaviours change over time; thus, organisations need to react against these changes to adapt to the environment (Zinn & Goldsby 2019). Strong DCs can enable organisations to do a better job of responding to unknown future, and an organisation with strong sensing and transforming capabilities is more resilient against fluctuations when unpredictable changes happen (Teece & Leih 2016). Consistent resource renewal makes organisations responsive, and SC resources of an organisation should be transformed over time to respond to environmental changes (Aslam et al. 2018). From another view, SC's members need to share information with their partner consistently; it helps organisations to perform their processes in coordination and to respond to market fluctuations. Information system integration is imperative for quick information sharing, but the timing and relevance of exchanged information are also critical in a dynamic marketplace (Irfan, Wang & Akhtar 2019). By applying cloud computing, organisations can quickly integrate different IT resources and establish a shared collaborative environment with their SC's partners (Jun & Wei 2011). Thus, in a case that there is a need to change business relationships, cloud computing may have a positive impact on transforming ability. Moreover, a virtual integrated sharing environment provided by cloud computing can assist organisations in adapting their processes with partners quickly (Helo, Shamsuzzoha & Sandhu 2016). Hence, cloud computing integrative capability may have a positive impact on transforming capability, and the following hypothesis is proposed.

H_{1c}: *Cloud computing integrative capability is positively related to transforming ability*

It is fundamental to collect and process a large amount of data proactively to achieve agility. It can be enhanced by a number of IT-enabled capabilities such as IT flexibility;

specifically, IT flexibility is necessary when the environment is uncertain, and sudden changes may happen (Roberts & Grover 2012). IT flexibility supports organisations when quick reconfiguration in IT resources is required (Han, Wang & Naim 2017). Thus, applying flexible IT can help organisations to make a hedge against uncertainty and promote different aspects of DCs such as seizing capability. Cloud computing is a type of flexible IT which makes organisations able to perform massive, complex and flexible computing tasks without maintaining expensive hardware (Hashem et al. 2015). Additionally, utilising cloud resources can be adjusted based on changes and needs. The computational power of cloud computing can improve the forecasting ability of organisations throughout the CSC and equip them against environmental uncertainty (Chase 2013; Hassani & Silva 2015).

Moreover, cloud computing entails a sort of flexibility that users can have access to the system from various platforms and devices (Iyer & Henderson 2010). This feature may cause better knowledge and information sharing between SC's members and help organisations to deal with the uncertainty of the environment and at the same time, preserve agility. For example, it may help them to achieve real-time information about existing capacity and inventory, and make them able to act timely and wisely if it is required. Further, cloud computing is massively scalable in different aspects such as payments and privatisation options. Thus, organisations can tailor their IT resources regarding their needs (Schniederjans, Dara & Hales 2016). Moreover, affordable cost of IT and high level of flexibility may act as an incentive for suppliers and service providers to collaborate since it can reduce their collaboration costs in a case that it is required (Bakos & Brynjolfsson 1993). Thus, it may provide this opportunity for organisations to negotiate with their suppliers/service providers and implement their strategies toward preserving agility. Accordingly, the following hypothesis is proposed.

H_{2a}: *Cloud computing flexibility is positively related to seizing ability.*

In an uncertain environment, organisations can maintain or achieve competitive advantage by utilising flexibility. The DC theory explains that an organisation that poses DCs can alter its resources and reallocate them according to market demands (Teece, Peteraf & Leih 2016; Han, Wang & Naim 2017; Roberts & Grover 2012). Cloud computing can improve an organisation ability to employ IT infrastructures rapidly. Thus, the organisation can modify its IT resource usage quickly according to environmental changes and encounter new businesses and processes (Ali, Warren & Mathiassen 2017; Senyo, Addae & Boateng 2018). It should also be added that organisations can do this by affordable cost based on their demand (Schniederjans, Dara & Hales 2016). Another requirement for flexibility in an uncertain environment is information processing. The level of uncertainty determines to how extent information needs to be processed, and organisations need to capture opportunities in an uncertain environment flexibly (Luo & Yu 2016). Big data analytic power can help organisations perform better decision-making and improve their strategy against uncertainty. Analysing big data can provide advanced predictive insights into strategy implementation processes (Wang et al. 2016). Thus, if big data exploit appropriately, organisations can promote DCs, and transform their resources in alignment with changes proactively. One of the cloud computing advantages is computational power, and this capability may impact the transforming aspect of DCs.

Moreover, the flexibility of cloud computing can facilitate the development of new collaborations since organisations can build electronic linkages immediately with new SC's partners (Bhattacherjee & Park 2014). Therefore, cloud computing flexibility can make it easier to modify SC's structure and processes according to environmental changes, and the following hypothesis is proposed. Finally, according to the provided explanations, the descriptive conceptual framework of this research is presented in Figure 2-7.

H_{2b}: *Cloud computing flexibility is positively related to transformation ability.*

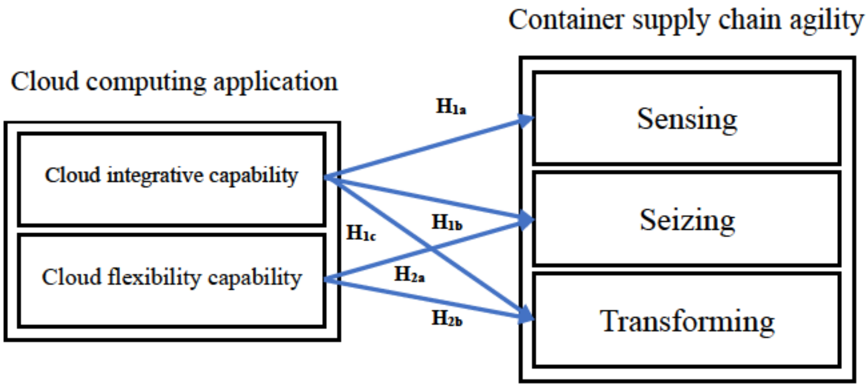


Figure 2-7: The descriptive conceptual framework of this research

2.12 Summary

In this chapter, the CSC and the significance of Australia in the CSC were explained. Also, it was realised that container transportation is an important part of the logistics process in the country. Moreover, agility was recognised as a capability which may enhance the CSC capability in addressing the changing environment and help it to work more efficient. Then, agility was discussed considering different perspectives including organisational agility and SCA. Next, SCA was elaborated according to DC theory dimensions including sensing, seizing and transforming. Also, it was realised that there is a gap in the literature to explore CSCA from the lens of DC theory; hence, to fill this gap each of these dimensions was explained in the context of the CSC. In the next stage, the crucial role of SCA enablers was explained, and IT was introduced as a critical SCA enabler. In the remainder of the chapter, cloud computing as a type of IT with some unique features such as scalability was explored. Further, it was realised that cloud computing technology might improve CSCA, and there is a gap in the literature to explore the possible existing relationships between cloud computing and CSCA. Thus, to cover this gap, the impact of cloud computing on SCA was discussed; also, the application of cloud computing in the CSC was explored. Accordingly, some hypotheses were proposed, and the conceptual framework was presented and discussed at the end. In the next step, it is required to apply a methodology to test the presented conceptual framework. The applied methodology is discussed in the next chapter.

Chapter Three: Methodology

3.1 Overview

The first chapter of this research explained research gaps, questions, objectives and contributions. In the second chapter, the literature about SCA, CSCA and cloud computing were explored. This chapter illustrates the research methodology employed to answer the research questions. Specifically, this chapter aims to identify cloud-enabled capabilities, CSCA dimensions and the relationship between cloud-enabled capabilities and CSCA by applying analytical techniques. To achieve such goals, the remainders of this chapter is organised as follows:

Section 3.2 discusses research philosophy and underpins this study's research strategy and design; section 3.3 explores research approach including issues such as research strategy and data collection tools and components; section 3.4 discusses different types of errors associated with applied methodology, and the techniques employed to deal with them; section 3.5 explains the data analysis tools and techniques; section 3.6 summarises this chapter.

3.2 Research philosophy

In this research, a comprehensive literature review was implemented to study agility and cloud computing. The literature review indicated three facts. Firstly, some studies explored cloud-enabled capabilities, but these capabilities should be verified in the context of the CSC by applying a quantitative method. Secondly, some scholars explored SCA dimensions, but there was no research to explain them in the CSC context; thus, this research intends to explain CSCA dimensions from DC theory perspective. Accordingly, some factors were extracted from the literature to measure CSCA dimensions, and a quantitative method was needed to verify these dimensions based on extracted factors. Thirdly, understanding the relationship between cloud-enabled capabilities and CSCA dimensions required a quantitative method. Hence, in this research, choosing methods was based on research needs, and it can be realised that pragmatism is one of this research' philosophies.

Moreover, the explanatory findings of this research relied on the objective investigation of agility dimensions, cloud-enabled capabilities and relationship between these two groups of variables. Also, understanding the relationship between variables needed to collect information from people who were active in the CSC section, and their opinions were interpreted objectively; thus, another philosophy that this research follows is post-positivism. As it was explained, a quantitative methodology was used to verify extracted factors in the CSC context and relationships between them, which was associated with a deductive approach.

3.3 Research approaches

Research approaches can be categorised in two groups of inductive and deductive (Saunders, Lewis & Thornhill 2016). In the deductive approach, hypotheses are tested in a domain which may be accepted or rejected by using practical data. In contrast, in the inductive approach, a researcher uses practical findings to construct a theory (Saunders, Lewis & Thornhill 2016). In the deductive approach, the researcher starts with abstract concepts alongside propositions that outline the logical connection among concepts. In the next step, the researcher goes from ideas, theory or a mental picture toward observable empirical evidence (Neuman 2014). According to Saunders, Lewis and Thornhill (2016, p.146), a deductive approach is implemented through six sequential steps as follows.

1- Raising an idea or a set of hypotheses to build a theory.

2- Using existing literature and deducting a number of testable propositions.

3- Comparing raised arguments with existing theories to see whether it offers and advance understanding or not. If it is positive, then continue.
4- Testing propositions by gathering data to measure variables and analyse them.
5- If the test fails, which means the results of the analysis are not consistent with the assumed propositions, the constructed theory is false and must be rejected or refined, and the process restarted.
6- If the test is confirmed, it means the theory will be accepted.

In this research, the literature was reviewed, and a conceptual framework was established. Comparing this with existing literature revealed that the proposed conceptual framework could advance understandings in related areas. In the next step, the data should be collected to measure variable and analyse them. In addition to the research philosophy and approach, conducting this research was influenced by research design.

3.3.1 Research strategy

As mentioned, the selected strategy to conduct this research is quantitative. Quantitative research is a strategy for testing objective theories by exploring relationships among different variables by applying statistical methods (Creswell & Creswell 2017). Quantitative research usually is conducted by applying methods such as a survey questionnaire or structured interviews. In these types of research, a researcher reaches many people and contact a large cohort of participants (Dawson 2019). The method relies on collecting and measuring numerical data and generalising the finding by applying statistical analysis (Neuman & Neuman 2006).

Generally, research questions, research objectives, existing knowledge on the topic, availability of resources and research philosophy guide research strategy selection (Saunders, Lewis & Thornhill 2016). There are several reasons why quantitative method design was selected for this research. As explained before, this research follows a deductive approach which is associated with a quantitative method (Saunders, Lewis & Thornhill 2016). A quantitative strategy helps to gather first-order data in a form that can be analysed to define the impact of cloud-enabled capabilities on CSCA. Moreover, based on DC theory, three dimensions of sensing, seizing and transforming have been used for CSCA which need to be verified by a quantitative method in the context of CSC. Furthermore, cloud computing can create integration and flexibility in CSC activities; applying quantitative methods can assist in exploring to what extent these capabilities were effective in the CSC. Additionally, it is important to use an appropriate instrument to conduct this research.

Given the use of quantitative or qualitative methodologies, research can be conducted by using a wide variety of instruments such as experimental design, survey, archival and documentary search, and case studies (Saunders, Lewis & Thornhill 2016). Each of the introduced strategies can be applied to the nature of the research. A survey is one of the most popular instruments for data gathering in social science (Neuman 2014). This research adopts the survey for data gathering strategy. In the next section, the survey is discussed. Also, it is clarified why the survey is the best fit in this research.

3.3.2 Survey

Survey is one of the tools in implementing social research and grew within a positivist approach to social science (Neuman 2014). It allows easy collection of standardised data from a population in a highly economical fashion (Saunders, Lewis & Thornhill 2016). According to Bhattacherjee (2012), the survey may have some strengths compared with other research methods as follows:

- The survey is an excellent tool to measure a wide variety of unobservable data such as people preference.
- It is suitable for collecting data from a large population remotely.
- It is economical considering time, cost and efforts compared with other methods such as case study.
- The survey allows covering a large area by applying e-mail, telephone and ensures that population characteristic is adequately represented in a small sample.

Moreover, according to Trochim and Donnelly (2015), there is some number of guides about different components of a survey such as population issues, sampling issues, question issues, content issues, bias issues and administrative issues that guided us to choose the most suitable survey type. For a population, a list of units that will be sampled should be available. Also, the cooperation of population, their literacy, and geographical restrictions are important hints that should be considered. For sampling, respondents should be available and accept to answer survey questions. For questions complexity, types of questions, length of questions and scale should be considered. Also, respondents' knowledge about the contents of questions should be considered. Bias issues include the ways to minimise raised bias through the survey which some of them are, avoiding social desirability and false respondents, controlling interviewer's distortion and subversion (Trochim & Donnelly 2015). Administrative issues concern the feasibility of a survey regarding available time, facilities and personnel (Trochim & Donnelly 2015). All these issues need to be considered in deciding whether the survey is a suitable approach for a research project or not.

This research mainly needed a quantitative method to observe a large number of related population. A web-survey is an appropriate tool to collect a large amount of information and explain causal relationships. Moreover, the target population of this research contains the members of the CSC, which are geographically dispersed across Australia, and the web-survey can assist in accessing them. Furthermore, resources such as time and cost are limited to complete this research. The web-survey can provide this opportunity to implement this research with a low cost and high speed. Also, the web-survey allows adding more indexes to CSCA dimensions and cloud-enabled capabilities by applying open-ended questions. To achieve abovementioned goals, the unit of analysis and sampling strategy should be determined.

3.3.3 Unit of analysis

The unit of analysis refers to the unit of data collection (Yin 2015). It is in various forms such as groups, people, social interactions, and geographical units. Hence the unit of analysis may be a single unit or collective, and its definition is affected by different factors such as the nature of data to be collected and the objective of the study (Zikmund et al. 2012).

SC scholars often generalise their findings of agility to the SC as a whole without any specific details to support this generalisation (Fayezi, Zutshi & O'Loughlin 2015). However, what remains unclear is how companies in the CSC perceive the concept of agility in their supply chain activity as well as the impact of different factors such as cloud computing on the CSCA. Thus, to explore this issue, the main role players should be recognised in the CSC context.

Container transport is one of the major activities of the CSC that is the transport of a container unit by a combination of truck, rail, barge and ocean vessels. In such a system, the relative advantage of every transport mode can be combined to provide efficient possible service (Iannone, Thore & Forte 2007). Since the main objective of this research is explaining the impact of cloud computing on the CSCA in Australia, the unit of analysis includes shipping line companies/agencies, freight forwarders, ports, and container logistics companies which are active in this industry. Freight forwarder companies, shipping lines (which shipping agencies are their representative), ports, and container logistics companies are the most pivotal parties in container haulage engaged in ocean and inland haulage of container throughout the CSC (Iannone, Thore & Forte 2007; Suk-Fung, Sun & Bhattacharjya 2013).

3.3.4 Population and sampling

A researcher needs an appropriate sample. Choosing a sampling strategy depends on research questions, method and available resources (Tashakkori & Teddlie 2010). The goal of sampling is selecting elements from a population to provide a reliable conclusion about that population (Cooper, Schindler & Sun 2006). A target population is a record of elements in the population that a scholar can easily access and select a sample from (Creswell & Creswell 2017). In other words, it can be defined as a list of elements of the population from which the sample is selected and choosing an appropriate target population can enhance the credibility of the research outcomes (Couper 2011). Figure 3-1 highlights the definitions of population, target population and sample.

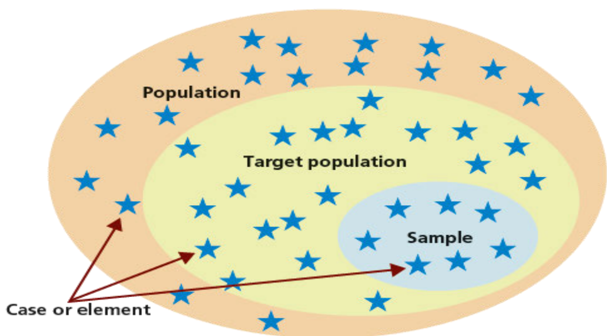


Figure 3-1: Population, target population, and sample

Source: Saunders, Lewis & Thornhill (2016, p.275)

In social science research, there are two types of sampling techniques, including probability and non-probability (Becker, Bryman & Ferguson 2012). The probability sample is a sample that is selected by applying random selection so that each element in a target population has a known chance of being selected (Bryman 2016). In contrast, a researcher may need to undertake an in-depth study that focuses on a small number of elements; in such cases, non-probability sampling methods may be applicable (Saunders, Lewis & Thornhill 2016).

SC managers, senior managers, general managers, business owners and logistics experts involve in SC's activates and decision-making process, and they have pivotal role and knowledge about SC's problems (Mangan & Christopher 2005). Thus, they would be able to competently answer research questions about CSCA and capabilities that cloud computing application can create in organisations within the CSC. Accordingly, for this research, an initial list of possible participants was prepared. The list was based on skimming the websites of Australian peak shipper's association, shipping Australia, Australian ports and Company360 database. The size of the target population is about 737 including supply chain managers, senior managers, general managers, business owners or logistics experts of 27 shipping agencies/companies, 550 freight forwarders, 10 ports which have container operation, and 150 container logistics companies. With regards to ports and shipping agencies data can be collected from the target population; thus, there is no need for sampling, but the size of the target population in freight forwarders and container logistics companies is large; thus, it needs probability sampling strategy to be adopted. Accordingly, to have an appropriate portion of elements of each group, a stratified random sampling strategy is applied for these two areas.

Stratified random sampling is a modification of random sampling in which a researcher divides a target population into two or more strata based on each strata's attributes. Then, random sampling is drawn from each stratum (Saunders, Lewis & Thornhill 2016). In this research, the target population in the areas of freight forwarders and container logistics companies forms two strata and, in each stratum, a simple random sampling strategy is applied. Therefore, firstly, it is required to know the total sample size.

It should be considered that increasing the size of a sample increases the likely precision of the sample. Therefore, an important part of the decision about sample size should be how much sample error is tolerable for a researcher (confidence level). The less sampling error needs a larger sample size (Bryman 2016). This is suggested as an important factor within the literature (Bell, Bryman & Harley 2018; Creswell & Creswell 2017; Saunders, Lewis & Thornhill 2016). Researchers typically work to a 95 per cent level of confidence. It means if a sample was selected 100 times, at least 95 of these samples would be certain to represent the characteristics of a target population (Saunders, Lewis & Thornhill 2016). In this research, the confidence level of 95 per cent is used, and according to Morgan Table, the total required sample size is 252 (Krejcie & Morgan 1970). The sample size for each stratum is calculated based on its population size ratio (Fowler 2013). It means 197 companies should be chosen randomly among freight forwarder, and 55 companies should be chosen randomly among container logistics companies. Table 3-1 presents the target population and sample sizes.

Table 3-1: Target population and sample size

Sector	Target population size	Sample size
Shipping companies/ agencies	27	27
Freight forwarder companies	550	197
Ports	10	10
Container logistics	150	55

3.3.5 Web survey instrument design

The web as a survey tool became fully operational only when modern web browsers appeared alongside advancement in web browser graphical advancements. From the 2000s with the introduction of web 2.0, web survey applications were developed, and respondents could be accessed using various gadgets such as laptops, computers, and mobiles (Callegaro, Manfreda & Vehovar 2015). This improvement in web decreased cost and enhanced speed in web-survey implementations (Callegaro, Manfreda & Vehovar 2015). SurveyMonkey was the application used to implement an online survey for this research.

3.3.6 Web-survey questionnaire

SurveyMonkey is a self-administrative software. It means that respondents can flexibly complete it. It has different modules that allow a user to design and distribute an online questionnaire. SurveyMonkey enables a convenient, user-friendly data collection. Also, it is suitable for respondents since they can answer the online questionnaire at their own pace, wherever and whenever they choose. Further, it can provide time and geographic flexibility (Callegaro, Manfreda & Vehovar 2015). Regarding these advantages, web-survey is a proper tool to implement this research. Although web-survey also has some disadvantages.

Exploiting existing advantages needs a researcher to avoid some pitfalls such as multiple open-ended questions, and long questions in designing the web survey instrument. This is because multiple open-ended questions may cause a low response rate (Archer 2008). Additionally, poor question wording and presentation on the web may cause misunderstanding of respondents and lead to incorrect responses. It also may demotivate participants and make them drop off the web survey process. Thus, the researcher should avoid vague questions and keep questions simple (Fan & Yan 2010). In this research, care was taken to avoid common design pitfalls. Specifically, this issue was considered as an important measure in the pre-test process.

Furthermore, the web-based instrument was segmented into parts with explanations provided at the headlines to guide respondents. Also, several questions were organised per screen to decrease the needed time to complete the survey and diminish the number of unanswered questions. Moreover, to improve readability, people without an interest in the topic were recruited as participants of the web-based instrument pre-testing. Also, in the pre-test process, different pitfalls such as long questions were addressed. Finally, after pre-testing process, the web-survey questionnaire was proofread by a professional proof-reader to avoid possible wording mistakes. The web survey instrument of this research was arranged in three main sections.

- Section one: Respondent’s profile.
- Section two: CSCA dimensions.
- Section three: Cloud-enabled capabilities.

Section one intends to collect demographic information about respondents’ companies such as company’s type, the position of respondent in his/her company, company’s annual revenue and the number of employees. The demographic information helps to categorise companies and realise differences between each category based on the analysis of the collected information. Section two intends to gather information about CSCA. This section is constructed from three subsections. The first subsection of section two focuses on transformation ability. This refers to an organisation's ability to adjust to a new condition after changes happen in the business environment. This ability helps an organisation to achieve agility. In the second subsection of section two, respondents are asked to answer questions about sensing ability as one of the CSCA dimensions. This section intends to measure organisations' ability to monitor the market consistently to explore market opportunities and threats. In the third subsection of section two, respondents are asked to answer questions about the seizing ability which intends to measure organisations' ability to implement jobs in a way that allows dealing with environmental uncertainty and preserving agility.

Section three examines cloud-enabled capabilities in organisations. The cloud-enabled capability is a second-order construct that depends on two first-order variables of cloud integration and flexibility. Thus, this section was divided into two subsections, and each subsection focuses respectively on cloud integration and cloud flexibility.

3.3.7 Question types and questionnaire description

In this research, different types of questions were used to gather various types of data. Open-ended questions can obtain deeper understandings of respondents. However, most of the web-survey questions are closed-ended questions because an excessive number of open-ended questions can reduce the response rate of the survey (Dillman, Smyth & Christian 2014). In this research, the open-ended questions were arranged at the end of each section of the web survey instrument to enable respondents to provide further information on the investigated topic. Table 3-2 presents closed-ended questions, their source and coding. Also, the questionnaire is provided in Appendix C.

A five-point Likert scale was adopted for multiple-choice close-ended questions with the aim of measuring the level of agreement among respondents. The Likert scale consists of a series of related statements. A balance of both positive and negative items is generally advised to decrease response-set bias (Willits, Theodori & Luloff 2016). Thus, in this research, the most common five-point Likert scale including terms of “strongly agree”, “agree”, “neither agree or disagree”, “disagree” and “strongly disagree” were used (Willits, Theodori & Luloff 2016).

Using a mid-point scale provides an option for respondents who have a neutral opinion. Therefore, respondents don’t feel forced to select an option in contrary to their opinion, and it can reduce the chance of bias (Chyung et al. 2017; Croasmun & Ostrom 2011). The reason for frequent use of Likert scale in social science is the phenomenon that to be measured most often can be measured by nominal scales (Subedi 2016). Moreover, the Likert scale is widely used in web-surveys’ questions and has facilitated quick data collection from respondents (Carifio & Perla 2007).

Table 3-2: Questionnaire sources and coding

Container supply chain agility (CSCA) construct			
Subconstruct	**Source**	**Relevant literature**	**Measures**
Sensing	Reflected	Fang et al (2014), Tseng and Liao (2015), Notteboom and De Langen (2015)	Tracking competitors ‘tactics and strategies (Sensing1)
	Adopted	Fang et al (2014)	Learning about the macro environment (Sensing2)
	Reflected	Prokopowicz and Berg-Andreassen (2016), Saxon and Stone (2017)	Learning about market trends (Sensing3)
	Adopted	Song et al (2015)	Devoting time for new service development and evaluating existing services (Sensing4)
	Reflected	Teece (2007)	Scanning the environment to identify opportunities and threats (Sensing5)
Seizing	Reflected	Brusset and Teller (2017), Rashed et al (2018), Polat and Günther (2016), de Bok et al (2018)	Forecasting future market trends (Seizing1)
		Yuen et al (2019), Yang (2016), Wong et al (2012)	Negotiating with service providers to obtain their commitments in the case of a significant increase in demand (Seizing2)
		Wang, Y, Gilland and Tomlin (2010), Angkiriwang, Pujawan and Santosa (2014)	Employing the same services from different service providers (Seizing3)
		Lai, Xue and Hu (2019), Chen et al (2017), Angkiriwang, Pujawan and Santosa (2014)	Setting an optimised capacity in a way that be able to respond to sudden changes in customer demands (Seizing4)
Transforming	Reflected	Caschili and Medda (2012), Panayides and Wiedmer (2011)	Cooperating with new partners to achieve operational efficiency (Transforming1)
		Thai (2016), Wen and Lin (2016), Kolar and Rodrigue (2018)	Changing service providers according to changes in customers demand (Transforming2)
		Wang, Meng and Liu (2013), Kim and Lee (2015), Vernimmen, Dullaert and Engelen (2007)	Modifying operational time according to changes in the operational time of other members (Transforming3)
		Edirisinghe, Zhihong and Wijeratne (2016), Dong, Lee and Song (2015), Jeevan et al (2015)	Modifying the required capacity to align with changes in customers' demands (Transforming4)
Cloud-enabled capabilities construct			
Subconstruct	**Source type**	**Relevant literature**	**Measures**
Cloud integration	Reflected	Jun and Wei (2011)	Applying cloud computing to establish a shared collaborative virtual environment with partners (Cloud_integration1)
		Mehrsai, Karimi and Thoben (2013)	Applying cloud computing to utilise shared software with partners to implement supply chain processes mutually (Cloud_integration2)
		Liu et al (2018)	Applying cloud computing to share information with partners consistently (Cloud_integration3)
		Ardito et al (2018)	Using cloud computing as a part underlying technology for integrating supply chain processes (Cloud_integration4)
Cloud flexibility	Reflected	Addo-Tenkorang and Helo (2016)	Applying cloud computing to enhance the capability of utilising big data and dealing supply chain environmental changes (Cloud_flexibility1)
	Reflected	Iyer and Henderson (2010)	Using cloud computing as a scalable technology in alignment with fluctuations in needs (Cloud_flexibility2)
	Adopted	Liu et al (2018)	Applying cloud computing to address new business relationships (Cloud_flexibility3)
	Reflected	Iyer and Henderson (2010)	Using cloud computing to access required information technology services at a low cost (Cloud_flexibility4)
	Reflected	Iyer and Henderson (2010)	Accessibility of cloud computing from any platform and device (Cloud_flexibility5)

3.3.8 Pre-testing of the survey

To enhance readability and decrease errors, the survey instrument was pre-tested before sending it to respondents. The pre-test implementation is critical to identify any weaknesses and bias before the survey implementation (Zikmund et al. 2012). Due to the inherent benefits of pre-testing, it is a significant part of the survey process in any case (Rea & Parker 2014).

The web-survey instrument of this research was pre-tested using ten participants, including graduate students, academics, professionals and people from out of the context of the research. It includes three lecturers in Australian Maritime College (AMC), University of Tasmania, two lecturers from Waikato and Monash management schools with relevant backgrounds in logistics and agility, three PhD graduates, a management consultant and one person out of context. It was essential to recruit an appropriate combination of people with different backgrounds to pre-test the survey instrument to make sure that the wording is understandable or not.

After preparing a list of eligible people and an invitation letter, a package, including a hard copy of the web-survey questionnaire, a pre-testing letter and an information sheet was sent to pre-test sample. The main goals of pre-test were to make sure about question understandability and to refine them (Bryman 2016; Saunders, Lewis & Thornhill 2016). Received comments from pre-testing participants were mainly about the ambiguity of some questions, length of some questions and some suggestions about wording issues. The web-survey instrument was revised based on the received feedback to enhance validity and clarity.

3.3.9 Research ethics

In social science research, obtaining Human Research Ethics approval is necessary before starting the data collection process. Ethical codes in social science include different issues such as honesty, objectivity, carefulness, openness, confidentiality and social responsibility (Resnik 2011). In the University of Tasmania (UTAS), the authority of ethics approval is by Human Research Ethics Committee Network (HREC), and the Tasmania Social Sciences (SS HREC). Moreover, The National Statement (NS) on Ethical Conduct in Human Research (Health & Council 2007b) and the Australian Code for the Responsible Conduct of Research (Health & Council 2007a) are resources that contain the requirements of ethics proposal for SS HREC. The following activities were performed to receive the SS HREC approval.

- Defining the risk level of the research.
- Completing the required application form, information sheet, consent form, invitation letter, and web survey questionnaire.
- Submitting the ethics' documents to the ethics committee for approval.
- Responding to the ethics committee's comments and resubmitting the application.
- Receiving ethics approval.

After SS HREC approval for the research project, the researcher began data collection process by applying the web survey.

3.3.10 Data collection administration

In this research, data collection was implemented in two ways. Firstly, if the information of potential respondents was available in the official website of companies, an invitation e-mail containing the information sheet, and a web link that instructed them to the web survey was sent to invite them to participate in the survey. If no information was available on the website, alternatively, potential respondents were contacted through their LinkedIn webpage, and a message containing the questionnaire web link was sent to invite them to participate in the web survey. All responses were collected on the SurveyMonkey database. Also, the information was posted anonymously online, although the demographic questions were enough to analyse the characteristics of respondents. The SurveyMonkey information collector was set to block multiple responses from participants and allowed participants to return at any time to complete or modify incomplete questionnaire for more flexibility. After two and four weeks, the first and second reminder messages were sent. All reminder messages contained the web-survey link and the notification sentence to capture respondents' attention.

3.4 Error control

One of the significant issues in social science research is reducing bias and errors. Failure in addressing errors can cause validity and reliability issues (Zikmund et al. 2012). Thus, it is necessary to identify the source of errors throughout the entire research process. Generally, two types of error may exist in a survey, namely sampling error and non-sampling error (Bryman 2016). Sampling error stems from the used sampling method, and a researcher should define a research population, unit of analysis and elements accurately in a way that serves the aim of the research (Gideon 2012). The non-sampling error stems from deficiencies such as poor question wording, or flawed data process (Bryman 2016). An accumulated error stems from sampling, and non-sampling refers to total survey error. In research, the major source of errors should be identified so that the survey resources can be allocated to reduce the errors as far as possible (Groves & Lyberg

2010). Therefore, in this research, appropriate approaches were employed to decrease the total survey error as they are discussed in the two next sections.

3.4.1 Dealing with sampling errors

Sampling errors can be rooted in the sampling scheme and sample size (Groves & Lyberg 2010). In this study, as the parties of the CSC are numerous, unnecessary elements were excluded from the target population, and the most significant companies that have a critical role in the CSC were included in the target population to reduce sampling scheme error. Moreover, the target population was divided into different groups containing similar elements, so that all groups were represented in the sample, and the sampling scheme error was diminished. Moreover, random sampling helped the researcher to keep sampling error to a minimum through surveying a large number of the target population with an acceptable confidence level (Bryman 2016).

3.4.2 Dealing with non-sampling errors

Non-sampling errors may derive from different resources containing response and non-response errors. Response errors refer to any errors that occur due to untrue or incorrect information. Response errors can stem from issues such as the order of questions, respondents' social desirability or even ambiguity in the research topic. On the other hand, non-response errors derive from simple refusals of answering a questionnaire because of issues such as illiterate respondents and not understanding of the questions (Gideon 2012).

In this research, sets of techniques such as designing an appealing questionnaire, applying well-known survey application of SurveyMonkey and arranging a suitable number of questions in each web page were used to decrease non-response errors (Dillman 2011). Furthermore, using random sampling techniques for recruitment of participant (Alvarez

& VanBeselaere 2003), and sending two reminders to non-respondents every two weeks helped the researcher to decrease non-response errors (Dillman 2011). The survey objective is to ask questions to which respondents provide accurate answers. Therefore, one of the challenges is to design proper survey questions that can measure the concept of interest and decrease response errors. To achieve such a goal, unclear questions, as well as questions that may encourage a certain response, were avoided (Dillman 2011). A comprehensive pre-test was conducted to assure the abovementioned criteria in the designed questionnaire. Particularly, the conducted pre-test helped to modify poor question wording and ambiguous questions, which improved the content validity of the survey and reduced non-sampling errors.

3.4.3 Managing non-response bias

When the target population do not respond to a survey, it may result in non-response bias. Since if respondents had responded, their responses would have impacted the survey results (Groves 2006). It is impossible to calculate a true no-response bias since no responses exist from non-respondents to understand to what extent their responses are different from the respondents' answer (Groves 2006). However, some methods are suggested for non-response bias estimation such as wave analysis and follow up analysis.

In wave analysis, late respondents' responses (those who respond after sending the reminder) are considered as proxies for non-respondents. The responses which are returned in the last wave of survey responses (for example, response after the first e-mail reminder) are compared to those in the first wave of responses (for example, the initial invitation to participate) (Phillips, Reddy & Durning 2016). This method is a common, well-accepted, and straightforward technique and researchers can use this to demonstrate whether their research suffers from non-response bias (Park & Fesenmaier 2012). Follow up analysis is another applicable method.

In the follow-up analysis, researchers contact potential respondents in the population of interest who haven't participated in the research and conduct a concise survey, including one or two crucial survey's questions. The follow-up respondents are considered as proxies for non-respondents (Phillips, Reddy & Durning 2016). In this method, it is often difficult to achieve a large enough number of follow-up respondents. Moreover, this method doesn't provide complete information such as demographic or secondary survey's questions to compare the results with the original sample. In contrast, in the wave analysis obtaining a large complete number of proxy responses is easier and quicker. Thus, in this research, the wave analysis was applied to deal with non-response bias, which the results are presented in the next chapter.

3.5 Overview of applied data analysis techniques

Data analysis is a systematic use of methods to describe and evaluate collected data. It is a significant and beneficial part of a study. For examples, it can help to structure the collected data from various source of data collection; it can assist in breaking a major problem into minor problems; it is a beneficial tool in filtering unnecessary data; also, it can help to recover missing data and minimise human bias (Hair et al. 2013). In this research, a spectrum of techniques and methods were applied to analyse collected data by the web-survey instrument. The key statistical and non-statistical techniques used to analyse and interpret data are explained in the followings.

3.5.1 Factor analysis and structural equation modelling

Exploring the relationship between variables is an important part of any scientific filed. In order to study variables scientifically, it is needed to define the relationship between them (Comrey & Lee 2013). The factor analysis (FA) can help to achieve relationships between variables mathematically. FA helps to model the covariation among a set of observed variables as a function of one or more constructs. The main goal of FA is to help a researcher to understand the nature of latent constructs underlying variables of interest (Bandalos & Finney 2018). Confirmatory factor analysis (CFA) and exploratory factor analysis (EFA) are two important types of FA techniques. CFA allows a researcher to test the relationship between observed variables and their underlying latent constructs. In the CFA, a researcher postulates relationship and patterns as a prior and then tests them statistically.

In contrast, EFA helps the researcher to identify constructs and underlying factors without any prior postulation (Comrey & Lee 2013). Both CFA and EFA rely on the same estimation methods such as maximum likelihood. However, while EFA is an exploratory procedure, in CFA the researcher must identify all aspects of a factorial model including, the number of factors, factor loadings and so forth (Brown 2014). In the current research, firstly, EFA was used to explore the underlying constructs of variables; then CFA was applied to modify and control the fitness of the extracted model. After implementing FA, the structural equation modelling (SEM) was applied to test the proposed hypotheses.

SEM applies different types of models to explore relationships among observed variables quantitatively. In other words, SEM makes it possible to test various theoretical models that hypothesise how variables define constructs and how constructs are related (Lomax & Schumacker 2004). SEM is an inference method that takes three inputs including a set of qualitative causal hypotheses based on a constructed theory, a set of questions about the causal relationship among variables of interests, and data. It also generates three outputs including numerical estimates of the model parameters for hypotheses testing, the degree to which testable implications of the model are supported and a set of implications such as relationships among variables that can be tested in the data (Kline 2015).

3.5.2 Content analysis

Open-ended questions were used as parts of the online questionnaire of this research; thus, it was required to analyse collected qualitative data. Content analysis is the mothed used as a support to achieve such a goal. Content analysis is a systematic method of describing phenomena. There are two types of content analysis including deductive and inductive (Elo & Kyngäs 2008). The deductive approach is employed when the goal of the study is to test a theory or framework formulated based on existing literature (Elo & Kyngäs 2008). In contrast, the inductive approach is applied when the literature is fragmented in a specific area (Elo & Kyngäs 2008). Based on the structure of this study, it was more appropriate to use an inductive approach since this research intended to explore new factors in the areas of cloud-enabled capabilities and CSCA. According to Elo and Kyngäs (2008), content analysis can be conducted in three steps including perpetration, organising and reporting.

In the preparation stage, a researcher selects a unit of analysis. Unit of analysis refers to different types of research objects such as a community, organisation, interviews and parts of the text that are coded (Graneheim & Lundman 2004). In this research, the responses to open-ended questions were considered as the unit of analysis.

The organising phase (data analysis) is started after the preparation stage and is conducted using the inductive approach. The organising phase contains three stages of open coding, creating categories and abstraction (Elo & Kyngäs 2008). At the first step, all statements made by respondents are read through, and some headings are written down to describe all aspects of the content (Hsieh & Shannon 2005). In the next step, open coding is implemented by coding responses to the open-ended questions as notes and bullet points (Hsieh & Shannon 2005). It should be considered that some categories are recurring, and some of them are mostly agreed among respondents. It is recommended to group them under the same heading (Burnard 1991). At the next step, the abstraction process is conducted (Elo & Kyngäs 2008; Graneheim & Lundman 2004). In this stage, each category is named using content-related words. This process is continued by applying multiple checking and coding comparison. Multiple checking involves rechecking node descriptions and modifying them to make them clear and more understandable. Through this process, in some cases, node descriptions are modified to narrower or wider descriptions and fit nodes with respondents' statements. Also, coding comparison involves reviewing the nodes to combine and divide them into better understandable nodes. The results of the analysis for each main construct are discussed in the data analysis sections.

3.6 Summary

In this chapter, research methodology adopted to gather data from the related target population in Australia was discussed, and justification was provided for selected data collection method (web-survey) by explaining its applicability to the research questions of this research. Also, the factors related to web-survey instrument pre-testing and data-collection administration were discussed. Suitable strategies to deal with the survey errors were explained, and data analysis techniques were explored at the end. The next chapter discusses the analysis of collected data and statistical methods that were applied for data analysis.

Chapter Four: Data Analysis

4.1 Overview

This chapter aims to describe the application of analytical and statistical tools in evaluating the collected data to discover useful information. This chapter was organised as follows to discuss data analysis processes:

Sections 4.2 presents the response rate; section 4.3 discusses the demographics of the survey's respondents by applying suitable tools such as charts and tables. Data preparation process including the management of missing values and non-response biases and different statistical tests are presented in section 4.4. Section 4.5 discusses the reliability and validity of constructs of the conceptual framework based on appropriate methods. Section 4.6 presents the results of the EFA application to modify constructs based on collected data in the CSC. Section 4.7 provides information about fitness criteria of the model, and the results of path analysis by applying SEM to understand the relationship between variables. Section 0 4.8 discusses the results of analysing qualitative data collected by open-ended questions, and section 4.9 presents a summary of this chapter.

4.2 Response rate

The target population of this research were the main CSC's players. A total of 134 responses were received related to each sector of the CSC. Table 4-1 presents the response rate for each type of company. Also, Figure 4-1 depicts the response rate information (as per Table 4-1) considering each stratum and the total collected responses.

Table 4-1: Response rates for the web-based survey

Type of company	Responses	Target population	The sample size of each stratum	Total Per cent in each stratum	Per cent in total
Port	5	10	10	%50	1.7%
Land transport	30	150	55	%54	10%
Freight forwarder	80	550	197	%40	28%
Shipping companies/agencies	10	27	27	%37	3.5%
Others	9	-	-	-	3.1%
Total	134	737	289	-	46%

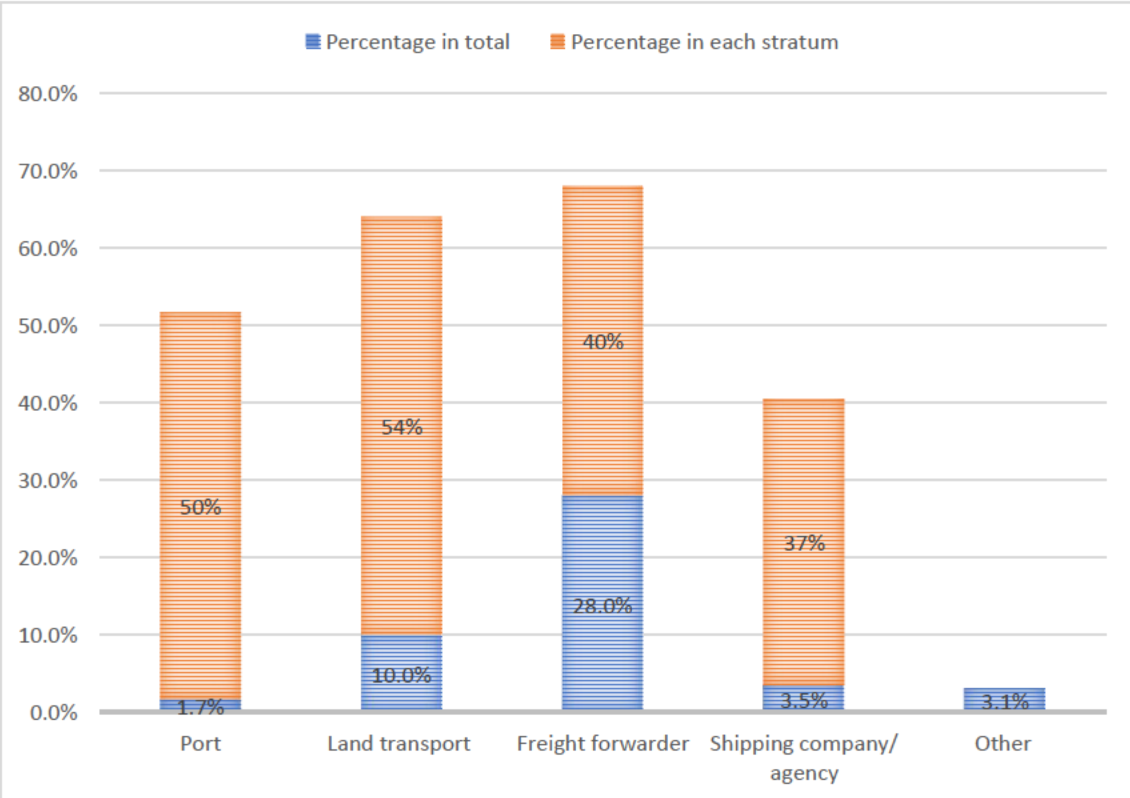


Figure 4-1: Response rate for the web-survey

4.3 Demographics of the survey respondents

Respondents' demographics include the respondent's position in the company, years of experience, types of organisations and their annual revenues. Demographics help to understand respondents' characteristics and to analyse any potential difference among CSC stakeholders.

Figure 4-2 depicts the respondents' position demographics. Most of this research's respondents are among general and senior managers. They are mainly engaged in the strategy-making process. Further, technology and agility are among significant strategical concerns, and it should be considered that a general manager is the only executive who can commit the entire organisation to a particular strategy and general managers are invariably involved in strategy formation, and they have a strategic vision for each business. Also, senior managers play significant strategic, operational and leadership related roles. Thus, the large number of senior and general managers participation can have a positive impact on the reliability of this research's outcomes.

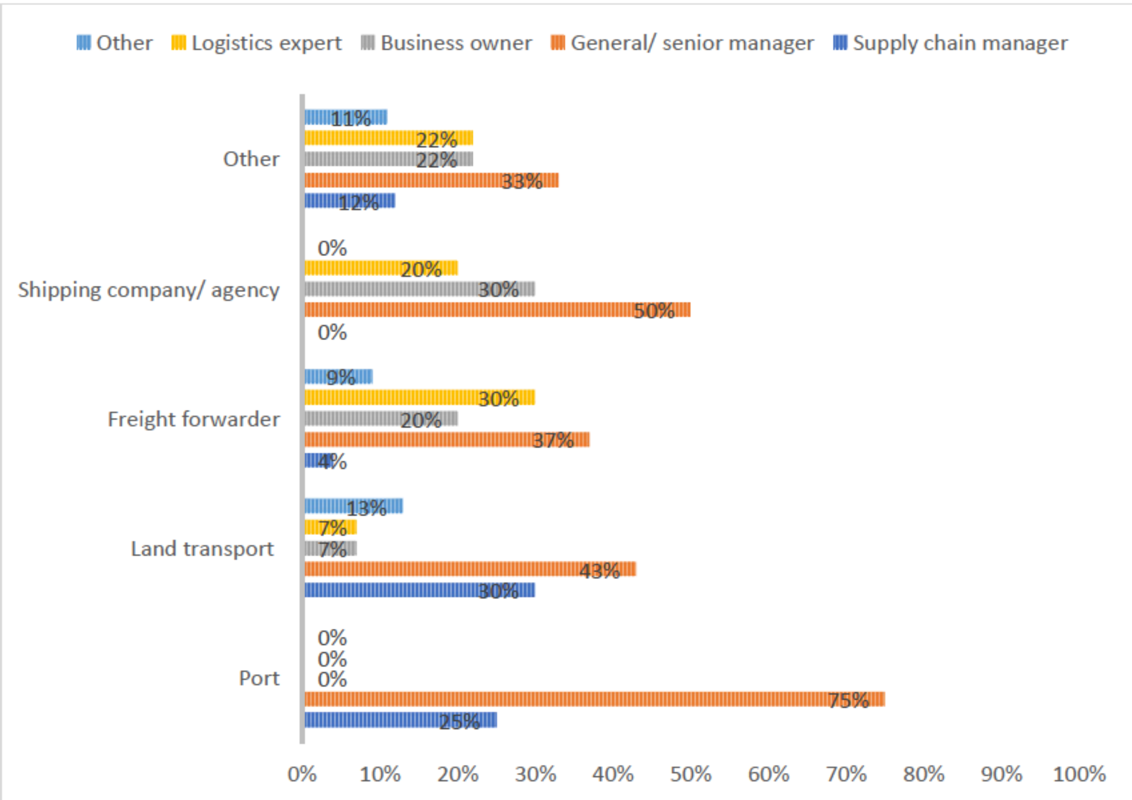


Figure 4-2: Respondents' position

Figure 4-3 depicts the demographics of respondents' years of experience. Highly experienced respondents can enhance the precision of this research's outcomes. In this research, in each stratum, 50% of participants have at least 5 years of working experience. Also, the most experienced respondents pertain to land transport companies. In this stratum, 63% of participants have at least 9 years of working experience. Also, 35% of participants in freight forwarders stratum have working experience less than 5 years and freight forwarder stratum has the first rank considering respondents with less than five years of working experience.

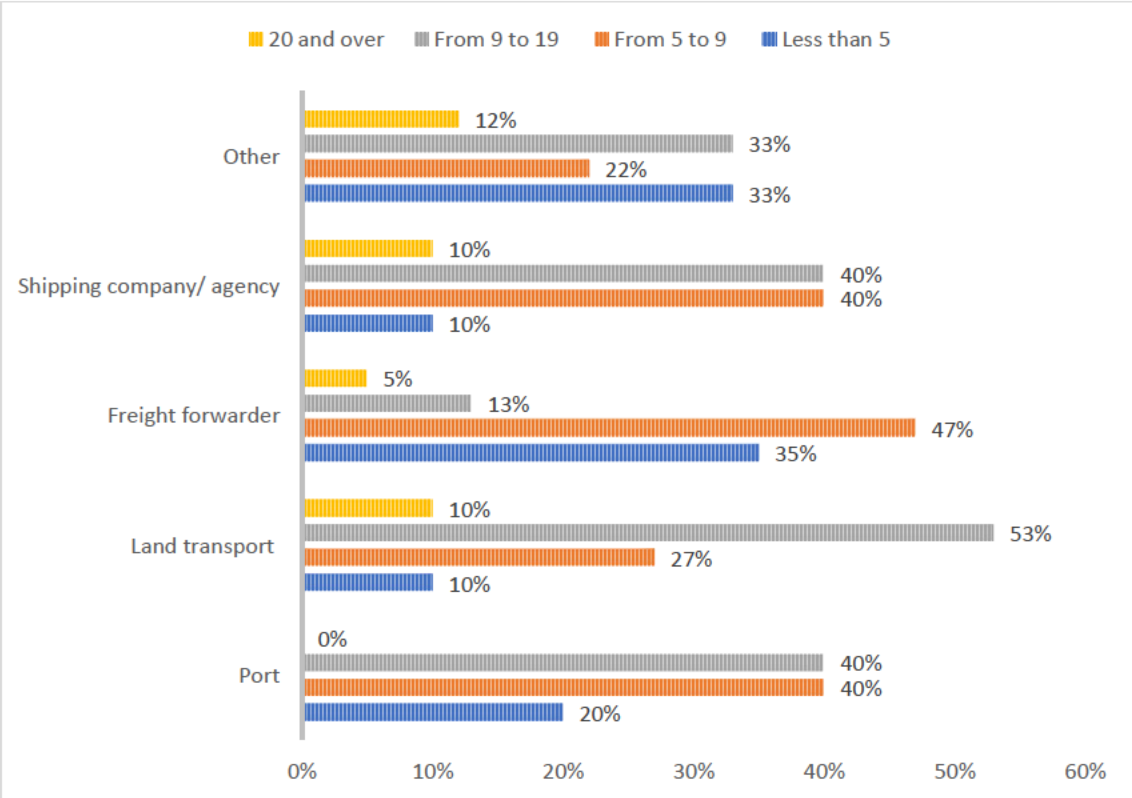


Figure 4-3: Respondents' years of experience

Figure 4-4 depicts the demographics of full-time employees among different categories. 40% of ports have more than 200 employees which considering volume and extensive activities of ports seems logical. The most of land transport and freight forwarder companies are small and medium businesses with the number of employees between 5-199. The most shipping companies/agencies are among medium and large businesses. Although 20% of shipping companies/agencies and freight forwarders are among micro-businesses, and it shows the range and volume of activities that these two groups of companies perform are highly flexible. It means, shipping companies/agencies and freight forwarders may act as micro-businesses with limited tasks, or they may act as large businesses with extensive activities.

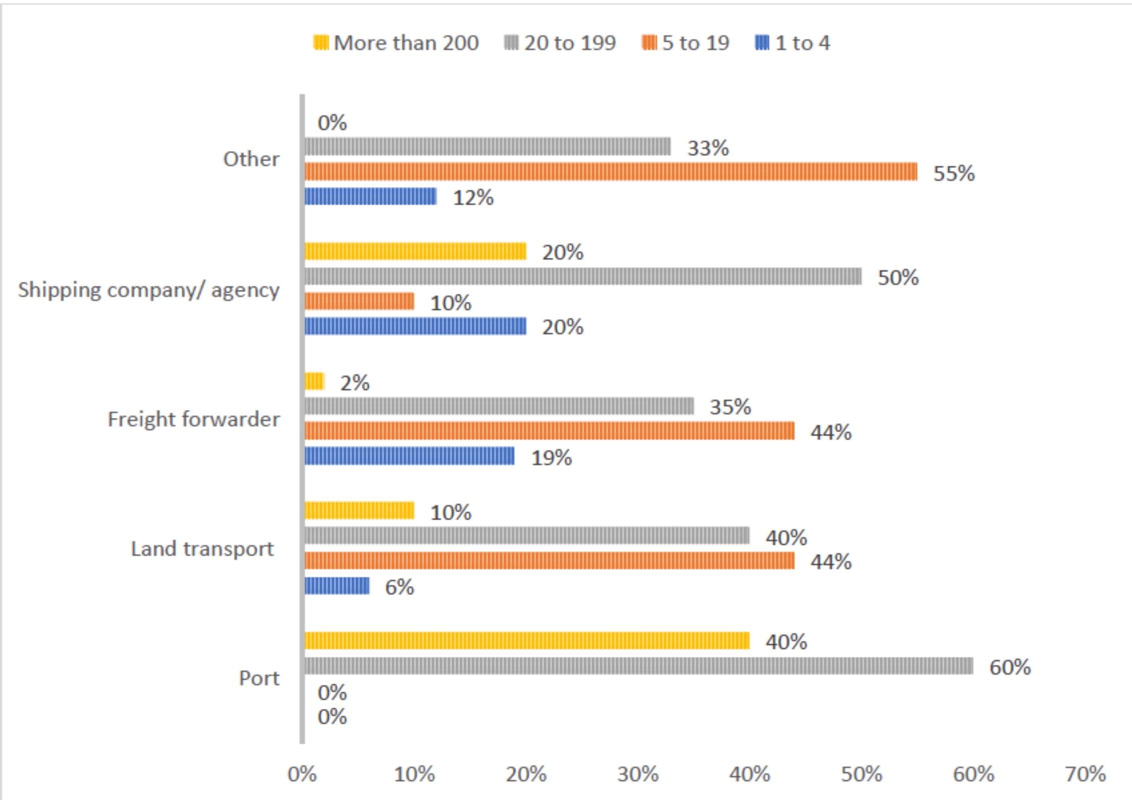


Figure 4-4: Number of full-time employees

Figure 4-5 depicts the demographics of organisations' revenue. Most of the ports have revenue more than 25 million AUD, which regarding the significant position of ports in trades, it makes sense. Most of the land transport companies have revenue between 2 and 25 million AUD, which is in the midrange. This result is in accordance with the size of respondents' companies which most of them are small and medium businesses. The revenue of freight forwarders is changing in different ranges and very close in some ranges. It may indicate severe competition between them in the container market. Most shipping companies/agencies have revenue of less than 10 million AUD. It shows many respondents in this stratum are shipping agency with limited business activities. Also, it should be considered that due to the reluctance of some respondents to provide information regarding the revenue stream for their respective organisation, the high level of missing data is observed in this section.

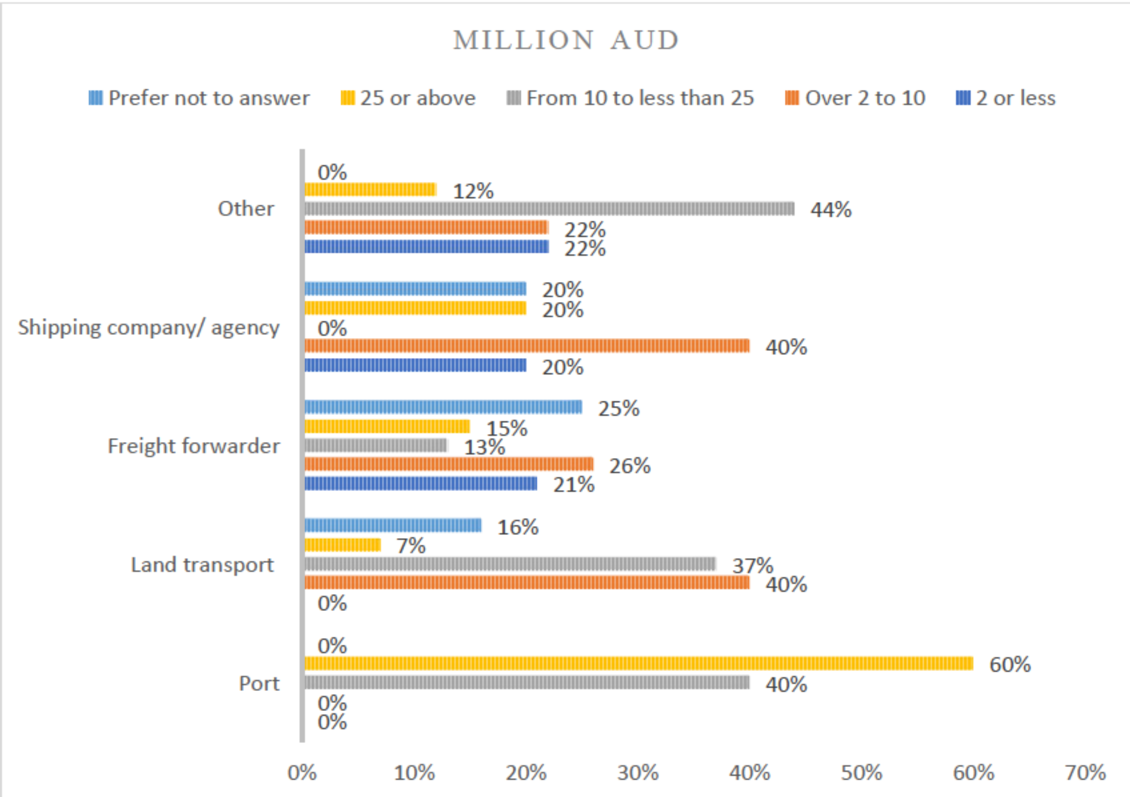


Figure 4-5: The revenue of respondents' organisation

4.4 Data screening and preparation

Data screening is a significant part of the data analysis process since organising the data can prevent mistakes, minimise potential measurement errors and save considerable time. Moreover, through a meticulous data preparation, it is possible to verify different statistical tests such as normality and consistency tests which are necessary before implementing multivariant analysis (Hair et al. 2013). Furthermore, data preparation is a mandatory task if a researcher intends to utilise standardised tools such as SPSS and AMOS.

The data examination process was performed in four steps; firstly, the data were screened to detect mismatches; secondly, missing values were analysed to determine irrelevant data and items that their missing values were beyond the threshold of usability to perform imputation; thirdly, several tests were undertaken to investigate if the assumptions of multivariate analysis were satisfied; and finally, the non-response bias tests were conducted to ensure the collected data represent a generalisation of the population.

4.4.1 Recognising mismatches

Completed questionnaires were investigated as part of the data assessment process. Since this study applied a survey by using the online questionnaire method, response error was an issue because the researcher did not have control over how it was completed. Initially, every completed questionnaire was checked to realise any incomplete questionnaire or responses. If the characteristics of a respondent's data did not match the defined population attributes, the respondent's data set was removed. Moreover, variables' names and the data's formats were modified so that they could be fit the statistical software packages of SPSS and AMOS. Out of 134 received responses, 19 cases did not match the defined criteria, so they were not included in the data analysis process. Table 4-2 presents the summary of deleted items.

Table 4-2: Summary of deleted items

Reasons for removing cases	Number of deleted cases	Sample size after removing
Irrelevant respondent position	4	130
Irrelevant industry	5	125
Incomplete items	10	115

4.4.2 Managing missing values

After the data screening phase, the next stage is dealing with missing data. Missing data takes place when valid values on some variables are not available (Hair et al. 2013). As it is common in quantitative research, this research also faced missing data issues. This research deals with missing data by employing a three-stage process proposed by Hair et al. (2013). These steps include eliminating obvious cases or variables, examining the pattern of missing and determining the approach to deal with missing data.

Identifying missing data patterns is important since knowing the patterns underlying the missing data can help to maintain the original distribution of values after missing data recovery as closely as possible. Two types of missing data were explored according to the literature including ignorable missing data and non-ignorable missing data. Ignorable missing data can be easily detected and do not need specific remedies, for example, skipped sections in a questionnaire that are not applicable for a respondent. In contrast, for non-ignorable missing data, a systematic missing data analysis is required (Tabachnick, Fidell & Ullman 2007). In this research, there was no ignorable missing data; however, there was ‘I do not know’ option for some questions which caused non-ignorable missing data.

Non-ignorable missing data can be categorised in two groups of knowing missing data and unknowing missing data (Hair et al. 2013). Knowing missing data is identifiable; for example, missing data due to error in data entry is considered as knowing missing data. In contrast, unknowing missing data is less recognisable, for example, missing data due to respondents' lack of knowledge or refusal in answering certain sensitive questions. In this research, some participants refused to answer the question about their company's annual revenue which is considered non-ignorable missing data. After identifying non-ignorable missing data, the amount of missing data should be determined. It allows to understand if the percentage of missing data for each variable or item is low enough not to influence the results of the study or not (Hair et al. 2013). SPSS recognises any block that doesn't have value as system-missing data. Figure 4-6 illustrates the missing data of this research.

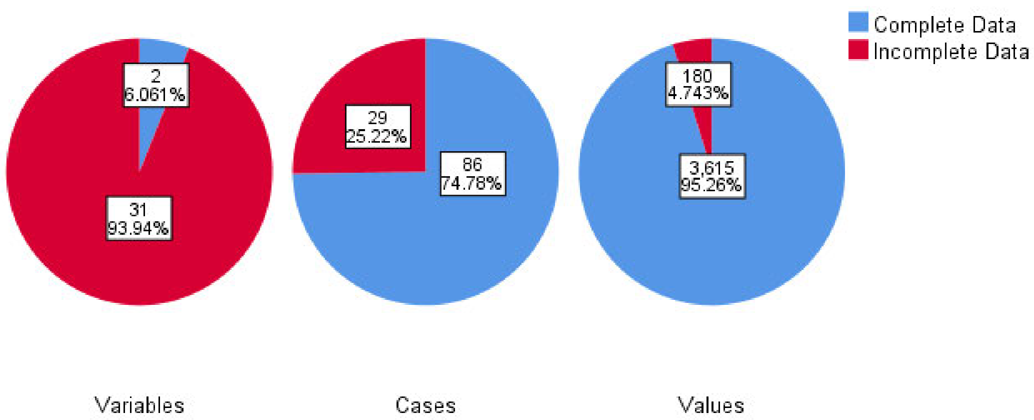


Figure 4-6: Summary of missing data

Figure 4-6 exhibits that 4.74 per cent of values were missed and due to this, about 25 per cent of cases and 94 per cent of variables were incomplete. Among variables, the largest missing value pertained to the annual revenue with 20 per cent. Also, 25 per cent of missing values pertained to demographic information and 75 per cent to the rest of the variables. To deal with missing data, according to Hair et al. (2013), cases with above 10 per cent of missing data and variables above 15 per cent of missing data should be deleted. In this research, all cases and variables were below stipulated limits. Thus, no cases or variables were deleted. The literature suggests the modelling-based imputation approach for the treatment of missed data (Hair et al. 2013; Tabachnick, Fidell & Ullman 2007). Therefore, expectation maximisation (EM) was performed by applying SPSS version 26, which produced a new data set with imputed missing values.

4.4.3 Testing for normality

Normality refers to the distribution of variables, and it is one of the most fundamental assumptions in multivariate analysis. Since assumption of certain statistical tests such as principal component analysis (PCA) depends on the normality of variables' distributions, violating this assumption can distort the results (Hair et al. 2013; Tabachnick, Fidell & Ullman 2007). Kurtosis and skewness are two factors that determine the shape of variables' distribution. Any departure from the normal distribution can impact the values of skewness and kurtosis. It is suggested that desired levels of skewness and kurtosis are within +1.96 and -1.96 for estimating a variable distribution with normal (Hair et al. 2013). The results of normality tests based on skewness and kurtosis were presented in Table 4-3, which shows that all values for kurtosis and skewness are within the acceptable levels. Thus, it can confirm the normality of variables which will be used in multivariate tests.

Table 4-3: Skewness and kurtosis tests of normality

	Skewness	Kurtosis
	Statistic	Statistic
Transformation1	-0.548	-0.498
Transformation2	-0.287	-0.704
Transformation3	0.467	0.427
Transformation4	0.399	0.490
Sensing1	-0.184	-0.540
Sensing2	-0.272	-0.610
Sensing3	-0.130	-0.924
Sensing4	1.02	-0.922
Sensing5	0.537	-0.540
Seizing1	0.226	-0.817
Seizing2	1.2	-0.723
Seizing3	-1.14	-0.807
Seizing4	-0.438	-0.6
Cloud_integration1	0.014	-1.33
Cloud_integration2	-0.285	-1.071
Cloud_integration3	-0.125	-1.2
Cloud_integration4	0.116	0.226
Cloud_flexibility1	-0.414	0.226
Cloud_flexibility2	-0.185	-0.936
Cloud_flexibility3	1.4	-0.855
Cloud_flexibility4	-0.273	-0.673
Cloud_flexibility5	0.236	-0.783

4.4.4 Non-response bias test

Non-response bias occurs when some respondents don't return the questionnaire. It leads to sampling bias since collected answers may differ from potential respondents who did not participate in the research (Dillman 2011). Non-response bias may decrease the accuracy of the research finding when findings are generalised to the population (Armstrong & Overton 1977). One of the methods that can be used for testing non-response bias is comparing early respondents with participants who returned the questionnaire after follow-up letters (Armstrong & Overton 1977). It is assumed that late respondents have similar characteristics with early respondents. Thus, comparing these two groups can reveal any existing non-response bias. Generally, no accepted norm can be applied to compare early and late respondents. Although it is suggested that early respondents are more interested in participating in research and as a result, they return the questionnaire early (Armstrong & Overton 1977; Korkeila et al. 2001).

In this research, an increase was observed in the response rate after sending the reminders. Thus, responses received within a week after sending first and second reminders were considered as late responses and responses received out of these periods as early responses. 61 responses (53 per cent) were received from early respondents, and 54 responses (47 per cent) were received from late respondents. The two-sample independent T-test at a 5 per cent significance level was implemented to compare means of two late and early respondent groups. The result of the test is displayed in Table 4-4. According to Table 4-4, all Sig values are greater than 0.05, which means the null assumption of the equality of means is not rejected.

Table 4-4: Independent sample t-test for comparing means of early and late responses

95% Confidence Interval of the Difference							
	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Transformation1	-.386	113	.700	-.05340	.13823	-.32725	.22046
Transformation2	-1.543	113	.126	-.22035	.14280	-.50327	.06257
Transformation3	-.447	113	.656	-.06748	.15110	-.36683	.23187
Transformation4	-1.609	113	.110	-.23971	.14902	-.53494	.05552
Sensing1	-.277	113	.783	-.04765	.17221	-.38882	.29353
Sensing2	-1.288	113	.200	-.17836	.13851	-.45277	.09605
Sensing3	-1.635	113	.105	-.20617	.12607	-.45593	.04359
Sensing4	1.067	113	.288	.19211	.18013	-.16475	.54898
Sensing5	-.636	113	.526	-.08695	.13674	-.35785	.18396
Seizing1	.582	113	.561	.09241	.15864	-.22189	.40670
Seizing2	1.314	113	.191	.19329	.14707	-.09807	.48466
Seizing3	.457	113	.649	.08226	.18006	-.27446	.43899
Seizing4	-.366	113	.715	-.06237	.17037	-.39990	.27517
Cloud_integration1	1.528	113	.129	.24193	.15828	-.07166	.55552
Cloud_integration2	1.544	113	.125	.24405	.15810	-.06918	.55728
Cloud_integration3	-.154	113	.878	-.02129	.13820	-.29509	.25252
Cloud_integration4	1.502	113	.136	.24694	.16441	-.07877	.57266
Cloud_flexibility1	-.104	113	.917	-.01518	.14599	-.30442	.27406
Cloud_flexibility2	.377	113	.707	.05961	.15829	-.25398	.37321
Cloud_flexibility3	-.646	113	.519	-.09549	.14777	-.38826	.19727
Cloud_flexibility4	-.299	113	.766	-.05131	.17181	-.39170	.28907
Cloud_flexibility5	.414	113	.680	.06005	.14517	-.22757	.34767

4.4.5 Testing for multicollinearity and outliers

Multicollinearity happens when independent variables measure the same thing, which causes redundant measures (Hair et al. 2013). Normally correlation higher than 0.9 between two independent variables can cause multicollinearity (Tabachnick, Fidell & Ullman 2007). The most serious effect of multicollinearity is that it can make regression coefficients unreliable and decrease their precision (Alin 2010). Since the distributions of variables are normal, Pearson's correlation coefficient was used to estimate the correlation matrix (Hauke & Kossowski 2011). A multicollinearity test was conducted by assessing the correlation matrix. All items' correlation coefficients were compared, and no multicollinearity was detected.

Outliers are observations with unique characteristics that are distinctly different from other observations (Hair et al. 2013). Detecting outliers is necessary since it can change the results of data analysis (Tabachnick, Fidell & Ullman 2007). Outliers can be detected in three categories including univariate, bivariate and multivariate. Since the univariant outlier identification seems to be redundant for variables ranging from 1 to 5, it was not applied for this research. Also, bivariant outlier identification needs scatter plots to pair variables and omit cases that fall distinctively outside the range of observation. It should be noted that 22 variables in this research create 231 scatter plots which make data analysis difficult. Hence, bivariant outlier identification was not used in this study.

Multivariant outlier identification is implemented by measuring M2/df as a T-value in which, M2 is the distance between each observation from the mean centre of observations and df is the number of variables which are involved (degree of freedom) (Hair et al. 2013). Also, the conservative threshold level of significances 0.005 or 0.001 are suggested by Hair et al. (2013), which results in the value of 2.5 for small sample size (80 or fewer), and 3 or 4 for large sample size. It should be noted that setting a low threshold may cause in the detection of many cases which may lead to bias, and a large threshold may cause ignoring some outliers and distorting data analysis results. This study includes 115 cases; thus, the stringent value of 2.5 was selected. The analysis was implemented, and no multivariant outlier was detected.

4.5 Reliability and validity

In order to enhance the accuracy of measurements in each construct, it is critical to test the reliability since without reliable measures, it is not possible to realise to what extent the data can be trusted. The construct's reliability is tested through controlling if a variable in a construct is consistent with the average behaviour of other variables or not. In this research, constructs' reliability was assessed by applying two statistical tests of Cronbach's Alpha and item-total correlation.

The Cronbach's Alpha is widely used for assessing the internal consistency of constructs and understanding whether items as a whole can represent a construct (Streiner 2003). Its value ranges between 0 to 1, where a high value indicates greater reliability. Cronbach's Alpha depends on different factors such as the number of items in a construct and the mean of correlation coefficients between items (Streiner 2003). The 'Cronbach's Alpha if item deleted, describes Cronbach's Alpha coefficient that will be achieved if an item is deleted in the construct. Thus, through interpreting the results, a researcher can understand if removing a variable in the construct will improve or deteriorate the total reliability of that construct. In contrast, the item-total correlation explains that to what extent a variable is reliable in representing the average behaviour of the construct.

In this research, the item-total correlation less than 0.3 was considered to describe that the corresponding variable doesn't correlate with an overall construct. Also, the value greater than 0.7 was considered for the reliability of the constructs (Streiner 2003; Tabachnick, Fidell & Ullman 2007). These tests were conducted in this research, and Table 4-5 displays the results. As can be seen in Table 4-5, all constructs' Cronbach's Alpha values are greater than 0.7. Also, all of the item-total correlation values are greater than 0.3. Thus, it can be concluded that the presented model is reliable. In addition to reliability, the validity of constructs is also an important issue.

Table 4-5: Item-total correlation and Cronbach's Alpha tests of reliability

Construct	Item	Item-total correlation	Cronbach's Alpha	Cronbach's Alpha if item deleted
Transformation	Transformation1	.541	.731	.661
	Transformation2	.547		.656
	Transformation3	.515		.675
	Transformation4	.487		.692
Sensing	Sensing1	.467	.724	.688
	Sensing2	.455		.689
	Sensing3	.578		.650
	Sensing4	.509		.671
	Sensing5	.451		.690
Seizing	Seizing1	.538	.736	.671
	Seizing2	.620		.631
	Seizing3	.409		.750
	Seizing4	.570		.652
Cloud integration	Cloud_integration1	.643	.779	.695
	Cloud_integration2	.556		.741
	Cloud_integration3	.543		.747
	Cloud_integration4	.603		.717
Cloud flexibility	Cloud_flexibility1	.491	.718	.664
	Cloud_flexibility2	.447		.681
	Cloud_flexibility3	.538		.646
	Cloud_flexibility4	.577		.625
	Cloud_flexibility5	.329		.722

4.5.1 Factorial validity and model modification

Factorial validity involves unified dimensionality where one or more observant variables measure every latent construct. Factorial validity identifies whether the proposed structure of constructs is matched with the underlying structure of variables that can be extracted from the data. Thus, the objective of factorial validity is to ensure that variables in a construct are intercorrelated enough to create represented constructs. Evidence of factorial validity is necessary to map the final model. EFA is one of the widely used statistical techniques for testing factorial validity (Osborne, Costello & Kellow 2008).

An important factor to consider in EFA is a sample size. It is suggested that a ratio of 5:1 can ensure reliability in the results of EFA (Hair et al. 2013). The measurement model of this research contained 22 variables and the final sample size of 115. Therefore, the calculation of the mentioned ratio ascertained the applicability of EFA. Furthermore, the applicability of EFA can be controlled through two tests of Kaiser-Meyer-Olkin and Bartlett (Mulaik 2009). The results presented in Table 4-6 indicate that EFA could be applied to this research model. Also, it should be mentioned that there are two main dependent and independent constructs in this study which there is a possible correlation between their subconstructs. Thus, it is required to control constructs' validity for the dependant and independent constructs in separate runs. It means if EFA is executed for the whole model in one run, due to the correlation between dependent and independent constructs, some factors intended to measure each separated construct may be loaded on the same component and lead to irrelevant results.

Table 4-6: Factor analysis applicability criteria

	Requirement	Research constructs	
		Cloud-enabled capabilities	Container supply chain agility (CSCA)
Case-to-variable ratio	>5	12.7	8.84
KMO	>0.50	0.75	0.83
Bartlett's test (Sig)	0	0	0

In running EFA, the PCA method with varimax rotation strategy, and a minimum eigenvalue greater than 1, which are the most common in social science were used (Osborne, Costello & Kellow 2008). Also, items were allocated to a factor if the number of items was more than one, factor loading value was greater than 0.5, and an item was not cross-loaded onto more than one factor with a loading value greater than 0.5 (Schene, van Wijngaarden & Koeter 1998). Additionally, items with factorial values less than 0.3 were suppressed (Kline 2014).

The iterative EFA was implemented for both constructs of this research to extract the final components. For the construct of the CSCA, two components were extracted. All items were loaded on two extracted components with factor loading values greater than 0.5. Also, for the construct of cloud-enabled capabilities, all factors were loaded on two components with factor loading values greater than 0.5 after rotation. The results were presented in Table 4-7 and Table 4-8.

Table 4-7: Factor loading after implementing EFA (CSCA)

Item	Factor	
	1	2
Transformation1	.746	
Transformation2	.737	
Transformation3	.711	
Transformation4	.743	
Sensing1		.617
Sensing2		.598
Sensing3		.700
Sensing4		.725
Sensing5		.610
Seizing1		.757
Seizing2		.681
Seizing3		.521
Seizing4		.740

Table 4-8: Factor loading after implementing EFA (Cloud-enabled capabilities)

Item	Factor	
	1	2
Cloud_integration1	.681	
Cloud_integration2	.761	
Cloud_integration3	.755	
Cloud_integration4	.811	
Cloud_flexibility1		.768
Cloud_flexibility2		.668
Cloud_flexibility3		.716
Cloud_flexibility4		.763
Cloud_flexibility5		.725

The factorial model of CSCA includes two subfactors. For loaded items, one of the subfactors measures transforming capability and the other one the combination of sensing and seizing. It means two subconstructs of sensing and seizing were merged. The new construct was named "proactive sensing". Also, the factorial model of cloud-enabled capabilities construct contains two subfactors of cloud integration and cloud flexibility capabilities. After the modification of constructs by implementing EFA, it was necessary to assess the validity of constructs, which could be achieved through convergent and discriminant validity tests.

4.5.2 Convergent and discriminant validity of constructs

Convergent validity involves the question of whether measures of a construct converge. In other words, to what extent each measure correlates with other measures in the same construct. According to Fawcett et al. (2014), for convergent validity, items should be loaded on constructs with composite reliability (CR) greater than 0.7 and average variance extracted (AVE) greater than 0.5. The AVE measures the level of variance captured by a construct versus the level due to measurement error. Also, the CR is a less biased estimate of reliability compared with Cronbach's Alpha (Alarcón, Sánchez & De Olavide 2015).

In this research, there were two layers of constructs, first-order constructs, and second-order constructs. The first-order constructs are cloud integration capability, cloud flexibility capability, transforming and, proactive sensing (the combination of sensing and seizing). Each mentioned first-order construct is a latent variable measured by some observant variables. The second-order constructs are cloud-enabled capabilities and CSCA. The cloud-enabled capability was measured by two first-order constructs of cloud integration and cloud flexibility. Also, the CSCA construct was measured by two first-order constructs of transforming and proactive sensing. The CR and AVE were calculated using formulae 1 and 2. Moreover, to assess reordered constructs reliability, the Cronbach's Alpha and item-total correlation were calculated (Fornell & Larcker 1981). The results were presented in Table 4-9. According to the results, all AVE and CR values are respectively greater than 0.5 and 0.7 except the AVE value of proactive sensing subconstruct. Also, the value of item-total correlation for all variable is greater than 0.3.

$$CR = \frac{(\sum_i \lambda_i)^2}{(\sum_i \lambda_i)^2 + (\sum_i e_i)} \quad (1) \qquad AVE = \frac{\sum_i \lambda_i^2}{\sum_i \lambda_i^2 + (\sum_i e_i)} \quad (2)$$

Where:

$n: Number\ of\ factors$

$1 - \lambda_i = e_i: error$

$\lambda_i: factor\ loadig\ value$

Table 4-9: Validity and reliability tests of constructs after implementing EFA

First-order constructs	Observant variables	Item-total correlation	AVE	CR	Cronbach's Alpha
Proactive sensing	Sensing1	0.5	0.42	0.87	0.84
	Sensing2	0.45			
	Sensing3	0.63			
	Sensing4	0.61			
	Sensing5	0.47			
	Seizing1	0.64			
	Seizing2	0.59			
	Seizing3	0.42			
	Seizing4	0.65			
Transforming	Transformation1	0.54	0.53	0.82	0.73
	Transformation2	0.54			
	Transformation3	0.51			
	Transformation4	0.48			
Cloud integration	Cloud_integration1	0.5	0.56	0.84	0.75
	Cloud_integration2	0.56			
	Cloud_integration3	0.57			
	Cloud_integration4	0.57			
Cloud flexibility	Cloud_flexibility1	0.62	0.53	0.85	0.785
	Cloud_flexibility2	0.48			
	Cloud_flexibility3	0.54			
	Cloud_flexibility4	0.61			
	Cloud_flexibility5	0.54			

The subconstructs of proactive sensing did not meet the requirements of convergent validity. Thus, to improve convergent validity items with the lowest loading values were deleted one by one to reach an acceptable level of AVE. Through this process, some items including, sensing 2, sensing 5 and seizing 3 were removed, and the AVE value improved to 0.5. Since this value is 0.5, and both CR and Cronbach's Alpha are at the acceptable levels, the validity was accepted (Gligor, Holcomb & Stank 2013). The results were presented in Table 4-10.

Table 4-10:Improving AVE value by deleting some items

Constructs	Latent constructs	Observant variables	AVE	CR	Cronbach's Alpha
Container supply chain agility	Proactive sensing	Sensing1	0.5	0.85	0.79
		Sensing3			
		Sensing4			
		Seizing1			
		Seizing2			
		Seizing4			
	Transforming	Transformation1	0.54	0.82	0.73
		Transformation2			
		Transformation3			
		Transformation4			
Cloud computing flexibility	Cloud integration	Cloud_integration1	0.56	0.83	0.77
		Cloud_integration2			
		Cloud_integration3			
		Cloud_integration4			
	Cloud flexibility	Cloud_flexibility1	0.53	0.84	0.75
		Cloud_flexibility2			
		Cloud_flexibility3			
		Cloud_flexibility4			
		Cloud_flexibility5			

Discriminant validity refers to the degree that different latent constructs and their measures can be distinguished from the other constructs and their indicators (Bagozzi, Yi & Phillips 1991). To calculate discriminant validity, Cronbach's Alpha of a latent construct should be greater than its mean correlation with other constructs. If the Alpha value of a latent construct is adequately higher than the mean of its correlation with other constructs, it is the evidence of discriminant validity, and it means the construct is not correlated with other distinct constructs (Ghiselli, Campbell & Zedeck 1981). The mean correlation of each construct with other constructs was calculated and presented in Table 4-11. The results exhibit that Cronbach's Alpha for constructs is greater than its mean correlation with other constructs.

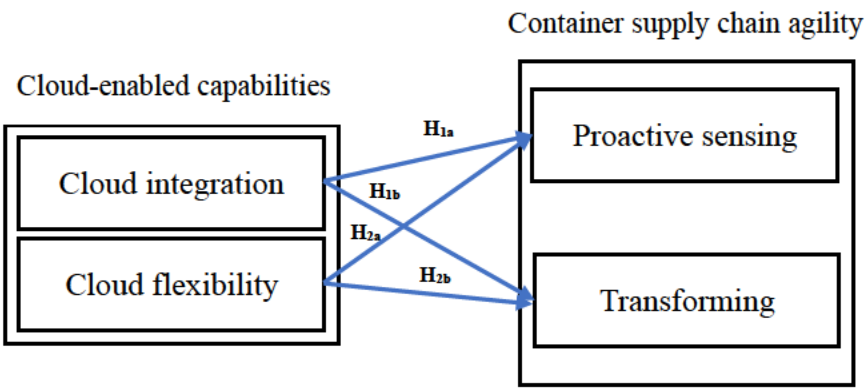
Table 4-11:Discriminate validity test of first-order constructs

Construct	Cronbach' S Alpha	Mean correlation with other constructs
Sensing and seizing	0.79	0.31
Transforming	0.73	0.31
Cloud computing integration	0.77	0.67
Cloud computing flexibility	0.75	0.67

4.6 Conceptual framework and hypothesis modification

Implementing EFA can guide a researcher to modify the research's conceptual framework. According to the EFA results, the main construct of CSCA is explained through two subconstructs of transforming and proactive sensing. The construct of CSCA included three subconstructs of Sensing, Seizing and Transforming, after running EFA items of two subconstructs of Sensing and Seizing were merged. Since remaining measures portray that organisations should sense their environment while getting their jobs done in a manner that makes them able to deal with uncertainty, it was named proactive sensing. All items that measure the subconstruct of "Transforming" remained, and this subconstruct did not change. Also, the same condition exists for two subconstructs of cloud-enabled capabilities. Therefore, the conceptual framework and hypotheses of this research were modified as presented in Figure 4-7. In the next section, the structural validity of the model will be tested by applying CFA, and hypotheses will be tested by applying structural equations modelling (SEM).

Figure 4-7: The modified conceptual framework



H_{1a}: *Cloud computing integrative capability is positively related to proactive sensing ability.*

H_{1b}: *Cloud integrative capability is positively related to transforming ability.*

H_{2a}: *Cloud flexibility capability is positively related to proactive sensing ability.*

H_{2b}: *Cloud flexibility capability is positively related to transforming ability.*

4.7 Validating the structural model and exploring relationships

In the previous section, the underlying structure of constructs was identified through EFA. In this section, CFA is applied to explore model fit indices for each part of the presented conceptual framework. The CFA can help to test the goodness of fit for each construct (Byrne 2013). In the next stage, SEM is employed to explore causal relationships between constructs based on proposed hypotheses. It should be mentioned that AMOS 26 was used to implement CFA and SEM.

4.7.1 Model fit criteria

The goodness of fit indexes should be calculated to realise the model fit. The criteria used in this research are Chi-square, RMSEA, GFI, CFI, RMR, NFI, and PCLOSE. The Chi-square statistic is used to test the hypotheses of the model fit. It tests if there is a meaningful difference between the population and the model covariance matrixes as the null hypothesis (Hooper, Coughlan & Mullen 2008). It is fruitful to obtain a significant p-value for Chi-square. However, there are some shortcomings with the Chi-square statistic (Hair et al. 2013). Firstly, the test is only acceptable when observed variables are multivariate normal. Secondly, the value of the Chi-square statistic decreases when the number of variables increases. Thirdly, Chi-square statistic is sensitive to sample size. It means increasing sample size can increase Chi-square and may result in the rejection of an acceptable model. In contrast, decreasing sample size may cause a decrease in Chi-square statistic and consequently cause acceptance of inaccurate models. Hence, it is better to use Chi-square for sample sizes between 100 and 200 (Hair et al. 2013). Due to the drawbacks of Chi-square statistic, some fit indices such as Root Mean Square Error of Approximation (RMSEA) were introduced.

RMSEA statistic measures the discrepancy between observed and estimated input metrics (Browne & Cudeck 1993). RMSEA value less than 0.05 for model means good fit, values between 0.05 to 0.08 are considered as an adequate fit, between 0.08 to 0.1 as mediocre fit and higher than 0.1 unacceptable model fit (Browne & Cudeck 1993).

GFI statistic examines the model fit in comparison with the null model. The GFI value ranges between 0 and 1, which value close to 1 indicates a better fit (Schumacker & Lomax 1996). Generally, GFI value greater than 0.95 is considered a good fit and GFI value greater than 0.9 means acceptable model fit (Schumacker & Lomax 1996). Whereas

GFI statistic that indicates a good fit if the statistic value is high, the RMR statistic indicates a good fit if its value is small (Comrey & Lee 2013). This is the square root of the squared discrepancies of the obtained and implied correlations (Kline 2014). RMR refers to the badness of fit, and it can be used in two ways; firstly, to compare the fit of two different specifications on the same data; secondly, to compare the same specification using different data (Comrey & Lee 2013).

Some model fit indices are comparative fit index measures. For example, Norm Fit Index (NFI) assesses the model by comparing the Chi-square value of the model to the Chi-square value of the null model. The null model is the worst-case scenario in which it is assumed that all measured variables are uncorrelated. Value for NFI ranges from 0 to 1, and values greater than 0.95 indicate a good fit (Bentler 1990). Comparative Fit Index (CFI) is revised NFI, which considers a sample size and works well even when the sample size is small. The same with NFI, this statistic compares the sample covariance matrix to the null model covariance matrix (Hooper, Coughlan & Mullen 2008). Table 4-12 presents model fit criteria in brief. In the next section, the fit criteria of the model are explored.

Table 4-12: Fit statistics

Indicator	Explanation	Benchmark (Byrne 2013; Hooper, Coughlan & Mullen 2008)
Chi-square (χ^2)	It evaluates the variation between the sample and fitted covariance matrixes and is sensitive to sample size.	P-value ≥0.05
RMSEA	It Compares optimal estimated parameters covariances and the population's covariance matrixes, and it is sensitive to the number of estimated parameters of the model.	RMSEA≤0.05
PCLOSE	It tests the P-value for the null hypotheses that the population's RMSEA is no greater than 0.05.	PCLOSE≥0.5
RMR	It is the square root of the difference between the residuals of the sample covariance matrix and the hypothesised covariance model.	RMR≤0.05
NFI	It compares the Chi-square value of the model to Chi-square of the null model.	NFI≥0.95
CFI	It compares the sample covariance matrix to the null model covariance matrix.	CFI≥0.95
GFI	It measures the fit between the hypothesised model and the observed covariance matrix.	GFI≥0.8

4.7.2 Cloud-enabled capabilities main construct

Two first-order constructs of cloud flexibility and cloud integration make the second-order cloud-enabled construct. CFA was implemented to explore model identifications and fit statistics for this second-order construct. The indexes of the goodness of fit were calculated for cloud-enabled capabilities to check whether if the model is consistent with data and doesn't need more modifications. The values of RMSEA and Chi-square' p-value were respectively 0.075 and 0.022, which were out of the acceptable level. Thus, modification indices were estimated, and Table 4-13 presents the results. Required modifications were executed, and model fit criteria calculated again, which they were at the acceptable range and indicated good fitness of the model. Figure 4-8 exhibits the cloud-enabled construct after implementing CFA; also, Table 4-14 presents final cloud-enabled construct identifications and fit-criteria.

Table 4-13: Modification induces

	M.I.	Par Change
e5 <--> e4	13.161	.149
e1 <--> e4	6.512	-.110

Figure 4-8: Cloud-enabled capabilities construct

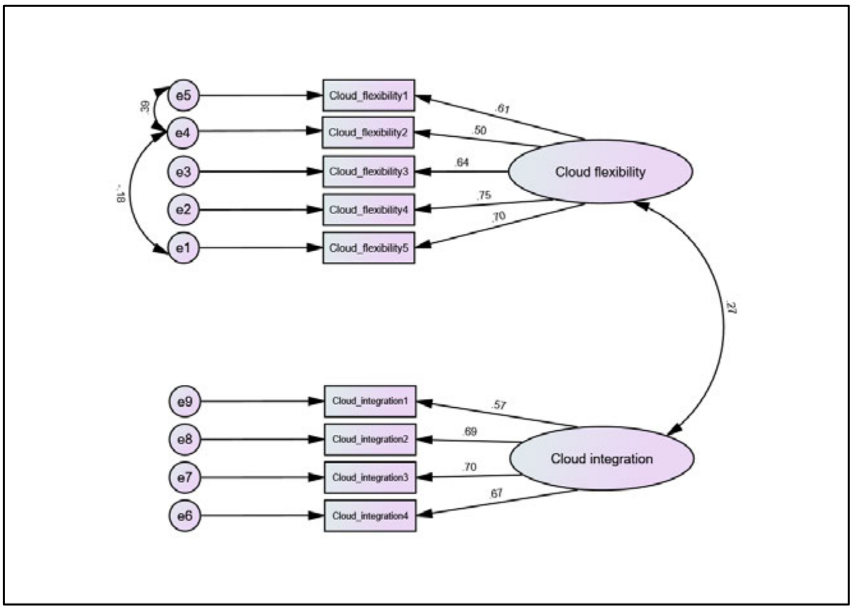


Table 4-14: Cloud-enabled construct identifications and model fit statistics

	Identifications	Model fit statistics	
Model identification and fit statistics	Observed variables= 9	Chi-square (χ^2)= 23	CFI= 1
	Probability level= 0.51		
	Estimated parameters= 21		RMSEA= 0
	Degree of freedom (df)= 24	RMR= 0.04	PCLOSE= 0.81
	GFI= 0.96		
Construct	Item	Estimates	
Cloud flexibility	Could_flexibility1	0.61	
	Could_flexibility2	0.50	
	Could_flexibility3	0.64	
	Could_flexibility4	0.75	
	Could_flexibility5	0.70	
Cloud integration	Cloud_integration1	0.57	
	Cloud_integration2	0.69	
	Cloud_integration3	0.70	
	Cloud_integration4	0.67	

4.7.3 Container supply chain agility main construct

It was assumed that the main construct of CSCA encompasses three subconstructs, i.e. sensing, seizing and transforming. After implementing EFA, the presumed factors of seizing and sensing were loaded on one component and constructed one construct which was named “proactive sensing”. The proposed model for the construct of the CSCA was illustrated in Figure 4-9. Also, the model identifications and fit statistics were calculated and presented in Table 4-15. The values of statistics identify the fitness of this construct.

Figure 4-9: Container supply chain agility construct

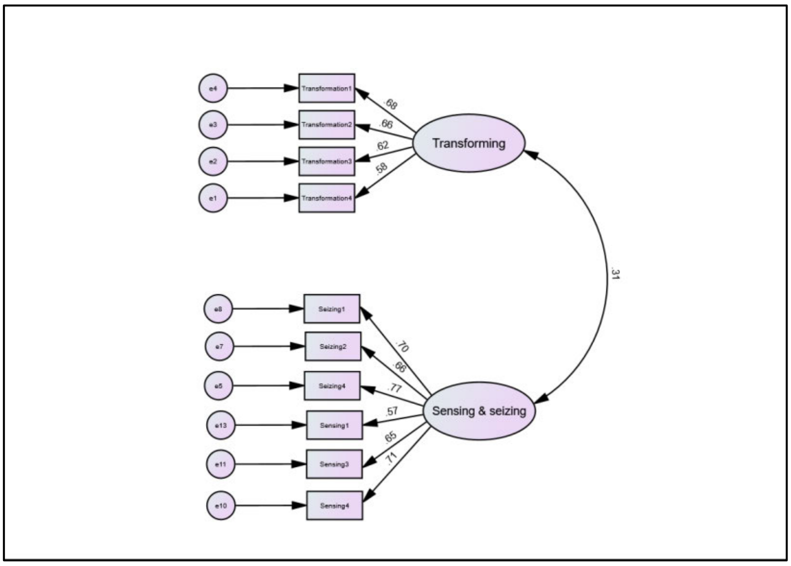


Table 4-15: Container supply chain main construct identification and model fit statistics

	Identifications	Model fit statistics	
Model identification and fit statistics	Observed variables= 10	Chi-square (χ^2)= 30	CFI= 1
	Probability level=0.67		
	Estimated parameters= 21		RMSEA= 0
	Degree of freedom (df)= 34	RMR= 0.035	PCLOSE= 0.92
	GFI= 0.95		
Construct	Item	Estimates	
Transforming	Transforming1	0.68	
	Transforming2	0.66	
	Transforming3	0.62	
	Transforming4	0.58	
Proactive sensing	Sensing1	0.57	
	Sensing3	0.65	
	Sensing4	0.71	
	Seizing1	0.70	
	Seizing2	0.66	
	Seizing4	0.77	

4.7.4 The structural model and hypotheses testing

After validating all constructs in the measurement model, a structural model can be tested to explore relationships as a second and one of the main steps of the data analysis process

(Hair et al. 2013; Kline 2014). SEM aims to identify which latent constructs impact the values of other latent constructs directly or indirectly (Byrne 2013). Thus, the propose of SEM is testing the underlying hypotheses to answer research questions. The hypotheses of the current research are presented in Table 4-16.

Table 4-16: Thesis underlying hypotheses

	Hypotheses
H_{1a}: Cloud integration → Proactive sensing	Cloud integrative capability is positively related to proactive sensing ability.
H_{1b}: Cloud integration → Transforming	Cloud integrative capability is positively related to transforming ability.
H_{2a}: Cloud flexibility → Proactive sensing	Cloud flexibility capability is positively related to proactive sensing ability.
H_{2b}: Cloud flexibility → Transforming	Cloud flexibility capability is positively related to transforming ability.

Path analysis was employed by using maximum likelihood estimation to test the hypotheses. The main propose of path analysis is to understand the extent to which a hypothesised model adequately describes sample data (Hair et al. 2013). Before implementing SEM factor loading values were controlled, and it was realised that the factor loading value of the Cloud_flexibility2 is 0.47, which is below 0.5; thus, this factor was removed. The model fit statistics were calculated and presented in Table 4-17. Also, the full structural equation model was presented in Figure 4-10.

The presented statistics indicated that the model was acceptable. Thus, it was possible to perform SEM. Moreover, the strengths of the relationships were presented in Table 4-18. According to the outcomes of SEM, two proposed hypotheses of the research were supported. Thus, it can be concluded that firstly, there is a significant relationship between cloud integration capability and proactive sensing ability; secondly, there is a significant relationship between cloud flexibility and proactive sensing ability. Also, two proposed hypotheses of this research were not supported. Firstly, there is no significant relationship between cloud integration capability and proactive sensing ability; secondly, there is no significant relationship between cloud flexibility capability and transforming ability. The results were presented in Table 4-18 and Table 4-19.

Table 4-17: Structural equation model fit statistics

	Identifications	Model fit statistics	
SEM fit statistics	Observed variables= 18	Chi-square (χ^2)= 125	CFI= 1
	Probability level= 0.6		RMSEA= 0
	Degree of freedom (df)= 129	RMR= 0.04	PCLOSE= 0.98
	GFI= 0.89		

Figure 4-10: The full structural equation model

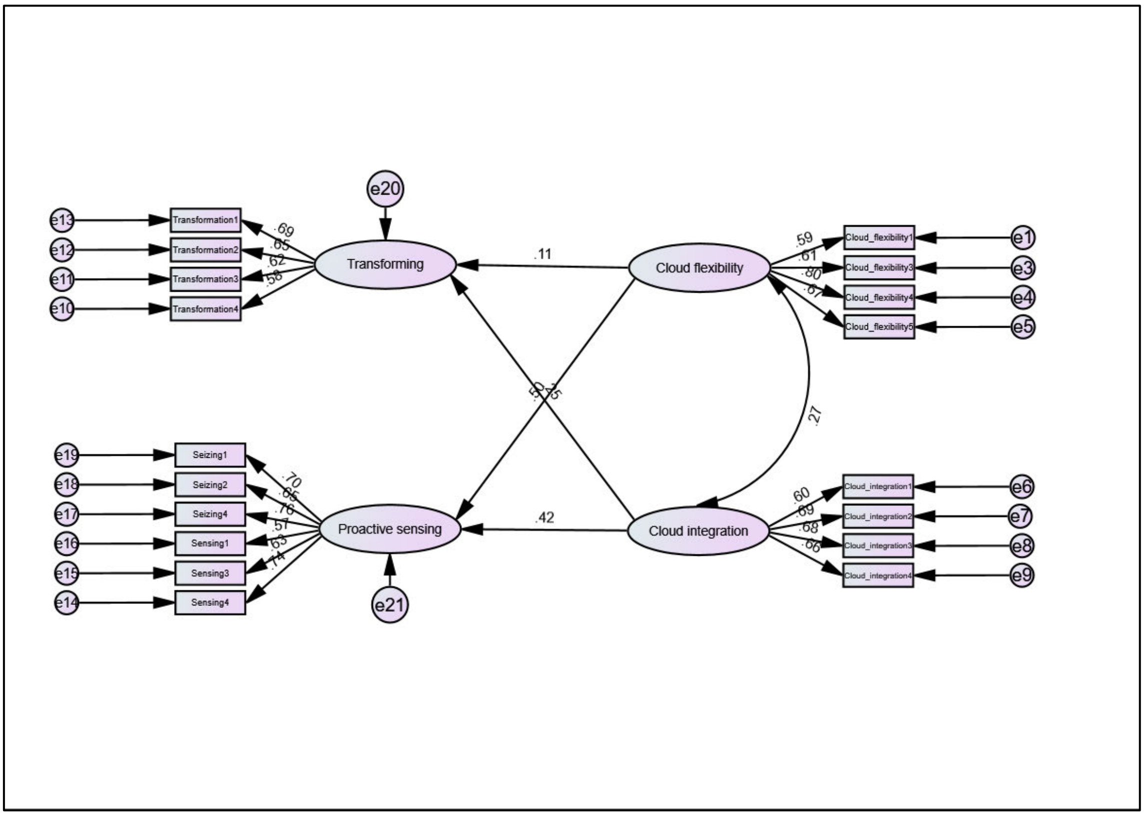


Table 4-18: The strength of structural paths

Constructs			Estimate	P-value
Transforming	<---	Cloud integration	.229	.073
Proactive sensing	<---	Cloud integration	.581	***
Proactive sensing	<---	Cloud flexibility	.757	***
Transforming	<---	Cloud flexibility	.113	.385
***=P<0.001				

Table 4-19: The outcomes of SEM for the research's hypotheses

Hypothesis title	Hypothesis	Outcome
H_{1a}	Cloud integrative capability is positively related to proactive sensing ability.	Supported
H_{1b}	Cloud integrative capability is positively related to transforming ability.	Not supported
H_{2a}	Cloud flexibility capability is positively related to proactive sensing ability.	Supported
H_{2b}	Cloud flexibility capability is positively related to transforming ability.	Not supported

4.8 Open-ended questions

In this research, qualitative data were obtained through open-ended questions. This section explores respondents' perceptions arising from responding to each open-ended question. Given the small volume of responses, Microsoft Excel software package was suitable to conduct content analysis.

4.8.1 Respondents' opinions about sensing capability

The sensing capability was one of the subconstructs of CSCA to measure an organisation's capability to monitor the market to explore market opportunities and threats continuously. Respondents were asked to answer, "What activities does your company do to explore market opportunities and threats?" The response rate of this part is 12 per cent, where 17 participants answered the open-ended question of this part. Table 4-20 presents a summary of the results. After coding, categorising and abstraction of respondents' opinions, five themes were identified. Theme number three includes the majority of codes (11 codes). Codes in this theme are about improving sensing ability through obtaining information from various sources including research, industry reports, media, partners and associations. Also, the theme number two includes two codes which respondents suggested understanding market trend is the way to improve sensing ability. All other themes just include one code which the content is same with the title of theme.

Table 4-20: Respondents' opinions about sensing capability

Number	Theme	Number of codes	Per cent
1	Using data analysis tools.	1	5
2	Understanding market trends.	3	17
3	Try to access information through various sources	11	64
4	Employing experts.	1	5
5	Applying information technology.	1	5
Total		17	100

4.8.2 Respondents' opinions about seizing capability

The seizing capability was one of the CSCA subconstructs to measure an organisation's capability to perform jobs in a manner that makes it able to preserve agility. Respondents were asked to answer, "What activities does your company do to act flexible and preserve agility?" The response rate of this part is 5 per cent, where 6 participants answered the open-ended question of this part. Table 4-21 presents a summary of the results. The theme number two includes two codes, two respondents believed understanding the partners' existing capacity can improve seizing ability. All other themes include one code which the content of code is same with the theme title.

Table 4-21: Respondents' opinions about seizing capability

Number	Theme	Number of codes	Per cent
1	Understanding the partners' existing capacity.	2	34
2	Understanding partners' capacity requirements.	1	17
3	Increasing interactions with partners.	1	17
4	Adopting an appropriate strategy.	1	17
5	In-house capacity development.	1	17
Total		6	100

4.8.3 Respondents' opinions about transforming capability

The transforming capability was one of the CSCA subconstructs to measure an organisation's capability to adjust to a new condition after changes happen in the business environment to achieve agility. Respondents were asked to answer, "What activities does your company do in the supply chain to transform and achieve agility?" The response rate of this part is 8 per cent, where 11 participants answered the open-ended question of this part. Table 4-22 presents a summary of the results. In this section, eight themes were identified and themes one, two and seven contain two codes. In theme one, codes support applying agile strategies such JIT and quick decision-making. In them two, two codes support localising facilities close to key customers geographically. In theme seven, two codes support utilising third parties. All other themes include one code the same with the theme title.

Table 4-22: Respondents' opinions about transforming capability

Number	Theme	Number of codes	Per cent
1	Using SCM agile strategy.	2	18
2	Localising supply to key customers.	2	18
3	Modifying logistics suppliers according to customer needs.	1	9
4	Using different logistics options including rail, road and coastal shipping.	1	9
5	Applying IT tools.	1	9
6	Employing specialist human resource.	1	9
7	Employing competent third parties.	2	18
8	Application of new technologies.	1	9
Total		11	100

4.8.4 Respondents' opinions about cloud computing integrative capability

Integration is a capability that the application of cloud computing technology can create in an organisation, and cloud integration was one of the cloud-enabled capabilities' subconstructs. This subconstruct measures cloud integrative capability. Respondents were asked to answer, "What are the areas that cloud computing has improved integration among your company and its partners?" The response rate of this part is 5 per cent, where 6 participants answered the open-ended question of this part. Table 4-23 presents a summary of the results. In this section, the themes number three and four contains two codes. In theme number three both codes support application of cloud computing to implement documentation process. In theme number four codes support using cloud computing to construct a shared software among partners and implement different logistics processes such as accounting. All other themes include one code which the content is the same with the theme topic.

Table 4-23: Respondents' opinions about cloud computing integrative capability

Number	Theme	Number of codes	Per cent
1	Using cloud computing as a system to interact with different partners such as customers, suppliers, and governments.	1	17
2	Using cloud computing to integrate warehouse management system.	1	17
3	Using as a platform to implement integrated documentation among partners.	2	34
4	Using SaaS facility in a shared environment	2	34
Total		6	100

4.8.5 Respondents' opinions about cloud flexibility capability

Flexibility is a capability that the application of cloud computing technology can create in an organisation, and cloud flexibility was one of the cloud-enabled capabilities' subconstructs. This subconstruct measures cloud flexibility capability. Respondents were asked to answer, "What are the areas where cloud computing has improved flexibility among your company and its partners?" The response rate of this part is 5 per cent, where 6 participants answered the open-ended question of this part. Table 4-24 presents the results after analysis. In this section, four themes were identified. Them three includes three codes. All codes in this theme support the remote access to cloud computing facility as an accelerator of cloud flexibility. All other themes include one code which the contents are same with the theme title.

Table 4-24: Respondents' opinions about areas that cloud computing can create flexibility

Number	Theme	Number of codes	Per cent
1	Providing flexibility in administration via decentralising functions	1	17
2	Providing flexibility by facilitating clients' access	1	17
3	Improving flexibility by facilitating remote access	3	50
4	Improving flexibility in spending for IT	1	17
Total		6	100

4.9 Summary

The aim of this chapter was to prepare data for data analysis. A systematic approach was applied to achieve this goal. Thus, firstly, the data were screened to recognise existing mismatches. As a result, some irrelevant and inconsistent data were removed. In the next stage, missing values were restored by using a statistical method. Moreover, a statistical test was implemented to control the normality of the variables and the results verified that all of the variables had a normal distribution. In the remainder of the chapter, T-test was performed to explore non-response bias by comparing early and late responses. The results indicated that non-response bias did not exist. Then, statistical methods were applied to identify multicollinearity and outlier, which results exhibited no multicollinearity and outlier.

After the data preparation process, reliability and validity of the constructs were tested. The reliability of the model was approved. Then factorial validity was discovered through EFA, which caused some modifications in the presented model. Then reliability, discriminant and convergent validity of the modified model were tested and verified. In the next stage, CFA was employed to modify the model based on the fitness criteria. In this stage, some factors were deleted to improve the fitness of the model. Then, SEM was applied to understand the relationships between dependent and independents variables. Regarding the results, two proposed hypotheses were accepted, and two were rejected. In the end, collected qualitative data by open-ended questions were analysed based on the content analysis approach. In the next chapter, the results are discussed.

Chapter Five: Discussion of Findings

5.1 Overview

In the previous chapter, the collected data were analysed, and the results were presented. This chapter discusses the findings. First of all, section 5.2 examines the results of FA for the two main constructs of this research. This is then followed by a discussion of the results of path analysis through SEM in section 5.3. Finally, section 5.5 provides a summary of this chapter.

5.2 Cloud-enabled capabilities and container supply chain agility

This research includes two second-order constructs, i.e. cloud-enabled capabilities and CSCA. The cloud-enabled capability construct contains the two subconstructs of cloud integration and cloud flexibility. Also, according to DC theory, it was assumed that the CSCA construct encompasses three subconstructs of sensing, seizing and transforming. It was necessary to verify these two main constructs based on collected data in the related context to answer the first and second subsidiary research's questions. Therefore, the FA was implemented to verify the structural validity of the model. In the following sections, the findings of the data analysis are discussed for each main construct of the model.

5.2.1 Cloud-enabled capabilities

The results of EFA and CFA verified that the cloud-enabled capabilities construct contains two subconstructs of integration and flexibility. The low correlation (0.27) between cloud integration and cloud flexibility subconstructs supports this assumption.

This finding also confirms the results of research by Liu et al. (2018) and Liu et al. (2016). They assume that cloud computing can create integration and flexibility in organisations which use this technology. Also, this finding accords with findings of research by Bharadwaj and Lal (2012), Guo, Kuo and Sahama (2012), and Hu et al. (2012) which discuss the flexibility that is created through the application of cloud computing in industries such as medical services and healthcare. The current research confirms the same results in the CSC in Australia. In the next section, the results of the FA concerning the cloud integration subconstruct are discussed.

5.2.1.1 Cloud integration

The subconstruct of cloud integration encompasses four observant variables. Table 5-1 presents the contribution of each observant variable in enhancing integration based on regression coefficients of factors in the ultimate construct of cloud-enabled capabilities. Also, Table 5-2 shows the answers of respondents to the open-ended question regarding the cloud integration subconstruct, which is "What are the areas that cloud computing has improved integration between your company and its partners?"

Cloud_integration3 has the highest loading value, which means that the application of cloud computing for information sharing is the most crucial factor that can create integration among organisations in the CSC network. This result accords with the findings of research by Cao, Schniederjans and Schniederjans (2017), Kochan et al. (2018) and Bruque-Cámara, Moyano-Fuentes and Maqueira-Marín (2016) which indicate the impact of cloud computing on information sharing in the SC context and healthcare industry respectively. This finding is justifiable since information sharing in the CSC is critical to achieving integration (Yuen & Thai 2017). In contrast, Cloud_integration1 has the lowest loading value. This identifies that the application of cloud computing to establish a shared virtual working environment among partners in the CSC has the lowest contribution to enhancing integration among organisations.

As shown in Table 5-1, Cloud_integration2 ranks second in improving integration. This variable was intended to measure the created integration through application of software in a shared cloud computing environment by organisations. This finding accords with the findings of research conducted by Leukel, Kirn and Schlegel (2011) and Kim et al. (2012) which present models based on software as a service (SaaS) application of cloud computing to improve a SC integration. The rank of Cloud_integration4 is third. This variable was intended to measure cloud computing capability in integrating SCM processes between organisations in a SC. Confirmation of this factor supports the model presented by Mehrsai, Karimi and Thoben (2013) and Yan et al. (2014), which study the capability of cloud computing in creating an integration in a SC in the manufacturing context.

Among the collected responses to the open-ended question, it was a suggestion to use cloud computing in order to interact with different partners (see row 1, Table 5-2). Cloud computing can help organisations to have better interaction with their partners by improving information sharing, and it was considered as one of the observant variables (see item 1, Table 5-1).

Table 5-1: Observant variables' contribution in enhancing integration by cloud computing application

Item	Variable name in the model	Observant variable	Weight
1	Cloud_integration3	Cloud computing application to share information with partners consistently.	0.7
2	Cloud_integration2	Cloud computing application to utilise shared software among partners to implement SC processes.	0.69
3	Cloud_integration4	Cloud computing application as a part of automation to integrate supply chain processes.	0.67
4	Cloud_integration1	Cloud computing application to establish a shared, collaborative virtual working environment with partners.	0.57

Some participants suggested various ways that cloud computing may improve integration in the CSC in their responses to open-ended questions. Also, a respondent noted the applicability of cloud computing in integrating SCM's processes in the warehouse management area (see row 2, Table 5-2). This finding supports research by Li and Shi (2013) and Durski et al. (2011), which discuss applying cloud computing to construct a warehouse management system. Warehouse management systems based on cloud computing can provide remote access to warehouse management processes and lead to a higher level of integration. The respondents' opinions display the significance of cloud computing application in order to integrate warehouse management processes in the CSC domain.

Moreover, some respondents mentioned the role of cloud computing in integrating documentation processes (see row 3, Table 5-2). Documentation is a critical process in the CSC context, and respondents' views about the influence of cloud computing in improving integration in documentation process indicate that cloud computing may provide a good opportunity for practitioners in this area. Specifically, blockchain is discussed as a technology that can be applied in order to implement documentation in the shipping domain (Loklindt, Moeller & Kinra 2018), and performing documentation process based on cloud computing may also bring its advantages. Some respondents believed that the utilisation of cloud computing as shared software among partners in accounting and logistics processes could increase integration among organisations in the CSC (see row 4, Table 5-2). This finding accords with research by Ruiz-Agundez, Penya and Bringas (2011), which provides a shared accounting model based on cloud computing to improve integration. It also supports the results of the study by Tianbao and Meng (2016), which provides a joint distribution logistics model based on cloud computing in the cold chain context to enhance logistics integration.

Table 5-2: Open-ended questions' responses to the cloud integration construct

Row	Number of respondents	Response	Item that supports
1	1	Using cloud computing as a system to interact with different partners such as customers, suppliers and governments.	1
2	1	Using cloud computing to integrate warehouse management systems.	3
3	2	Using cloud computing as a platform in order to implement integrated documentation among partners.	3
4	2	Using SaaS in a shared environment in areas such as logistics and accounting.	2
Total	6		

5.2.1.2 **Cloud flexibility**

The subconstruct of cloud flexibility encompasses five observant variables. Table 5-3 presents the contribution of each observant variable in enhancing flexibility based on regression coefficients of factors in the ultimate construct of cloud-enabled capabilities. Also, Table 5-4 shows the answers of respondents to the open-ended question regarding the cloud flexibility subconstruct, which is "What are the areas that cloud computing has improved flexibility in your company?"

Cloud_flexibility4 encompasses the highest factor loading value and cloud_flexibility2 the lowest. This indicates that access to cloud computing services with a low cost has a significant impact on improving flexibility. This may be due to the importance of cost and competitiveness of price in the container market (Rajkovic et al. 2015). Among open-ended responses, a respondent supported cloud computing flexibility in IT spending (see row 4, Table 5-4). This item may emphasise on scalability as an effective feature of cloud computing in improving flexibility. Similarly, cloud_flexibility2 supports this idea; although, cloud computing scalability has the smallest contribution in improving flexibility.

Among responses to open-ended questions, some participants emphasised the impact of cloud computing accessibility in improving flexibility (see rows 2 and 3, Table 5-4). Accessibility was confirmed as one of the observant variables (Cloud_flexibility5). The high factor loading value of this factor and stress of respondents on cloud computing accessibility may be perceived as the significance of this factor in improving flexibility in CSC environment. Also, it supports the research results of Dellios and Papanikas (2014) which illustrates rapid access, easy and free application development, easier maintenance and better information management as advantages of constructing an e-maritime system based on cloud computing.

Cloud_flexibility3 was intended to measure flexibility enabled by cloud computing through addressing new business relationships. The correlation of this variable with the cloud flexibility subconstruct supports the findings of research by Asbjørnslett, Lindstad and Pedersen (2012). They developed a service level agreement model based on the features of cloud computing in addressing new business relationships.

Table 5-3: Observant variables' contribution in enhancing flexibility through cloud computing

Item	Variable name in the model	Observant variable	Weight
1	Cloud_flexibility4	Cloud computing is a technology which enables a company to access different information technology services at a low cost.	0.75
2	Cloud_flexibility5	Cloud computing infrastructure is easily accessible from various devices such as mobile and laptop.	0.7
3	Cloud_flexibility3	Cloud computing is an information technology environment that can address new business relationships.	0.64
4	Cloud_flexibility1	Cloud computing is a tool that helps to analyse big data and interpret environmental changes.	0.60
5	Cloud_flexibility2	Cloud computing is an information technology infrastructure which is scalable in alignment with fluctuations in needs.	0.50

Also, a respondent suggested the application of cloud computing technology in improving flexibility in administrative functions. This would indeed be beneficial since cloud computing allows the elimination of redundancy which is applicable in administrative functions. For example, organisations with the same kinds of activities may have identical functions, and cloud computing may provide an opportunity for them to implement their administrative tasks in a shared interactive environment. This function may be applicable in the CSC since a container operation's processes are highly standard. This finding accords with findings of research by Cellary and Strykowski (2009) which discusses the application of cloud computing in establishing an e-government system.

Table 5-4: Open-ended questions' responses to the cloud flexibility construct

Row	Number of respondents	Response	Item that supports
1	1	Providing flexibility in administration via decentralising functions	null
2	1	Providing flexibility by facilitating clients' access	2
3	3	Improving flexibility by facilitating remote access	2
4	1	Improving flexibility in spending for IT	1
Total	6		

5.2.2 Container supply chain agility

According to the DC theory, agility can be created through three clusters of capabilities, namely sensing, seizing and transforming in an organisation (Teece Peteraf & Leih 2016). Through EFA implementation, factors related to sensing and seizing were loaded on one component and formed one construct. This means that the collected data fit into two constructs rather than three in the CSC context. The reason for this is that there was a high correlation between observant variables of sensing and seizing constructs.

There is a strong relationship between sensing and seizing capabilities in the CSC context. In other words, the more that organisations in the CSC sense opportunities and threats in their environment, the more they perform their jobs in a way that makes them able to deal with uncertainty and preserve agility. This finding accords with the findings of research by Heusinkveld, Benders and van den Berg (2009) which indicates that success in implementing new practices and concepts needs a great sensing capability. When an organisation intends to seize an opportunity via implementing agile practices, it should be able to gain the required knowledge about related areas. Also, this supports the findings of research by Lee and Rha (2016), which illustrates the strong relationship between sensing and seizing capabilities. However, in research by Kump et al. (2018) which measures DCs in organisations based on sensing, seizing and transforming, implementing EFA verifies three constructs. It should be considered that the mentioned research's focus is on measuring DC in organisations, but in the current research, the focus is on measuring the agility from the SC perspective. Moreover, in the current study, data were collected from organisations which are active in the CSC in Australia, but Kump et al. (2018) collected data from innovative enterprises in Austria.

A high correlation between sensing and seizing subconstructs indicates that organisations in the CSC should act proactively and consider improving both capabilities simultaneously since ignoring one of these can negatively impact the other one and spoil efforts in agility establishment. For example, when an organisation in the CSC learns about market trends, it should simultaneously forecast market demands and consider the optimal capacity to be able to respond to sudden changes based on forecasts. It was the reason that this construct was named proactive sensing.

All observant variables intended to measure transforming capability were loaded on the same component due to a high correlation between them. Transforming capability is one of the DC clusters, and it contributes to constructing CSCA. This finding accords with findings of Blome, Schoenherr and Rexhausen (2013) and Lu and Ramamurthy (2011) in which their main focus in demonstrating agility is on transforming capability.

5.2.2.1 Proactive sensing

In the construct of proactive sensing, after EFA implementation, three observant variables, namely Sensing2, Sensing5 and Seizing3, were deleted. These variables were intended to measure an organisation's ability to learn about the macro-environment which scan the environment to identify new business opportunities and to employ the same services from different service providers. Table 5-5 presents the contribution of each remaining observant variable in enhancing proactive sensing capability based on factor loading weights of the ultimate construct of CSCA. Also, Table 5-6 shows the answers of respondents to the open-ended questions regarding the proactive sensing subconstruct which are "What activities does your company do to explore market opportunities and threats?" and "What activities does your company do to act flexible and preserve agility?"

The low correlation of Sensing2 with proactive sensing construct resulted in deleting this variable. Sensing2 was intended to measure organisations' capability to learn about the macro-environment. This low correlation may indicate that organisational learning about the macro-environment happens through different indirect channels such as interacting with partners embedded in the CSC network. This supports the findings of research by Min, Mentzer and Ladd (2007), which emphasises learning through partners is one of the SCM orientation essentials. Also, responses to the open-ended questions support this idea (Table 5-6, see row 8).

Another deleted variable was Sensing5, intended to measure organisations' capability to scan the environment and identify new business opportunities. The low correlation of this variable with the proactive sensing subconstruct may illustrate that organisations in the

CSC scan their environment indirectly by using market trends, competitors and partners' information. Respondents' emphasis on their efforts to access information, as well as the significance of information technology, may support this assumption (see rows 3 and 5 in Table 5-6).

Another variable that was deleted in order to improve fitness criteria was the observant variable associated with Seizing3. This may indicate that rather than receiving the same service from various service providers, organisations may try to seize existing opportunities through activities such as achieving partners' commitment and increasing interaction with them. The qualitative responses from respondents (see rows 9 and 11 in Table 5-6), and high correlation of Seizing2 may confirm this assumption.

Seizing4 has the highest factor loading value. This means that the most influential capability to improve proactive sensing is the ability of organisations in setting an optimal capacity in a way that makes them able to respond to the sudden changes in customer needs. It accords with findings of research by Gligor (2014) and Roberts and Grover (2012), which introduce responsiveness as one of the crucial factors that can improve SCA. Also, a respondent supported this observant variable and indicated that in-house capacity development is an influential factor impacting seizing capability (see row 10, Table 5-6). It should be considered that capacity should be set at an optimal level; otherwise, it may cause extra cost.

Sensing1 has the lowest factor loading value. This identifies that improving the ability of tracking competitors' tactics and strategies in the CSC has the lowest priority in enhancing proactive sensing capability. This may illustrate that understanding competitors' activities is not the focus of organisations in improving proactive sensing capability as they may focus on other areas such as marketing information.

Sensing4 was intended to measure the capability of organisations to develop new services and evaluate the existing one. This supports the findings of research by Boon-itt, Wong and Wong (2017), which indicates that evaluating existing services is an essential capability of a service SC. Moreover, this also accords with research by Kindström, Kowalkowski and Sandberg (2013) which emphasises service innovation as a critical enabler of seizing capability. Seizing1 is the variable intended to measure organisations' capability in forecasting future market demands. Correlation between this variable and the proactive sensing subconstruct accords with findings of research by Huang et al. (2012). They identified forecasting ability as a tool with which to seize opportunities and achieve operational agility in the manufacturing context.

Seizing2 is the variable intended to measure the capability of organisations in achieving service providers' commitment. Trust and commitment between an organisation and its suppliers can lead to an improvement in joint performance and make organisations able to implement necessary adjustments in circumstances where seizing an opportunity is an essential matter. The relationship between proactive sensing and Seizing2 supports the findings of the research by Lee (2016), which discusses the positive impact of commitment and trust on suppliers' sustainability performance. Thus, in this case, if there is an opportunity to act more sustainably, the relationships based on commitment and trust with the suppliers can help to seize the opportunity. It also supports findings of the research by Graca, Barry and Doney (2015), which emphasises positive outcomes of commitment in buyer-supplier relationships. Their research discusses how trust and commitment can lead to better communication, cooperation and conflict resolution. These factors may help to seize opportunities when it is crucial.

Sensing3 is the variable intended to measure the organisational capability of learning about market trends. Risk is a consequence of inefficiency in areas such as an inability to react swiftly to the volatility of demand and market changes, and a failure to implement some agile paradigms such as mass customisation to address the market changes (Peck 2005). Learning about market trends may immunise organisations against changes and make them capable of sensing opportunities and threats. This finding confirms the results of research by Masteika and Čepinskis (2015), which discusses the capability of sensing market trend as a setup for being agile. Moreover, one respondent in the current research supported this variable and mentioned understanding market trends as an influential factor in acting proactively in a dynamic environment (see row 2, Table 5-6).

Table 5-5: Observant variables' contribution in enhancing proactive sensing capability

Item	Variable name in the model	Observant variable	Weight
1	Seizing4	A company capability to set an optimal capacity to be able to respond to sudden changes in customers' demands.	0.76
2	Sensing4	A company capability of new services development and evaluating existing services.	0.71
3	Seizing1	A company capability to forecast future market demands.	0.70
4	Seizing2	A company capability to obtain service providers' commitment.	0.66
5	Sensing3	A company capability to learn about market trends.	0.65
6	Sensing1	A company capability to track competitors' tactics and strategies.	0.57

Some participants suggested various ways to improve proactive sensing capability in their responses to open-ended questions. A respondent expressed the importance of using the data analysis tool to operate a business more proactively (see row 1, Table 5-6). SCs are operating in the big data era where the big data has transited from being an emerging topic to a growing research area, and data analysis plays an essential role in exploiting big data. Data analysis is a tool that can assist in utilising big data in areas such as real-time decision making. This finding supports the research's results of Zhong et al. (2016) and Mishra et al. (2018) which discuss the role of big data exploitation in different aspects of SCM.

Majority of respondents emphasised the significance of accessing information (see row 3, Table 5-6), thereby exposing the crucial role of information in the CSC environment. Accessing information can facilitate learning about market trends and forecasting future market demands. Therefore, it is considered as one of the variables of this research. This finding also accords with findings of the study by Luo, Shi and Venkatesh (2018), which discusses the crucial role of information in SC excellence. A respondent mentioned the role of experts in acting proactively (see row 4, Table 5-6). This response supports the findings of research by Sheehan, Ellinger and Ellinger (2014), which discusses the necessity of developing human resource expertise when dealing with a dynamic environment.

Another respondent pointed out the role of using IT (see row 5, Table 5-6). IT facilitates information sharing among SC partners, and its significance has been emphasised by many researchers such as Singh and Teng (2016) and Fosso Wamba et al. (2015). Some respondents mentioned the necessity of understanding partners' existing capacity, and a respondent pointed out understanding partners' capacity requirements (see rows 6 and 7, Table 5-6). These ideas emphasise that organisations' strategy in capacity planning should be in alignment with their partners' strategy in the CSC. It also supports the findings of research by Chu, Shamir and Shin (2016) which discusses the necessity of communication for capacity alignment in a SC, and the study by Zhu (2015) which suggests decentralised decision making to set a successful capacity planning program.

A respondent emphasised the role of increasing interaction with partners to enhance the ability to act proactively in a dynamic environment (see row 8, Table 5-6). It supports the findings of the research by Salvador et al. (2001), which discusses the significance of interacting with partners and its impact on performance. Also, a respondent mentioned the necessity of adopting an appropriate strategy in addressing a dynamic environment (see row 9, Table 5-6). Different strategies, such as agility can be employed to deal with a dynamic environment, and this finding supports the study by Gligor, Esmark and Holcomb (2015), which focuses on an agile strategy to deal with a dynamic environment. A respondent suggested in-house capacity development. It should be considered that maintaining extra capacity can cushion organisations against sudden changes in demand, although this should be at an optimal level. This finding supports the findings of research by Kian and de Souza (2017), which discusses the necessity of extra capacity in saving cost.

Table 5-6: Open-ended questions' responses to the proactive sensing construct

Row	Number of respondents	Response	The item that it supports
1	1	Using data analysis tools	3, 5
2	3	Understanding market trends	3
3	11	Try to access information through research, industry reports, media, partners and associations	3, 5
4	1	Employing experts	null
5	1	Applying information technology	3, 5, 6
6	2	Understanding partners' existing capacity	1
7	1	Understanding partners' capacity requirements	1
8	1	Increasing interactions with partners	4
9	1	Adopting an appropriate strategy	null
10	1	In-house capacity development	1, 2
Total	23		

5.2.2.2 **Transforming**

Transforming is another cluster of capabilities that assists in establishing CSCA. This subconstruct consists of four observant variables. Table 5-7 presents the contribution of each observant variable in enhancing transforming capability based on factors' loading values in the ultimate construct of CSCA. Also, Table 5-8 shows the answers of respondents to the open-ended question regarding the transforming construct, which is "What other activities does your company engage in the supply chain to transform and achieve agility?"

Transformation2 measured organisations' capability to adjust their service providers according to the changes in customers' demands. The high correlation of Transforming2 with the transforming subconstruct supports the findings of research by Stevens and Johnson (2016), which emphasises frequent structural adjustment to the supply base to secure continued growth. It should be considered that in a service SC the service providers normally play the role of the suppliers.

Transformation1 measured the capability of organisations to cooperate with new partners to achieve operational efficiency when changes happen in the environment. The correlation of this variable with the transforming subconstruct accords with findings of Chang, Chiang and Pai (2012), which discusses cooperation as an influential factor in improving efficiency. Also, it supports the findings of research by He and Lai (2012), which stresses the role of cooperation in improving operational efficiency via transforming manufacturers from purely product-oriented to service-oriented organisations.

Transformation3 measured the capability of organisations in modifying their operational time based on the changes in the operational time of other members. The correlation of this factor with the transforming construct supports the findings of research by Ivanov (2010) which presents a model to co-ordinate the operational plans of two independent supply chain partners linked by material flow and non-strategic information flows. Also, it supports the findings of research by Zhu et al. (2018) which emphasises operational transparency as a critical capability since it can enable organisations to align their operational time with other SC's members.

Transforming4 measured organisations' capability to modify their capacity in alignment with their customer demands. The correlation of this factor with the transforming subconstruct supports research by Ivanov (2010) which discusses that customers are an essential part of SC orientation and emphasises the necessity of coordinating capacity planning strategy with partners regarding customers' needs.

Among the collected qualitative data through open-ended questions, some respondents believed in using SCM agile practices to improve transforming capability (see row 1, Table 5-8). This opinion supports all observant variables used in this subconstruct since SC agile strategies are not limited to a specific area and can empower organisational transforming capability in different SC aspects such as customer relationship management. As a consequence, it will influence various aspects of performance such as rapid adjusting of capacity. This finding accords with research by Tarafdar and Qrunfleh (2017), which discusses the impact of SCA on SC performance with the mediating role of SC practices.

Moreover, a respondent pointed out the role of specialist human resources for improving transforming capability (see row 6, Table 5-8). Professional human resources can impact transforming capability. The human resources are a vital element of every organisation which can impact all aspects of an SC's activities; thus, the human resources may affect all elements of Table 5-7. This finding also accords with research by Stank, Paul Dittmann and Autry (2011) which discusses talent as one of the SC excellence pillars.

Furthermore, a respondent mentioned modifying logistics suppliers according to customers' needs (see row 3, Table 5-8). This opinion directly supports item one in Table 5-7. Another respondent emphasised the use of different logistics options (see row 4, Table 5-8). Using different logistics options can enable organisations to adjust to a new condition and fulfil customers' expectations. Thus, this opinion indirectly supports items 1, 3 and 4 of Table 5-7. Moreover, this finding supports research by Gligor and Holcomb

(2014), which discusses how different logistics strategies can help a firm to reconfigure SC's resources quickly to respond to changes in demand.

Table 5-7:Observant variables' contribution in enhancing transforming capability based on regression coefficients

Item	Variable name in the model	Observant variable	Weight
1	Transformation1	The capability of organisations to cooperate with new partners to achieve operational efficiency.	0.68
2	Transformation2	The capability of organisations to adjust their service providers in alignment with changes in customers' demand.	0.66
3	Transformation3	The capability of organisations to modify their operational time in alignment with changes in the operational time of other members.	0.62
4	Transformation4	The capability of organisations to modify required capacity according to changes in customers' demands.	0.58

Furthermore, among people who answered open-ended questions, some respondents mentioned the role of localising supply to the key customers (see row 2, Table 5-8). Localising supply to the key customers can enable organisations to act flexibly in various issues such as access to resources. It can also help organisations to improve their adaptability aligned with their destination market's environment. These factors may help organisations adjust themselves better to changes in their customers' needs. Therefore, the respondents' opinion about localising supply to key customers supports items 3 and 4 of Table 5-7. This finding also supports research by Kumar Sharma and Bhat (2014) which discusses how an agile SC should be demand-driven with the localised configuration to maximise effectiveness. It also accords with findings of research by Wu and Jia (2018), which discusses the benefits of SC localisation in improving agility.

A respondent believed that applying IT tools can improve transforming capability (see row 5, Table 5-8). IT can facilitate connection with SC's partners and establishing a new SC relationship. Thus, it can promote transforming capability. Also, this finding accords with findings of research by Oh, Ryu and Yang (2019) which explores the interaction between an SC's capabilities and IT and their influence on a firm's performance. This opinion also supports items 1 and 2 of Table 5-7 since IT can facilitate cooperation with SC members and linkage with new partners.

Some respondents mentioned the impact of third parties competency in improving transforming capability (see row 7, Table 5-8). Third parties play an essential role in modern SCM. Organisations need the service of third parties to outsource parts of their SC's operations and reduce the burden of being involved in different activities such as logistics. Selecting an appropriate third party can enable organisations to reform based on needs and achieve agility. For example, an organisation can benefit from the capability of a third party in responding to its customers' changes in demands. This finding accords with findings of research by Leuschner et al. (2014) which indicates the positive impact of third parties in improving customer service and a firm's performance.

A respondent mentioned the impact of technology on transforming capability. Different technologies may be used in the various aspects of SCM based on needs. For example, according to the results of this research, cloud computing technology has a positive impact on transforming capability. Depending on the area in which technology is used, it can impact on transforming capability.

Table 5-8: Open-ended questions' responses to the transforming construct

Row	Number of respondents	Response	The item that it supports
1	2	Using SCM agile strategy.	1, 2, 3, 4
2	2	Localising supply to key customers.	3, 4
3	1	Modifying logistics suppliers according to customer needs.	1
4	1	Using different logistics options including rail, road and coastal shipping.	1, 3, 4
5	1	Applying IT tools.	1, 2
6	1	Employing specialist human resource.	1, 2, 3, 4
7	2	Employing competent third parties.	1, 2, 3, 4
8	1	Application of new technologies.	1, 2, 3, 4

5.3 Exploring the relationship between cloud-enabled capabilities and container supply chain agility

In this section, the results of the SEM are discussed to explore the relationship between cloud-enabled capabilities and CSCA. Four hypotheses of this research were explored in the previous chapter. Regarding the results of the SEM, two hypotheses were supported while the other two were not. In the following sections, each hypothesis is discussed.

5.3.1 The impact of cloud computing integrative capability on transforming ability

The hypothesis: *H_{1b}: Cloud integrative capability is positively related to transforming ability*, as tested in the SEM, is not supported. Thus, cloud integration does not have a significant effect on transforming capability. This finding implies that created integration through cloud computing application cannot improve the transforming capability of CSCA. Thus, if organisations in the CSC expect higher transforming capability, they may improve it through other ways. In the SC context, a way to elevate transforming capability may be changing the SC design into short-term responses that can bring immediate results, as it was suggested by Aslam et al. (2018). Moreover, in line with realigning structure, existing capabilities should be aligned, and additional capabilities should be invested (Teece 2018). Also, initiating structural change should be in coordination with strategic alliances (Priyono, Dewi & Lim 2019). The integration that cloud computing creates may hinder required structural changes, and this perspective may support the result of this section. However, it should be considered that transforming capability is just one of the SCA dimensions and organisations should orchestrate all three capabilities of sensing, seizing and transforming in a manner that makes them able to achieve the highest level of agility.

5.3.2 The impact of cloud computing integrative capability on proactive sensing ability

The hypothesis: *H_{1a}: Cloud integrative capability is positively related to proactive sensing ability*, as tested in the SEM, is supported. It means that the integration that cloud computing creates in organisations throughout the CSC can help to realise opportunities and threats and mobilise resources to utilise opportunities and deal with threats. Cloud computing is a type of IT, and this finding supports the research by Ngai, Chau and Chan (2011), which discusses the positive impact of IT integration on SCA. It is also in line with findings of research by Overby, Bharadwaj and Sambamurthy (2006), which consider a positive indirect impact of IT integration on sensing and seizing as two aspects of enterprise agility and provides a model with which to measure agility. Also, it accords with findings of research by DeGroote and Marx (2013), which indicates the impact of IT usage on coordination and sensing the market. However, DeGroote and Marx explore market sensing ability and agility in two independent constructs. The positive relation between cloud computing and IT integration can be supported since the integration that cloud computing creates may cause better linkage among organisations in the CSC network, and it can make them able to interact better and implement superior information sharing with their partners. In other words, IT integration may facilitate interaction among partners. Also, interaction with partners is one of the items that can improve sensing capability according to respondents' opinion (see row 8, Table 5-6).

5.3.3 The impact of cloud flexibility on proactive sensing ability

The hypothesis: H_{2a}: *Cloud flexibility capability is positively related to proactive sensing ability*, as tested in the SEM, is supported. It means that the flexibility that cloud computing creates in an organisation can improve the proactive sensing aspect of CSCA. This finding accords with the study by Patten et al. (2005), which discusses the impact of IT flexibility on agility. However, the current study explored the relationship between cloud computing as a type of IT on dimensions of CSCA. It is also in line with a study conducted by Benitez-Amado and Ray (2013), which examines the impact of IT infrastructure on business flexibility. In Benitez-Amado and Ray's study, business flexibility is defined as a combination of sensing and seizing capabilities. However, the current study explored the relationship between created flexibility through cloud computing as a type of IT and CSCA dimensions.

5.3.4 The impact of cloud flexibility on transforming ability

The hypothesis: H_{2b}: *Cloud flexibility capability is positively related to transforming ability*, as tested in the SEM, is not supported. Therefore, created flexibility through cloud flexibility cannot improve transforming capability. It means that cloud flexibility cannot enhance organisations' capability to adjust to new conditions in alignment with environmental changes. Transforming capability depends on various factors such as leadership (Teece Peteraf & Leih 2016), and it seems that the flexibility that cloud computing creates is not substantially influential in improving this aspect of SCA. This finding supports the results of the study by Liu et al. (2013). According to Liu et al.'s research, the relationship between flexible IT infrastructure and SCA was not support. However, in the current study, the relationship between cloud computing as a type of flexible IT infrastructure and CSCA dimensions is discussed in more details. In this research, the advantages of cloud computing regarding its impact on CSCA were studied. However, it is beneficial to discuss some drawbacks of cloud computing to provide a better understanding of its application.

5.4 Drawbacks of cloud computing

Besides all benefits that cloud computing can provide, it has some drawbacks. First of all, the adoption of cloud computing may result in substantial changes in an organisation which may affect employees (Maresova, Sobeslav & Krejcar 2017). Thus, before the application of cloud computing readiness of an organisation in technology transition should be assessed. Moreover, security and reliability of service are among the important issues. Information security means defending information from unauthorised access, use and disclosure, and scholars are still trying to improve cloud security and privacy of data (Tchernykh et al. 2019). Reliability implies that the service is available to the users consistently all the time without disruption. The application of cloud computing depends on the internet and a service provider quality of the service which may impact on service reliability (Tchernykh et al. 2019). Research in the area of fog computing has attempted to improve cloud computing reliability (Hao et al. 2017).

Further, as cloud computing provides the powerful computational capability and a huge amount of storage capacity for users with a high level of flexibility and low cost, this may encourage organisations to move their sensitive information and virtual operations to cloud systems. If malicious attacks threaten a cloud provider, it can severely impact engaged businesses which use subjected cloud service (Xue & Xin 2016). Hence, before applying cloud computing issues such as organisation maturity for technology acceptance, cloud service provider reputation, quality of service, and the sensitivity of data which will be stored on cloud service should be assessed.

5.5 Summary

This chapter discussed the results of the research. It revealed that cloud computing application creates two capabilities, namely flexibility and integration. Also, CSCA encompasses two main dimensions of proactive sensing and transforming. Both cloud-created capabilities and CSCA dimensions were discussed and compared with existing literature.

Moreover, the relationship between cloud-enabled capabilities and CSCA dimensions were examined. It was revealed that there is a positive relationship between both cloud integration and flexibility with proactive sensing capability, but the positive relationships between cloud integration and flexibility with transforming capability were not supported. Furthermore, the results of the SEM were also compared with existing literature. Also, in the end, some drawbacks of cloud computing were discussed. In the next chapter, the summary of key findings are presented, and responses to the research questions are provided.

Chapter Six: Conclusion

6.1 Overview

This chapter provides a conclusion to this research and is organised as follows: Section 6.2 provides a summary of the findings, section 6.3 explores the contributions of this research, section 6.4 discusses research limitations and opportunities for future research, and section 6.5 concludes the chapter.

6.2 Summary of the findings

The main purpose of this research was to study the impact of cloud computing on CSCA. Hence, the primary research question was: *How does cloud computing impact on CSCA?* The main purpose of this research required the researcher to set three objectives, and achieving these objectives paved the way to answering the primary research question. The first objective was to establish an understanding of the CSCA dimensions associated with the first subsidiary research question; therefore, the first subsidiary research question was: *What are CSCA dimensions?* The second objective was to study the capabilities that cloud computing application can create in organisations within CSC in Australia; therefore, the second subsidiary research question was: *What are the capabilities that cloud computing application can create in organisations within the CSC?* The third objective was to determine the relationship between cloud-enabled capabilities and CSCA dimensions; therefore, the third subsidiary research question was: *What is the relationship between achieved capabilities through cloud computing application and CSCA dimensions?*

A comprehensive literature review was conducted to understand created capabilities through cloud computing application and SCA dimensions (Chapter Two). It was realised that cloud computing application could create integration and flexibility, and SCA could be demonstrated based on the three dimensions of sensing, seizing and transforming. Since cloud computing and SCA were not investigated in the context of CSC, it was necessary to verify the validity and reliability of examined measures in each construct. Thus, in Chapter Four, EFA and CFA were applied to understand whether or not the collected data confirm presumed constructs in the context of CSC. The FA verified two cloud-enabled capabilities of integration and flexibility in the CSC context and two dimensions, namely transforming and proactive sensing for CSCA dimensions. Investigating cloud-enabled capabilities and CSCA dimensions paved the way to explore the relationship between them, and the third objective.

In Chapter Two, based on the reviewed literature, a conceptual framework was proposed to achieve a better understanding of the relationship between cloud-enabled capabilities and CSCA constructs. In Chapter Four, after the implementation of FA, the conceptual framework and relationships between constructs were revised. In the next stage, SEM was performed to accept or reject the proposed causal relationships between cloud-enabled capabilities and CSCA and thereby achieve the third objective. The results verified the relationship between integration and flexibility that cloud computing creates in organisations and proactive sensing. Empirical findings of the research related to the research's questions are presented in the following sections.

6.2.1 Container supply chain agility

The first subsidiary research question of this study, SRQ1: What are agility dimensions in CSC?, was proposed to examine the CSCA according to DC theory. The results of data analysis demonstrated that CSCA encompasses two main dimensions, namely transforming and proactive sensing. Transforming capability can be enhanced in the CSC by means of several factors including adjusting service providers in alignment with changes in customers' demands; cooperating with new partners in order to achieve operational efficiency; modifying operational time in alignment with changes in the operational time of other members, and modifying required capacity according to changes in customers' demands. Also, some factors help to develop proactive sensing capability including setting an optimal capability to respond to sudden demand changes, developing new services and evaluating existing ones, forecasting future market demands, obtaining service providers' commitment, learning about market trends and tracking competitors' tactics and strategies. The most significant findings in the area of CSCA can be summarised as follows:

- The most influential capability for improving proactive sensing is the capability of organisations in setting an optimal capacity in a way that makes them able to respond to the sudden changes in customer needs.

- Improving the capability of tracking competitors' tactics and strategies in the CSC has the lowest priority for enhancing proactive sensing capability.

- Organisations' capability to adjust their service providers according to changes in customers' demands is the most influential factor that can improve transforming capability in the CSC context.

- The capability of organisations to modify the required capacity in alignment with changes in customers' demands is a factor with the least impact on transforming capability.

6.2.2 Cloud-enabled capabilities

The second subsidiary research question of this study, SRQ2: What capabilities are created in an organisation by cloud computing application?, was proposed to explore capabilities that cloud computing application can create in organisations within the container supply chain (CSC) network. The results of the data analysis verified that cloud computing application could create two capabilities, namely integration and flexibility, in organisations within the CSC.

Cloud computing can create an integration in the CSC by providing a platform to share information among partners, accommodating shared software among partners, facilitating the integration of the CSC's processes, and providing a shared, collaborative virtual working environment among the CSC's members. It can also create flexibility in the CSC by facilitating access to different IT services with low cost and from various devices such as mobile and laptop easily, addressing new business relationships, and enabling big data analysis in order to interpret environmental changes. The most important findings can be summarised as follows:

- Information sharing is the most crucial factor that can create integration among organisations in the CSC network.
- Establishing a shared virtual working environment among partners in the CSC has the lowest priority for enhancing integration among organisations.
- Access to cloud computing service providers with a low cost has a significant impact on improving flexibility.
- The application of cloud computing to utilise big data has the smallest contribution in improving flexibility in the CSC.

6.2.3 The relationship between cloud-enabled capabilities and container supply chain agility

The third subsidiary research question of this study, SRQ3: What is the relationship between achieved capabilities by cloud computing application and CSCA dimensions?, was proposed to explore the relationship between cloud-enabled capabilities and CSCA. The results of the data analysis indicated that there is a causal relationship between cloud integration and proactive sensing; also, there is a causal relationship between cloud flexibility and proactive sensing. It means that, in the CSC, if organisations apply cloud computing in a manner that was discussed in this research, it may create integration and flexibility in their SCs' activities. As a result, they can expect to enhance their proactive sensing capability, which is a combination of sensing and seizing capabilities. The most important findings of this section can be summarised as follows:

- Created integration through cloud computing application in organisations within the CSC cannot improve the transforming capability as one of the CSCA dimensions.
- Created integration through cloud computing application in organisations within the CSC can help to improve proactive sensing capability as one of the CSCA dimensions.
- The flexibility that cloud computing application creates in organisations within the CSC can improve proactive sensing capability.
- The flexibility that cloud computing application creates in organisations within the CSC cannot enhance transforming capability.

6.3 Contributions of this study

The contributions of this research are in two areas: SCM literature and managerial. These areas are discussed in more detail below.

6.3.1 Contributions to SCM literature

Firstly, this research developed and validated the construct of cloud-enabled capabilities empirically. An effective IT infrastructure is among the top concerns of IT management, and the development of efficient IT is necessary. Cloud computing technology is a type of IT with specific characteristics that can improve effectiveness. This research developed a valid and reliable instrument with which to measure cloud-enabled capabilities in the CSC context through statistical processes of EFA and CFA. In this area, this study extends the work of several scholars such as (Azevedo et al. 2012; Cao, Schniederjans & Schniederjans 2017; Tiwari & Jain 2013).

Secondly, this research developed an instrument with which to measure SCA in the context of the CSC. Agility is a critical characteristic of best value SC, and this study developed a CSCA construct based on the three subconstructs of sensing, seizing and transforming, although through FA the number of subconstructs reduced from three to two. The subconstructs of sensing and seizing were merged into one construct named proactive sensing. In this area, this study extends the work of scholars such as (Chen 2018; Kump et al. 2018; Rahimi et al. 2017; Tse et al. 2016).

Thirdly, this research studied the influence mechanism of cloud computing on CSCA based on DC theory. The study developed a conceptual framework through which to explore how organisations in a CSC leverage cloud computing capability to enhance SCA in the three areas of sensing, seizing and transforming. In this area, this study extends the work of researchers such as (Govindaraju, Akbar & Suryadi 2018; Lee 2012).

Fourthly, DCs exist in the form of capability clusters, namely sensing, seizing and transforming. This research applied the DC theory in the CSC context empirically. The presented model provides a richer and more in-depth understanding of DCs. It clarifies how the combination of sensing, seizing and transforming capabilities can establish SCA in the CSC.

6.3.2 Managerial contributions

From a practical perspective, this study developed a framework which can guide managers in some areas. Firstly, this research can help them prioritise the areas in which they can use cloud computing to improve IT integration and flexibility. To promote IT integration in CSC activities managers can share information with their partners in cloud computing environment rather than traditional information sharing methods, utilise SaaS layer of cloud system to develop shared software, and apply cloud computing as core IT system to integrate different activities such as warehousing, controlling and distribution. Also, exploiting cloud computing flexibility needs specific attention to the following areas: Appropriate data management and exploiting big data analytics power, adjusting cloud system usage in alignment with changes in demands and developing cloud computing application in initiating new business relationships.

Furthermore, this research can assist managers in understanding the areas in which they can focus to improve their SCA. Thus, they can use the results of this research as a guide to recognising their strengths and weaknesses. To enhance agility in CSC activities, organisations should consider sensing their environment, seize opportunities and reconfigure their resources. To improve sensing and seizing ability, managers should track their organisation competitors' tactics and strategies, stress more on learning about market trends, consistently develop new services and evaluate existing services considering their added value, forecast future market trends, try to achieve their organisation service providers' commitment, set optimised capacity to be able to respond to sudden changes.

Further, to improve reconfiguration capability, managers should adjust their SC structure by cooperating with new partners and adjusting their service providers according to the changes in customer demands, modify their capacity and operational time in alignment with other CSC members. Additionally, by observing the aforementioned guidelines, managers can expect positive impacts of cloud computing on boosting their activities towards improving CSCA.

6.4 Limitations and future research

Despite the contributions of this research, some limitations need to be taken into consideration. These limitations may open new avenues for future research. They are discussed as follows.

Firstly, the theoretical model of this research was limited and can be developed by future research. For example, other capabilities that may be created by cloud computing technology such as e-business capability (Yeh, Lee & Pai 2015) can be added to the cloud-enabled construct. Also, the SCA construct may be measured by using other variables such as process integration (Martinez-Sanchez & Lahoz-Leo 2018) rather than sensing, seizing and transforming. Furthermore, the moderating role of some variables such as environmental dynamism (Gligor, Esmark & Holcomb 2015) can help to achieve better insight into the impact of cloud computing on SCA.

Secondly, a web-survey instrument as a quantitative method was used to collect information in this study. For the future research applying qualitative methods such as interview may reveal more indexes for measuring cloud-enabled capabilities and CSCA, which may be omitted in this research.

Thirdly, the data for this study were collected from organisations which are active in the CSC in Australia. Since the CSC has been extended across the world, implementing this study in other geographical regions can complete the results of this research. Moreover, this study's focus was the CSC, and it can be implemented in different industry sectors such as manufacturing.

Fourthly, the conceptual framework of this research can be changed to investigate the impact of other agility enablers such as human resources and IT rather than cloud computing on SCA. Moreover, the impacts of SCA can be an area of investigation; for example, researchers may explore the impact of SCA on SC performance. Furthermore, the impact of big data and SC digitalisation are two areas which have not been explored by many scholars, and these can provide good opportunities for future research topics.

6.5 Conclusion

Cloud computing is a type of IT infrastructure with specific characteristics. Moreover, in today's turbulent environment, organisations need to respond quickly to sudden environmental changes. Agility is a capability that can make organisations able to address these environmental changes. Cloud computing can improve SCA, and according to the reviewed literature, there was a gap about investigating the impact of cloud computing on CSCA in Australia. With the assumption that cloud computing can improve CSCA, this research contributes to filling the existing gaps and provides empirical evidence and insight into areas of cloud computing and CSCA.

Directly addressing the research question raised in Chapter One, it can be concluded that cloud computing application can create the two capabilities of integration and flexibility in organisations within the CSC. Also, agility in the context of the CSC has the two dimensions of proactive sensing and transforming. The integration and flexibility that cloud computing application creates in organisations can improve proactive sensing capability.

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Appendixes

APPENDIX A ETHICS APPROVAL

UNIVERSITY of TASMANIA

28 June 2019

Dr Reza Emad
C/- University of Tasmania

Sent via email

Dear Dr Emad

REF NO: H0018189
TITLE: The Investigation on the Impact of Cloud Computing on Supply Chain Agility

We are pleased to advise that acting on a mandate from the Tasmania Social Sciences HREC, the Chair of the committee considered and approved the above project on 26 June 2019.

Please ensure that all investigators involved with this project have cited the approved versions of the documents listed within this letter and use only these versions in conducting this research project.

This approval constitutes ethical clearance by the Tasmania Social Sciences HREC. The decision and authority to commence the associated research may be dependent on factors beyond the remit of the ethics review process. For example, your research may need ethics clearance from other organisations or review by your research governance coordinator or Head of Department. It is your responsibility to find out if the approvals of other bodies or authorities are required. It is recommended that the proposed research should not commence until you have satisfied these requirements.

In accordance with the National Statement on Ethical Conduct in Human Research, it is the responsibility of institutions and researchers to be aware of both general and specific legal requirements, wherever relevant. If researchers are uncertain they should seek legal advice to confirm that their proposed research is in compliant with the relevant laws. University of Tasmania researchers may seek legal advice from Legal Services at the University.

All committees operating under the Human Research Ethics Committee (Tasmania) Network are registered and required to comply with the *National Statement on the Ethical Conduct in Human Research* (NHMRC 2007 updated 2018).

Therefore, the Chief Investigator's responsibility is to ensure that:

(1) All investigators are aware of the terms of approval, and that the research is conducted in compliance with the HREC approved protocol or project description.

(2) Modifications to the protocol do not proceed until **approval** is obtained in writing from the HREC. This includes, but is not limited to, amendments that:

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(i) are proposed or undertaken in order to eliminate immediate risks to participants;
(ii) may increase the risks to participants;
(iii) significantly affect the conduct of the research; or
(iv) involve changes to investigator involvement with the project.

Please note that all requests for changes to approved documents must include a version number and date when submitted for review by the HREC.

(3) Reports are provided to the HREC on the progress of the research and any safety reports or monitoring requirements as indicated in NHMRC guidance. Researchers should notify the HREC immediately of any serious or unexpected adverse effects on participants.

(4) The HREC is informed as soon as possible of any new safety information, from other published or unpublished research, that may have an impact on the continued ethical acceptability of the research or that may indicate the need for modification of the project.

(5) All research participants must be provided with the current Participant Information Sheet and Consent Form, unless otherwise approved by the Committee.

(6) This study has approval for four years contingent upon annual review. A *Progress Report* is to be provided on the anniversary date of your approval. Your first report is due 26 June 2020, and you will be sent a courtesy reminder closer to this due date. Ethical approval for this project will lapse if a Progress Report is not submitted in the time frame provided

(7) A *Final Report* and a copy of the published material, either in full or abstract, must be provided at the end of the project.

(8) The HREC is advised of any complaints received or ethical issues that arise during the course of the project.

(9) The HREC is advised promptly of the emergence of circumstances where a court, law enforcement agency or regulator seeks to compel the release of findings or results. Researchers must develop a strategy for addressing this and seek advice from the HREC.

Should you have any queries please do not hesitate to contact me on (03) 6226 2975 or via email ss.ethics@utas.edu.au.

Yours sincerely

Jude Vienna-Hallam
Executive Officer I Social Sciences

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APPENDIX B1 INVITATION LETTER

Email subject:
Study on supply chain agility and cloud computing.

Dear Sir/Madam

My name is Ali Shakourloo, a higher degree by research (HDR) candidate at the Australian Maritime College, University of Tasmania. I would like to invite you to participate in an online survey that is the major part of my research **investigating the impact of cloud computing on supply chain agility.**

Your valuable knowledge, experience, and views about supply chain agility and cloud computing technology will make a great contribution toward a better understanding of the impact of cloud computing technology on supply chain agility.

You will be asked to answer questions regarding **agility dimensions** and **cloud computing technology** within your company. Please be assured that all individual responses collected through the survey will only be used for research purposes and treated in a **strictly confidential** manner.

The survey will take **less than 15 minutes** of your precious time to complete. Your participation in this survey is **entirely voluntary** and you have the right to withdraw your participation from this study at any time without any reasons. If you have any questions about this study or if you would like to discuss any aspects of this study, please do not hesitate to email me at Ali.shakourloo@utas.edu.au.

If you agree to participate in this survey, please click the survey link here, where you will be directed to an information sheet about this study and survey questions.

Thank you in advance for your time and valuable contribution.

Yours sincerely,

Ali Shakourloo
HDR candidate in supply chain management
Australian Maritime College (AMC)
University of Tasmania
Launceston Tasmania

APPENDIX B2 REMINDER LETTER

Email subject:
Reminder for participating in the survey on supply chain agility and cloud computing.

Dear Sir/Madam

Recognising your very busy schedule, I am sending you this note as a reminder to invite you to participate in an online survey that is the major part of my research **investigating the impact of cloud computing on supply chain agility.**

Your valuable knowledge, experience, and views about supply chain agility and cloud computing technology will make a great contribution toward a better understanding of the impact of cloud computing technology on supply chain agility.

You will be asked to answer questions regarding **agility dimensions** and **cloud computing technology** within your company. Please be assured that all individual responses collected through the survey will only be used for research purposes and treated in a **strictly confidential** manner.

The survey will take **less than 15 minutes** of your precious time to complete. Your participation in this survey is **entirely voluntary** and you have the right to withdraw your participation from this study at any time without any reasons. If you have any questions about this study or if you would like to discuss any aspects of this study, please do not hesitate to email me at Ali.shakourloo@utas.edu.au.

If you agree to participate in this survey, please click the survey link here, where you will be directed to information sheet about this study and survey questions.

Thank you in advance for your time and valuable contribution. Here

Yours sincerely,

Ali Shakourloo
HDR candidate in supply chain management
Australian Maritime College (AMC)
University of Tasmania
Launceston Tasmania

APPENDIX B3 INFORMATION SHEET

The impact of cloud computing on supply chain agility
PARTICIPANT INFORMATION SHEET

This research is being conducted in partial fulfilment of a Master's degree

Research team

Dr. Reza Emad, National Centre for Ports and Shipping/Australian Maritime College
Dr. Peggy Shu-Ling Chen, National Centre for Ports and Shipping/ / Australian Maritime College
Ali Shakourloo, Master of Philosophy student, National Centre for Ports and Shipping/ Australian Maritime College
Ali.shakourloo@utas.edu.au

1. Invitation

You are invited to participate in a research study examining the impact of cloud computing application on your supply chain agility.

2. What is the purpose of this study?

This study aims to investigate how cloud computing technology can improve your supply chain agility.

3. Why have I been invited to participate?

You have been invited to participate in this survey because you have valuable experience, knowledge, and insights about different issues such as the application of cloud computing and supply chain agility.

4. What will I be asked to do?

You will be asked to complete a web-survey questionnaire. It will ask for information regarding your supply chain agility and application of cloud computing technology in your organisation. We expect the total required time is maximum 15 minutes. Please note that the completion and submission of online questionnaire will be implied as your consent for participating in this survey. It is also worth mentioning that the survey's questions format is multiple choice that ask about your level of agreement.

5. Are there any possible benefits from participation in this study?

This study will advance knowledge about the impact of cloud computing on organisational agility in supply chain, and the results will contribute to the development of recommendations that may be useful to the building of supply chain agility within your organisation. You can have a copy of research's results upon your request. Also, the results of this research can be accessed via the library of the University of Tasmania from December 2020 after publication.

6. Are there any possible risks from participation in this study?

There are no foreseeable risks from participating in this project. All information you provide will remain anonymous and will be used only for the purposes of this research. Only aggregated data will be used for analysis and publication. This will ensure that the anonymity and confidentiality of the participants and their organisation are maintained.

7. What if I change my mind during or after the study?

Participation is completely voluntarily and you can withdraw at any time before completing online questionnaire. Since the online data collection process is completely anonymous, after submitting the online questionnaire, it is not possible to withdraw and remove the provided data.

8. What will happen to the data when this study is over?

The information collected from the participants will be kept in online storage servers of the University of Tasmania that can only be accessed by authorised users (the research student and his supervisory team).
The online storage space will be password-encrypted to increase the security of the data. All files will be held for 5 years from the completion of this research and then will be destroyed.

9. How will the results of the study be published?

The results of the study will be presented or published at conferences and in other academic arenas including journals and master thesis. The master thesis will be accessible via the library of the University of Tasmania from December 2020. None of the individual data collection forms will be included in any form of publication and only aggregated and analysed data will be presented making it impossible to identify any participants or organisations.

10. What if I have questions about this study?

If you have any questions about this study or if you would like to discuss any aspects of this study, please do not hesitate to contact the following people:

Name	Role	Email	Telephone
Dr G. Reza Emad	Chief Investigator	Reza.Emad@utas.edu.au	+61362349594
Dr Peggy Shu-Ling Chen	Co-Investigator	pchen@utas.edu.au	+61 363249694
Ali Shakourloo	Student Investigator	Ali.shakourloo@utas.edu.au	

This study has been approved by the Tasmania Health and Medical/Social Sciences Human Research Ethics Committee. If you have concerns or complaints about the conduct of this study, you can contact the Executive Officer of the HREC (Tasmania) Network on (03) 6226 6254 or email human.ethics@utas.edu.au / ss.ethics@utas.edu.au. The Executive Officer is the person nominate to receive complaints from research participants. You will need to quote H00xxxxx.

APPENDIX C QUESTIONNAIRE

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Questionnaire:

1. Respondent's profile

1.1. Which of the following best describes your company?

☐ Port authority ☐ Land transport (road & rail) operator

☐ Freight forwarding company ☐ Shipping company/shipping agency ☐ Other

1.2. Which of the following best describes your position in your company?

☐ Supply chain manager ☐ General manager/Senior manager

☐ Business owner ☐ logistics expert ☐ Other

1.3. How long have you been working in your position?

☐ Less than 5 years ☐ 5–9 years

☐ 10–19 years ☐ 20 years and over

1.4. How many full-time employees does your company have?

☐ 1-4 employees ☐ 5–19 employees

☐ 20–199 employees ☐ more than 200 employees

1.5. What is the annual revenue of your company in Australia?

☐ $2 million or less ☐ Over $2 to $10 million

☐ From $10 to less than $25 million ☐ $25 million or above

☐ Prefer not to answer

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1.6. How long has your company been active in the industry

☐ 1-4 years ☐ 5-10 years

☐ More than 10 years

2. Supply chain agility dimensions

2.1. Transforming

(1 = strongly disagree, 2 = disagree, 3 = neither agree or disagree, 4 = agree, 5 = strongly agree)

Item code	Survey Items	1	2	3	4	5
Transforming1	When changes happen in a competitive environment, my company cooperates with new partners to achieve operational efficiency.	□1	□2	□3	□4	□5
Transforming2	My company changes service providers according to changes in customers' demands.	□1	□2	□3	□4	□5
Transforming3	My company easily modifies its operational time in alignment with changes in the operational time of other members.	□1	□2	□3	□4	□5
Transforming4	My company easily modifies its required capacity in alignment with changes in the capacity of other members.	□1	□2	□3	□4	□5
Open-ended question	What other activities does your company engage in the supply chain to transform and achieve agility? Please kindly explain.					

2.2. Sensing

(1 = strongly disagree, 2 = disagree, 3 = neither agree or disagree, 4 = agree, 5 = strongly agree)

Item code	Survey Items	1	2	3	4	5
Sensing1	My company tracks competitors' tactics and strategies.	$\square_1$	$\square_2$	$\square_3$	$\square_4$	$\square_5$
Sensing2	My company has the capability to learn about the macro-environment.	$\square_1$	$\square_2$	$\square_3$	$\square_4$	$\square_5$
Sensing3	My company has the capability to learn about market trends.	$\square_1$	$\square_2$	$\square_3$	$\square_4$	$\square_5$
Sensing4	My company devotes a lot of time for new services development and evaluating existing services.	$\square_1$	$\square_2$	$\square_3$	$\square_4$	$\square_5$
Sensing5	My company scans the environment to identify opportunities and threats.	$\square_1$	$\square_2$	$\square_3$	$\square_4$	$\square_5$
Open-ended question	What other activities does your company engage to explore opportunities and threats?					

2.3. Seizing

(1 = strongly disagree, 2 = disagree, 3 = neither agree or disagree, 4 = agree, 5 = strongly agree)

Item code	Survey Items	1	2	3	4	5
Seizing1	My company forecasts its future market demands.	□1	□2	□3	□4	□5
Seizing2	My company proactively negotiates with its service providers to obtain their commitment in the case of a significant increase in demand.	□1	□2	□3	□4	□5
Seizing3	My company employs the same services from different providers.	□1	□2	□3	□4	□5
Seizing4	My company sets an optimal capacity in a way that to be able to respond to sudden changes in its customer demands.	□1	□2	□3	□4	□5
Open-ended question	What other activities does your company engage in the supply chain to preserve agility? Please kindly explain.					

2.4. Cloud integration

(1 = strongly disagree, 2 = disagree, 3 = neither agree or disagree, 4 = agree, 5 = strongly agree)

Item code	Survey Items	1	2	3	4	5
Cloud_integration1	Application of cloud computing services supports my company to establish a shared collaborative virtual working environment with our partners.	☐$_1$	☐$_2$	☐$_3$	☐$_4$	☐$_5$
Cloud_integration2	Application of cloud computing provides a standard and virtual environment to utilise shared software with our supply chain partners to implement supply chain processes mutually.	☐$_1$	☐$_2$	☐$_3$	☐$_4$	☐$_5$
Cloud_integration3	Application of cloud computing allows sharing our information consistently with our partners and customers.	☐$_1$	☐$_2$	☐$_3$	☐$_4$	☐$_5$
Cloud_integration4	Cloud computing is used by my company as a part of automation to integrate supply chain processes.	☐$_1$	☐$_2$	☐$_3$	☐$_4$	☐$_5$
Open-ended question	What are other areas that cloud computing has improved integration between your company and its partners? Please explain.					

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2.5. Cloud flexibility

(1 = strongly disagree, 2 = disagree, 3 = neither agree or disagree, 4 = agree, 5 = strongly agree)

Item code	Survey Items	1	2	3	4	5
Cloud_flexibility1	Cloud computing enhances our capability to use big data and deal with environmental changes in the supply chain environment.	□1	□2	□3	□4	□5
Cloud_flexibility2	Cloud computing provides an information technology infrastructure that is scalable in alignment with fluctuations in our needs.	□1	□2	□3	□4	□5
Cloud_flexibility3	Cloud computing provides an environment that can address new business relationships.	□1	□2	□3	□4	□5
Cloud_flexibility4	Cloud computing enables my company to access different information technology services at low cost.	□1	□2	□3	□4	□5
Cloud_flexibility5	Cloud computing provides an environment that can be accessed from any platform or devices easily.	□1	□2	□3	□4	□5
Open-ended question	What are other areas that cloud computing has improved flexibility in your company? Please explain.					

APPENDIX D Explanatory Factor Analysis: Cloud enabled capabilities

Correlation Matrix

		Cloud_integration1	Cloud_integration2	Cloud_integration3	Cloud_integration4	Cloud_flexibility1	Cloud_flexibility2	Cloud_flexibility3	Cloud_flexibility4	Cloud_flexibility5
Correlation	Cloud_integration1	1.000	.380	.390	.394	.185	.144	.083	.164	.147
	Cloud_integration2	.380	1.000	.470	.477	.144	.222	.110	.219	.095
	Cloud_integration3	.390	.470	1.000	.477	.182	.176	.159	.182	.180
	Cloud_integration4	.394	.477	.477	1.000	.045	-.078	.024	.036	-.050
	Cloud_flexibility1	.185	.144	.182	.045	1.000	.574	.411	.459	.412
	Cloud_flexibility2	.144	.222	.176	-.078	.574	1.000	.327	.364	.231
	Cloud_flexibility3	.083	.110	.159	.024	.411	.327	1.000	.461	.460
	Cloud_flexibility4	.164	.219	.182	.036	.459	.364	.461	1.000	.537
	Cloud_flexibility5	.147	.095	.180	-.050	.412	.231	.460	.537	1.000

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.232	32.557	32.557	4.232	32.557	32.557	4.012	30.863	30.863
2	2.149	16.532	49.089	2.149	16.532	49.089	2.369	18.226	49.089
3	.994	7.650	56.739						
4	.888	6.827	63.566						
5	.811	6.235	69.800						
6	.718	5.527	75.327						
7	.568	4.367	79.694						
8	.530	4.074	83.768						
9	.498	3.834	87.601						
10	.472	3.632	91.233						
11	.425	3.267	94.500						
12	.394	3.031	97.531						
13	.321	2.469	100.000						

Extraction Method: Principal Component Analysis.

Communalities

	Initial	Extraction
Cloud integration1	1.000	.484
Cloud integration2	1.000	.600
Cloud integration3	1.000	.601
Cloud integration4	1.000	.674
Cloud flexibility1	1.000	.603
Cloud flexibility2	1.000	.454
Cloud flexibility3	1.000	.515
Cloud flexibility4	1.000	.598
Cloud flexibility5	1.000	.527

Extraction Method: Principal Component Analysis.

Component Matrix

	Component	
	1	2
Cloud_integration1	.494	.489
Cloud_integration2	.541	.554
Cloud_integration3	.565	.531
Cloud_integration4	.342	.747
Cloud_flexibility1	.701	-.334
Cloud_flexibility2	.605	
Cloud_flexibility3	.618	-.364
Cloud_flexibility4	.704	-.319
Cloud_flexibility5	.621	-.376

Extraction Method: Principal Component Analysis.

a. 2 components extracted.

Rotated Component Matrix

	Component	
	1	2
Cloud_integration1		.681
Cloud_integration2		.761
Cloud_integration3		.755
Cloud_integration4		.811
Cloud_flexibility1	.768	
Cloud_flexibility2	.668	
Cloud_flexibility3	.716	
Cloud_flexibility4	.763	
Cloud_flexibility5	.725	

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

APPENDIX E Explanatory Factor Analysis: Container supply chain agility.

Correlation Matrix

		Sensing1	Sensing2	Sensing3	Sensing4	Sensing5	Seizing1	Seizing2	Seizing3	Seizing4	Transformation1	Transformation2	Transformation3	Transformation4
Correlation	Sensing1	1.000	.309	.398	.391	.244	.377	.393	.171	.441	.169	.116	-.010	.044
	Sensing2	.309	1.000	.364	.287	.384	.367	.224	.249	.327	-.048	.057	.048	-.175
	Sensing3	.398	.364	1.000	.459	.393	.467	.416	.397	.469	.291	.233	.132	.246
	Sensing4	.391	.287	.459	1.000	.320	.538	.445	.279	.552	.226	.016	.039	.085
	Sensing5	.244	.384	.393	.320	1.000	.412	.244	.281	.331	.029	.012	-.017	-.029
	Seizing1	.377	.367	.467	.538	.412	1.000	.441	.298	.527	.132	.072	.112	-.006
	Seizing2	.393	.224	.416	.445	.244	.441	1.000	.436	.535	.139	.142	.142	.013
	Seizing3	.171	.249	.397	.279	.281	.298	.436	1.000	.280	.096	.106	.158	.107
	Seizing4	.441	.327	.469	.552	.331	.527	.535	.280	1.000	.277	.134	.154	.156
	Transformation1	.169	-.048	.291	.226	.029	.132	.139	.096	.277	1.000	.416	.411	.426
	Transformation2	.116	.057	.233	.016	.012	.072	.142	.106	.134	.416	1.000	.458	.390
	Transformation3	-.010	.048	.132	.039	-.017	.112	.142	.158	.154	.411	.458	1.000	.337
	Transformation4	.044	-.175	.246	.085	-.029	-.006	.013	.107	.156	.426	.390	.337	1.000

Total Variance Explained

Component	Initial Eigenvalues Total	% of Variance	Cumulative %	Extraction Sums of Squared Loadings Total	% of Variance	Cumulative %	Rotation Sums of Squared Loadings Total	% of Variance	Cumulative %
1	4.232	32.557	32.557	4.232	32.557	32.557	4.012	30.863	30.863
2	2.149	16.532	49.089	2.149	16.532	49.089	2.369	18.226	49.089
3	.994	7.650	56.739						
4	.888	6.827	63.566						
5	.811	6.235	69.800						
6	.718	5.527	75.327						
7	.568	4.367	79.694						
8	.530	4.074	83.768						
9	.498	3.834	87.601						
10	.472	3.632	91.233						
11	.425	3.267	94.500						
12	.394	3.031	97.531						
13	.321	2.469	100.000						

Extraction Method: Principal Component Analysis.

Communalities

	Initial	Extraction
Sensing1	1.000	.385
Sensing2	1.000	.386
Sensing3	1.000	.570
Sensing4	1.000	.531
Sensing5	1.000	.385
Seizing1	1.000	.574
Seizing2	1.000	.480
Seizing3	1.000	.292
Seizing4	1.000	.591
Transformation1	1.000	.581
Transformation2	1.000	.547
Transformation3	1.000	.508
Transformation4	1.000	.552

Extraction Method: Principal Component Analysis.

Component Matrix

	Component	
	1	2
Sensing1	.603	
Sensing2	.510	-.355
Sensing3	.754	
Sensing4	.709	
Sensing5	.539	-.307
Seizing1	.724	
Seizing2	.686	
Seizing3	.540	
Seizing4	.768	
Transformation1	.391	.654
Transformation2	.303	.675
Transformation3		.657
Transformation4		.708

Extraction Method: Principal Component Analysis.

a. 2 components extracted.

Rotated Component Matrix

	Component	
	1	2
Sensing1	.617	
Sensing2	.598	
Sensing3	.700	
Sensing4	.725	
Sensing5	.610	
Seizing1	.757	
Seizing2	.681	
Seizing3	.521	
Seizing4	.740	
Transformation1		.746
Transformation2		.737
Transformation3		.711
Transformation4		.743

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

APPENDIX E Confirmatory Factor Analysis: Cloud-enabled capabilities

E_1: Cloud flexibility

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Cloud_flexibility5	<---	Cloud_flexibility	1.000				
Cloud_flexibility4	<---	Cloud_flexibility	1.314	.230	5.711	***	
Cloud_flexibility3	<---	Cloud_flexibility	1.001	.190	5.269	***	
Cloud_flexibility2	<---	Cloud_flexibility	.966	.198	4.873	***	
Cloud_flexibility1	<---	Cloud_flexibility	1.105	.195	5.677	***	

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Cloud_flexibility	.245	.072	3.415	***	
e1	.349	.057	6.142	***	
e2	.408	.075	5.455	***	
e3	.371	.060	6.224	***	
e4	.477	.072	6.596	***	
e5	.301	.054	5.542	***	

E2: Cloud integration

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Cloud_integration4	<---	Cloud_integration	1.000				
Cloud_integration3	<---	Cloud_integration	.820	.150	5.478	***	
Cloud_integration2	<---	Cloud_integration	.942	.172	5.460	***	
Cloud_integration1	<---	Cloud_integration	.778	.162	4.798	***	

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Cloud_integration	.377	.105	3.608	***	
e1	.399	.077	5.169	***	
e2	.284	.054	5.299	***	
e3	.384	.072	5.361	***	
e4	.491	.077	6.411	***	

E3: Cloud-enabled capabilities

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Cloud_integration4	<---	Cloud_integration	1.000				
Cloud_integration3	<---	Cloud_integration	.865	.158	5.474	***	par_1
Cloud_integration2	<---	Cloud_integration	.981	.181	5.431	***	par_2
Cloud_integration1	<---	Cloud_integration	.814	.170	4.793	***	par_3
Cloud_flexibility5	<---	Cloud_flexibility	1.000				
Cloud_flexibility4	<---	Cloud_flexibility	1.267	.213	5.944	***	par_4
Cloud_flexibility3	<---	Cloud_flexibility	.989	.220	4.505	***	par_5
Cloud_flexibility1	<---	Cloud_flexibility	.941	.211	4.467	***	par_6

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Cloud_integration	.352	.101	3.490	***	par_9
Cloud_flexibility	.269	.087	3.096	.002	par_10
e1	.423	.077	5.501	***	par_11
e2	.274	.053	5.177	***	par_12
e3	.379	.071	5.341	***	par_13
e4	.486	.076	6.393	***	par_14
e5	.325	.071	4.557	***	par_15
e6	.399	.099	4.020	***	par_16
e7	.353	.065	5.398	***	par_17
e8	.362	.063	5.702	***	par_18

APPENDIX F Confirmatory Factor Analysis: Container supply chain agility

F_1: Proactive sensing

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Seizing4	<---	proactive_sensing	1.000				
Seizing2	<---	proactive_sensing	.745	.113	6.587	***	
Seizing1	<---	proactive_sensing	.855	.121	7.050	***	
Sensing4	<---	proactive_sensing	.995	.138	7.199	***	
Sensing3	<---	proactive_sensing	.626	.097	6.426	***	
Sensing1	<---	proactive_sensing	.753	.132	5.707	***	

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
proactive_sensing	.480	.107	4.482	***	
e1	.337	.061	5.508	***	
e2	.351	.054	6.471	***	
e3	.359	.058	6.154	***	
e4	.447	.074	6.024	***	
e5	.270	.041	6.559	***	
e6	.563	.082	6.867	***	

F_2: Transforming

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Transformation4	<---	Transforming	1.000				
Transformation3	<---	Transforming	1.082	.237	4.555	***	
Transformation2	<---	Transforming	1.093	.234	4.667	***	
Transformation1	<---	Transforming	1.023	.221	4.624	***	

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Transforming	.222	.076	2.907	.004	
e1	.418	.069	6.055	***	
e2	.385	.068	5.633	***	
e3	.321	.062	5.196	***	
e4	.307	.057	5.394	***	

F_3: Container supply chain agility

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Transformation4	<---	Transforming	1.000				
Transformation3	<---	Transforming	1.071	.236	4.545	***	
Transformation2	<---	Transforming	1.079	.231	4.668	***	
Transformation1	<---	Transforming	1.069	.226	4.727	***	
Seizing4	<---	Proactive_sensing	1.000				
Seizing2	<---	Proactive_sensing	.740	.112	6.623	***	
Seizing1	<---	Proactive_sensing	.842	.120	7.041	***	
Sensing4	<---	Proactive_sensing	.982	.136	7.204	***	
Sensing3	<---	Proactive_sensing	.631	.096	6.563	***	
Sensing1	<---	Proactive_sensing	.746	.130	5.720	***	

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Transforming	.219	.075	2.906	.004	
Proactive_sensing	.486	.107	4.527	***	
e1	.421	.069	6.138	***	
e2	.393	.068	5.804	***	
e3	.331	.061	5.433	***	
e4	.289	.056	5.170	***	
e5	.332	.061	5.480	***	
e6	.352	.054	6.491	***	
e7	.366	.059	6.223	***	
e8	.454	.074	6.094	***	
e9	.264	.041	6.524	***	
e10	.565	.082	6.882	***	

APPENDIX G Structural Equation Modelling

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Proactive_sensing	<---	Cloud_integration	.581	.165	3.531	***	
Transforming	<---	Cloud_flexibility	.113	.130	.868	.385	
Transforming	<---	Cloud_integration	.229	.127	1.795	.073	
Proactive_sensing	<---	Cloud_flexibility	.757	.189	4.002	***	
Seizing4	<---	Proactive_sensing	1.000				
Seizing2	<---	Proactive_sensing	.746	.111	6.705	***	
Seizing1	<---	Proactive_sensing	.849	.119	7.143	***	
Sensing4	<---	Proactive_sensing	1.030	.135	7.617	***	
Sensing3	<---	Proactive_sensing	.614	.096	6.406	***	
Sensing1	<---	Proactive_sensing	.753	.130	5.787	***	
Transformation4	<---	Transforming	1.000				
Transformation3	<---	Transforming	1.069	.236	4.530	***	
Transformation2	<---	Transforming	1.068	.230	4.633	***	
Transformation1	<---	Transforming	1.086	.229	4.739	***	
Cloud_integration1	<---	Cloud_integration	1.000				
Cloud_integration2	<---	Cloud_integration	1.163	.226	5.157	***	
Cloud_integration3	<---	Cloud_integration	.984	.193	5.098	***	
Cloud_integration4	<---	Cloud_integration	1.153	.229	5.029	***	
Cloud_flexibility1	<---	Cloud_flexibility	1.000				
Cloud_flexibility3	<---	Cloud_flexibility	1.050	.212	4.948	***	
Cloud_flexibility4	<---	Cloud_flexibility	1.618	.314	5.153	***	
Cloud_flexibility5	<---	Cloud_flexibility	1.149	.248	4.624	***	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
Proactive_sensing	<---	Cloud_integration	.425
Transforming	<---	Cloud_flexibility	.110
Transforming	<---	Cloud_integration	.248
Proactive_sensing	<---	Cloud_flexibility	.500
Seizing4	<---	Proactive_sensing	.763
Seizing2	<---	Proactive_sensing	.655
Seizing1	<---	Proactive_sensing	.696
Sensing4	<---	Proactive_sensing	.740
Sensing3	<---	Proactive_sensing	.627
Sensing1	<---	Proactive_sensing	.569
Transformation4	<---	Transforming	.584
Transformation3	<---	Transforming	.622
Transformation2	<---	Transforming	.651
Transformation1	<---	Transforming	.691
Cloud_integration1	<---	Cloud_integration	.596
Cloud_integration2	<---	Cloud_integration	.693
Cloud_integration3	<---	Cloud_integration	.678
Cloud_integration4	<---	Cloud_integration	.662
Cloud_flexibility1	<---	Cloud_flexibility	.589
Cloud_flexibility3	<---	Cloud_flexibility	.610
Cloud_flexibility4	<---	Cloud_flexibility	.809
Cloud_flexibility5	<---	Cloud_flexibility	.680

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Cloud_integration	.255	.083	3.077	.002	
Cloud_flexibility	.208	.068	3.055	.002	
e19	.217	.060	3.643	***	
e20	.199	.069	2.865	.004	
e1	.341	.059	5.824	***	
e2	.353	.053	6.629	***	
e3	.367	.057	6.396	***	
e4	.417	.069	6.052	***	
e5	.278	.041	6.757	***	
e6	.565	.081	6.965	***	
e7	.422	.069	6.142	***	
e8	.395	.068	5.817	***	
e9	.338	.061	5.520	***	
e10	.282	.056	5.033	***	
e11	.464	.073	6.339	***	
e12	.373	.068	5.487	***	
e13	.290	.051	5.654	***	
e14	.436	.075	5.819	***	
e15	.392	.061	6.438	***	
e16	.388	.062	6.279	***	
e17	.287	.089	3.220	.001	
e18	.320	.067	4.767	***	