Developing sustainability performance through dynamic capabilities in a supply chain cluster context

Mahmoud Ramadan Mahmoud Barakat

A thesis submitted to the University of Huddersfield in partial fulfilment of the requirements for the degree of Doctor of Philosophy

The University of Huddersfield Business School

Main Supervisor: Dr. Jialin Snow Wu
Co-supervisor: Dr. Julia Meaton
Former main Supervisor: Dr. Nicoleta Tipi

October 2020

Copyright statement

Abstract

The complexity and uncertainty in the dynamic business environment expose organisations to risks that may be caused by external or internal factors such as technical failure, human error, strikes, equipment failure, pandemic diseases, natural disasters or terrorist attacks. These events cause market shocks as they lead to disruptions in the production process and the flow of products; in addition, they cause supply and demand fluctuations. One of the tools that organisations can use to enhance their sustainability and performance during disruptions is to build dynamic capabilities through establishing strong networks and alliances in the form of a cluster. This research proposes links between the three dimensions of sustainability (environmental, social and economic) and dynamic capabilities (resilience and absorptive capability) in a supply chain cluster context. It develops a conceptual framework that presents supply chain cluster design characteristics (geographical concentration, networked collaboration and supporting services) as tools for enhancing sustainability through dynamic capabilities by combining a number of theoretical views, (systems theory, extended resource-based view and dynamic capability theory), to help organisations maintain performance during disruptions. Focusing on sustainability and building environmental-friendly clusters are among the aspects of sustainability development strategy of the Egyptian government 2030. Through the developed conceptual framework, this research will investigate the impact of supply chain cluster design characteristics on sustainability through achieving dynamic capabilities, in addition to investigating the impact of sustainability on organisational performance.

In order to achieve the main aim of the research, data were collected using 811 questionnaire responses from organisations operating in the Egyptian market. Structural equation modelling was used to investigate the relationships between the research variables. Results indicated that there is a direct link between supply chain cluster design characteristics, namely geographical concentration, networked collaboration and supporting services and dynamic capabilities (resilience and absorptive capacity). In addition, dynamic capabilities can significantly enhance the three dimensions of sustainability (environmental, economic and social). Furthermore, dynamic capabilities were found to be significantly mediating the relationship between design characteristics and sustainability. Finally, sustainability can be used to enhance operational and financial performance except for environmental sustainability, which had no significant impact on organisational performance. The structural equation modelling technique adopted to analyse the quantitative data allows illustration of how dynamic capabilities (resilience and absorptive capacity) affect sustainability (environmental, social, economic) and ultimately impact organisational, operational and financial performance, while simultaneously taking into consideration the effect of the three supply chain cluster design characteristics (geographical concentration, networked collaboration and supporting services) and organisation size, role and type. The use of standardised data and control variables in this study helps extend systems theory, dynamic capabilities theory and resources-based view by promoting supply chain clusters as a system in which sub-elements (cluster members) can form links and depend on each other to create a pool of resources. In addition, this extension strengthens the generalisability of the abstract ideas in the theories conceptualised in the framework, as previous research has focused only on high-technology sectors in developed countries. This study fills an additional research gap by testing

the relationships proposed in the conceptual framework in a developing county (Egypt), while controlling for different business sectors. It also fills the research gap regarding the relationships between dynamic capabilities and sustainability, and between sustainability and financial and non-financial organisational performance. In addition, it provides a more holistic picture by focusing on three dimensions of sustainability. The empirical results will also fill a gap in the literature regarding the impact of clustering on dynamic capabilities. The results from previous research on clusters and dynamic capabilities lack generalisability because they have tended to be based on case studies. Furthermore, there is a lack of evidence on how supply chain cluster design characteristics may be linked to performance through dynamic capabilities and sustainability. The focus on the link between dynamic capabilities, the three dimensions of sustainability and organisational performance will allow organisations to use supply chain cluster design characteristics as tools to enhance sustainability and maintain an acceptable level of performance. In addition, it will help organisations operating in Egypt to sustain their performance and compete globally in spite of strong market fluctuations.

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Dedications

I dedicate my dissertation to my mother and my two brothers Mohamed and Abdallah, with a special feeling of gratitude to my late father, who in his last days said to me, "Don't worry, son, you will get your Ph.D. soon". I also dedicate this dissertation to all who have been supporting me throughout the process, my wife Omnia and my daughter Doha who also taught me to be a fighter.

Acknowledgements

I would like to thank Dr. Jialin Snow Wu for her continuous support of my study and research, for her patience, motivation, enthusiasm and immense knowledge. I would also like to thank Dr Julia Meaton and Dr. Nicoleta Tipi for their support and encouragement.

I am very grateful for the invaluable support, assistance and patience of those who have taken many hours of their time to listen to me: Dr. Sara Elgazzar, Dr. Sandra Haddad, Dr. Islam Abdelbary, Dr Islam shettaia, Dr. Ziad AlKalha, Dr. Abdulrazaq Kamal, Dr. Ahmed Attia, Dr. Alvin Nadher, Dr. Hazem Rasheed, Dr. Tamer Kabrtay, Mr. Ahmed Eid, Mr. Ahmed Hessen and Mr. Tarek Madkour.

I am also deeply thankful for my wife for her unconditional support, "thank you, Omnia"; I will be forever grateful. Finally, I am thankful to my family and my father and mother in- law who encouraged me and prayed for me throughout the time of my research.

Academic biography

Barakat, M., Tipi, N., & Wu, J. (Snow). (2020). A closer look at the definition of resilience and its capabilities: a tool to survive at a time of crisis. Paper presented at the Logistics Research Network (e-LRN), Cardiff Business School, United Kingdom.

CHAPTER ONE – INTRODUCTION

1.1 Research background

The world is full of unfortunate events, such as the terrorist attacks in 2001, the tsunami in 2004, the financial crisis in 2008, the H1N1 Flu Virus in 2009, the Icelandic volcano eruption in 2010 and COVID-19 in 2020. These events cause market shocks as they disrupt the demand and supply (Baldwin & Tomiura, 2020; Del Rio-Chanona et al., 2020) and eventually affect supply chain negatively (McKibbin & Fernando, 2020). This will make the global market more challenging to companies, threaten their survival and push them from their upward trend of development (Annarelli & Nonino, 2016), in addition to keeping organisations' focus away from enhancing sustainability levels (Mari et al., 2016). The importance of sustainability comes from the fact that it is considered to be a practical tool to maintain environmental, social as well as economic performance (Gimenez et al., 2012) and not just focus on financial gains (Bodhanwala & Bodhanwala, 2018). This will help organisations achieve better economic outcomes while avoiding harm to individuals and nature, in addition to preserving resources for current and future generations (Taticchi et al., 2013). Particularly, organisations that focus on increasing sustainability levels can achieve higher performance, as it can be already observed that these organisations recorded high levels of performance during the first quarter of 2020 under COVID-19 pandemic (Albuquerque et al., 2020).

Unexpected market shocks do not only affect organisations: since organisations are interconnected, any event causes a butterfly effect in the network. When a shock that causes a fall or a delay in production in one of the organisations in the network hits the market, the whole

network will be negatively affected (Del Rio-Chanona et al., 2020; Geng et al., 2013a; Wang & Xiao, 2016). This stresses the idea that organisations cannot survive through market challenges on their own; rather, they should enhance their competitiveness by forming alliances and facing these challenges as a single unit (Huang & Xue, 2012; Villa et al., 2009). More specifically, in order to reach high levels of sustainability and gain its rewards (Zhu et al., 2008b) which is higher organisational performance (Albuquerque et al., 2020), organisations need to effectively collaborate and share resources (Esfahbodi et al., 2016; Grimstad & Burgess, 2014).

Organisations can form alliances and establish strong networks through supply chain clusters, which are an integration of supply chain management and industrial clusters (Huang & Xue, 2012), in order to survive in a highly competitive global market by jointly facing any unfavorable events in the market (Villa et al., 2009). As clusters enhance the interconnectivity of geographically close businesses (Yan & Wang, 2008), economies and organisations can decrease the negative impact of destructive events (Villa et al., 2009; Yan & Wang, 2008) and organisational vulnerability (Ismail Farrah, 2017) when clusters are formed (Villa et al., 2009; Yan & Wang, 2008). Vulnerability is concerned with future events, as it is the probability of facing damage from unexpected events in the future (Freshwater, 2015). The extent to which the system (e.g. supply chain) is vulnerable to undesirable events measures the probability of the event affecting the system and the degree to which the system will be affected; finally, it measures the system's ability to absorb undesirable events (Cardona, 2004).

This stresses the importance of dynamic capabilities (Cao, 2011), namely resilience and absorptive capacity (Brusset & Teller, 2017; Riikkinen et al., 2017) as they help organisations overcome risk and decrease vulnerability, in addition to maintaining their future competitive advantage and

attaining growth in performance during disruptions (Cao, 2011). Absorptive capacity is the process of accumulating and processing knowledge and enhancing learning activities (Branzei & Vertinsky, 2006; Eisenhardt & Martin, 2000; Teece, 2007). It helps organisations learn and understand changes in the dynamic business environment (Albort-Morant et al., 2018; Chandrashekar & Mungila Hillemane, 2018; Supartha & Ratih, 2017; Tsai, 2012). Resilience can also be a tool for adapting to unexpected shocks in the market (Østergaard & Park, 2013) and facing risks that are caused by vulnerabilities (Christopher, 2016) through reducing the probability of causing damage to the organisation (Sheffi & Rice, 2005).

Since disruptions and market volatility are the norm in today's business environment (Christopher, 2016; Fiksel et al., 2015), and organisations do not focus on sustainability during destructive events (Mari et al., 2016), it can be argued that supply chain cluster can help organisations enhance sustainability (Golicic et al., 2017). However, supply chain cluster members can still be negatively affected by unexpected market shocks (Østergaard & Park, 2013; Wang & Xiao, 2016). Improving absorptive capacity and resilience can help members of a supply chain cluster enhance their performance (Aliasghar et al., 2018; Geng et al., 2013a; Han, 2009; Huang & Xue, 2012; Tsai, 2012; Yan & Wang, 2008) and overcome the dynamic business environment (Geng et al., 2013a; Han, 2009; Huang & Xue, 2012; Villa et al., 2009) through building sustainability (Riikkinen et al., 2017; Saenz et al., 2014). This research focuses on investigating the impact of supply chain cluster design characteristics on sustainability through dynamic capabilities, in addition to investigating the impact of sustainability on organisational performance in the Egyptian market. The remainder of this chapter will discuss the following: the research problem, the research overall aim and objectives and the research importance and contribution. Then, a brief introduction to

research methodology adopted in this research is discussed, and finally a summary of thesis structure is presented.

1.2 Research problem

Formation of supply chain clusters can secure a steady flow of resources as they promote local network and collaboration among geographically concentrated organisations (Geng et al., 2013a; Porter, 1998; Tolossa et al., 2013). In addition, close proximity of supply chain clusters' members (Lei & Huang, 2014) allows for quick and more frequent communications among members and efficient sharing of resources and information, which decreases transaction cost (Johansson & Quigley, 2004) and leads to enhancement of productivity and problem solving (Koren & Pető, 2020). However, forming clusters to sustain performance includes increasing connectedness in the process (Geng et al., 2013a; Han, 2009; Porter, 1998), which can increase the occurrence of cascading failures (Del Rio-Chanona et al., 2020; Geng et al., 2013a; Wang & Xiao, 2016). Disruptive events may negatively impact even highly connected organisations (Craighead et al., 2007; Del Rio-Chanona et al., 2020). The failure of one organisation in the supply chain cluster to deliver materials and/or information on time will disrupt the operations of all other organisations in the supply chain cluster because they are interdependent and interconnected (Geng et al., 2013a; Wang & Xiao, 2016), which will lead to a decline of organisations' adaptability (Craighead et al., 2007) since dynamic capabilities are needed to help organisations adapt and respond to market changes (Teece, 2016; Teece, 2007), become more sustainable and ultimately improve their performance (Riikkinen et al., 2017; Zahra & George, 2002). In addition to the fact that organisations tend not to focus on sustainability during destructive or disruptive events (Mari et al., 2016), dynamic capabilities (Teece, 2007), such as resilience and absorptive capacity (Brusset

& Teller, 2017; Shubham et al., 2018), are particularly important in helping organisations achieve long-term sustainability in constantly changing environments through modifying their environmental, social and economic sustainability processes whenever the market changes (Fiksel et al., 2014). Finally, it is very important to implement sustainable practices in supply chain clusters as the concentration of industrial and logistics activities such as transportation raise environmental issues and harm the surrounding communities (UNIDO, 2016).

This research is focusing on allowing organisations to gain the benefits of connectedness through building dynamic capabilities and enhancing sustainability to eventually achieve higher organisational performance with no decline in their adaptive capabilities. In addition, it gives organisations inside supply chain clusters a tool to maintain high level of sustainability through its supply chain cluster design characteristics. This will eventually allow organisations to maintain profitability without sacrificing social and environmental issues. The research problem is stated as follows:

"Investigating the impact of supply chain cluster design characteristics on sustainability through dynamic capabilities to enhance organisational performance"

The motivation behind conducting this research is to provide a framework where organisations can have adequate tools (supply chain cluster design charactarsitics and dynamic capabilities) to enhance their sustaiability levels (e.g. efficient use of energy to reduce cost (Zhu et al., 2008a), preserve the environment (Abdul-Rashid et al., 2017) and enhance customer health and safety (Agrawal et al., 2016)), in addition to giving organisations incentives to invest in sustainable activities through linking sustainability to organisational performance.

1.3 Research question, aim and objectives

The research gap that this thesis aims to cover is to illustrate the nature of the relationship between supply chain cluster design characteristics and dynamic capabilities, in addition to the impact of dynamic capabilities on sustainability. Furthermore, it investigates the mediating role of dynamic capabilities between supply chain cluster design characteristics and sustainability. Finally, it illustrates the impact of sustainability on organisational performance in a supply chain cluster context. Based on this, three research questions were developed as follows:

I. What is the strength of the relationship between supply chain cluster design characteristics and dynamic capabilities, and between dynamic capabilities and sustainability?
II. How do supply chain cluster design characteristics affect sustainability through dynamic capabilities?
III. What is the nature of the relationship between sustainability and organisational performance in a supply chain cluster context?

The first question focuses on establishing a link between the research constructs through a conceptual framework, while the second and third questions focuse on testing these relationships. Based on this the thesis overall aim is as follows:

Investigating the link between supply chain cluster design characteristics and dynamic capabilities "resilience and absorptive capacity" in an effort to develop organisational sustainability and eventually enhance organisational performance. This overall aim can be achieved through the following objectives:

I. Constructing a conceptual framework to explore the nature of the relationship between supply chain cluster design characteristics, dynamic capabilities, sustainability and organisational performance.

II. Examining the relationship between supply chain cluster design characteristics, dynamic capabilities and sustainability to evaluate the mediating role of dynamic capabilities (resilience and absorptive capacity).

III. Illustrating the impact of sustainability on organisational, operational and financial performance.

Table 1.1 explains how the research questions will be answered through achieving the research aim and objectives.

Table 1.1 Research questions, aims and objectives

Research questions	Research objectives	Achieving the research objective	Aim
What is the strength of the relationship between supply chain cluster design characteristics and dynamic capabilities, and between dynamic capabilities and sustainability?	- Constructing a conceptual framework to explore the nature of the relationship between supply chain cluster design characteristics, dynamic capabilities, sustainability and organisational performance.Examining the relationship between supply chain cluster	- Presenting the three theoretical lenses and conducting a review of literature to establish a link between the research variables. - Developing research	Investigating the link between supply chain cluster design characteristics and dynamic capabilities "resilience and absorptive capacity" in an effort to develop organisational sustainability and eventually enhance

How do supply chain cluster design characteristics affect sustainability through dynamic capabilities?	design characteristics, dynamic capabilities and sustainability to evaluate the mediating role of dynamic capabilities (resilience and absorptive capacity).	hypotheses based on the constructed conceptual framework. - Constructing a research questionnaire to collect data. - Conducting PLS-SEM on collected data to test the developed hypotheses.	organisational performance.
What is the nature of the relationship between sustainability and organisational performance in a supply chain cluster context?	Illustrating the impact of sustainability on organisational, operational and financial performance.		

1.4 Research scope

The Arab Republic of Egypt is located in the Middle East. Its area is around 1 million square km, where most of its land is in the north-eastern African continent and only a small part of its land is located in the continent of Asia. Egypt is bordered on the north by the Mediterranean Sea, and on the east by the Red Sea (COMESA, 2020; MFA, 2019). The population of approximately 100 million (CAPMAS, 2019) is concentrated in Cairo, Giza and Alexandria (MFA, 2019). Administratively, Egypt is divided into 27 governorates; these governorates are a blend of urban and rural areas, and some are completely urban; however, the majority of the land in Egypt is desert and is uninhabited (MFA, 2019).

The Middle East region has witnessed a political and an economic instability starting from 2010 because of the revolutions against the corrupted leaders of the political regimes (Elzarka, 2013), in addition to the lack of sustainable jobs and growth (Worldbank, 2017b). The revolutions in the

Middle East and Egypt led to an increase in the political and economic instability (Abdelbary, 2018; Elzarka, 2013). The risk of doing business in Egypt increased dramatically because of this instability and led to significant financial losses (Elzarka, 2013). Recently, the Egyptian government has been applying some economic reforms to stabilise the economic situation, such as value added tax and liberalization of the exchange rate, which led to a growth in domestic products and a decline in current account deficit; this improved the country's external position, which positively affected tourism and foreign direct investment (Youssef et al., 2019).

Economic and social reforms are embedded in the Egyptian governmental plan for sustainability development strategy 2030 (Worldbank, 2017b), which includes enhancing services and infrastructure delivery for individuals as well as organisations (Worldbank, 2017b) (Ministry of Trade and Industry) (MTI, 2019). The improvements of the business environment through government support such as government funding and infrastructure delivery will lead to business and economic growth, through which organisations' competitiveness and job creation will be enhanced (Worldbank, 2017b). In addition, they will also help in sustaining and developing clusters that will enhance industry's growth, increase the overall country' exports and strengthen the spatial and sectorial level of connectedness among supply chains (MTI, 2019). Furthermore, these reforms also focus on enhancing social and environmental aspects of sustainability and not just economic sustainability (MTI, 2019; Worldbank, 2017b).

According to the General Authority for Investment (GAFI, 2016), there are 114 industrial zones in Egypt that are supported by the government by providing infrastructure, such as electricity, sewage and roads. These zones are located around 26 cities (FADCOC) (Federation of Egyptian Chamber of Commerce). Most of these cities contain one or more academic institution(s) and a

chamber of commerce and trade/ industry associations that provide services, such as specialised training, technical support, facilitated internal trade, education, research and development and research through forming a network with governmental agencies (Ali, 2012; FADCOC), in addition to providing help to individuals as well as entities to start a business (FADCOC). Lack of support from these entities will lead to a decline in organisational and overall cluster development (Elola et al., 2012; Huang & Xue, 2012).

Based on (FADCOC), GAFI (2016) and (Ali, 2012), supply chain clusters are mainly located around three major governorates in Egypt (Cairo, Alexandria and Giza). These governorates are considered to be the major cities in Egypt that contain business activities and the highest percentage of population (Aboelmaged & Hashem, 2019; Gaber, 2017; Turrisi et al., 2013) and are the focus of similar studies for data collection purposes (Aboelmaged & Hashem, 2019).

This research focuses on the Egyptian market because despite implementing economic reforms, increasing economic growth (Abdelbary, 2018) and focusing on sustainability development (MTI, 2019; Worldbank, 2017b), the Egyptian economy is still facing some instability (Worldbank, 2019). Events that cause economic and political instability in Egypt are recently becoming more frequent (Abdelbary, 2018). The Egyptian revolution in 2011 (Abdelbary, 2018; Elzarka, 2013), dollar crisis in 2016 (Worldbank, 2019) and more recently its energy production, water supplies and land fertility are at risk because of the Renaissance Dam in Ethiopia (Allam & Eltahir, 2019; Wheeler et al., 2016). These events make it more challenging to collaborate and mitigate risks (Elzarka, 2013). Furthermore, the lack of enforcement of laws and regulations related to sustainability (Faragallah, 2016), unavailability of funds and the lack of awareness and proper

education are some of the barriers of applying sustainability practices in the Egyptian environment (Elbarky & Elzarka, 2015).

From the above, it can be concluded that Egypt has seen a lot of changes in the past few years. Focusing on how organisations can enhance their sustainability during this turmoil through using supply chain cluster design characteristics and dynamic capabilities will be very beneficial. In addition, it will help the Egyptian government achieve its goal of promoting sustainable activities inside supply chain clusters and enhance economic activities (MTI, 2019). Furthermore, this study is in line with the Egyptian sustainability development strategy 2030 (Worldbank, 2017b) as it will help organisations to focus on sustainability to enhance performance, which will lead to rationalization of energy consumption and focusing on renewable energy (MTI, 2019; Worldbank, 2017b). In addition, it will help the Egyptian government plan to develop micro, small and medium enterprises and enhance exports through the creation of environmental-friendly supply chain clusters (MTI, 2019). Furthermore, it will contribute in solving the decline of hydropower production because of the Renaissance Dam in Ethiopia (Allam & Eltahir, 2019; Wheeler et al., 2016), especially that environmental-friendly supply chain clusters focus on water waste management as there is a general global shortage in water (UNIDO, 2016).

Another important aspect of focusing on the Egyptian market is that the proposed links in the conceptual framework need to be further examined in different settings, e.g. different regions and industries (Aboelmaged & Hashem, 2019; Golicic et al., 2017; Younis & Sundarakani, 2019), because these links were mostly related to wine industries and used only resilience as a dynamic capability e.g. (Conz et al., 2017; Flint et al., 2011; Golicic et al., 2017). In addition, studies related to supply chain clusters e.g. (Capone & Zampi, 2019; Chandrashekar & Mungila Hillemane, 2018;

Patti, 2006) mainly focused on high-technology sectors in developed countries, which led to a lack of generalisability (Golicic et al., 2017; Lis & Rozkwitalska, 2020). The following section will discuss the importance and contribution of this study in details.

1.5 Importance and contribution

This study aims to provide a guide to organisations on benefiting fully from being in a cluster and enhancing sustainability and performance by building dynamic capabilities. It does so by developing an integrated framework to investigate the impact of supply chain cluster design characteristics on sustainability through dynamic capabilities. It also examines the impact of sustainability on organisational performance in Egypt. The integrated framework combines the theoretical lenses of systems theory, the extended resource-based view and dynamic capabilities theory in a supply chain cluster context, deepening understanding of how these theories can be linked. A conceptual framework is derived by operationalising and measuring general concepts from these theories through the specific constructs of supply chain cluster design characteristics, dynamic capabilities, sustainability and performance (Swanson & Holton, 2005).

Relationships between these constructs require further examination in different settings, including different regions and industries (Aboelmaged & Hashem, 2019; Golicic et al., 2017; Younis & Sundarakani, 2019), as previous studies related to supply chain cluster (Capone & Zampi, 2019; Chandrashekar & Mungila Hillemane, 2018; Patti, 2006) have focused mainly on high-technology sectors in developed countries (Golicic et al., 2017; Lis & Rozkwitalska, 2020). This study's focus is on a developing market (Egypt), which provides broader generalisability (Golicic et al., 2017; Lis & Rozkwitalska, 2020). In addition, since the country's political and economic instability in 2011, organisations in Egypt continue to face challenges in collaborating and mitigating risks

(Abdelbary, 2018). Furthermore, failure to enforce relevant laws and regulations (Faragallah, 2016; McKenna, 2013), unavailability of funds and lack of awareness and education are barriers to implementing sustainability in the Egyptian environment (Elbarky & Elzarka, 2015).

Despite substantial research in the field of supply chain management on the relationship between resilience and environmental sustainability (Golicic et al., 2017), and between absorptive capacity and environmental sustainability (Aboelmaged & Hashem, 2019; Albort-Morant et al., 2018; Walton et al., 2020), relatively little is known about how the two dynamic capabilities factors (resilience and absorptive capacity) are linked with the three dimensions of sustainability—economic, social and environmental (Golicic et al., 2017; Ruiz-Benitez et al., 2019; Touboulic & Walker, 2015). Emerging research also suggests the need for a deeper understanding of relationships between supply chain cluster design characteristics, dynamic capabilities (Golicic et al., 2017; Lis & Rozkwitalska, 2020) and sustainability (Sirilertsuwan et al., 2018), especially that previous research mainly focused on specific aspects of environmental sustainability, such as green innovation e.g. (Aboelmaged & Hashem, 2019), green practices e.g. (Song & Choi, 2018; Walton et al., 2020) and green purchasing practices e.g. (Riikkinen et al., 2017).

Previous research also focused on the relationship between information sharing among supply chain cluster members and absorptive capacity e.g. (Belso-Martínez et al., 2016) or close proximity to customers and absorptive capacity e.g. (Presutti et al., 2017), in addition to the relationship between local networks and absorptive capacity (Chandrashekar & Mungila Hillemane, 2018; Wang et al., 2018). Furthermore, researchers investigated how organisations operating in a cluster can develop resilience or absorptive capacity. However, the focus was on organisations; there was no investigation on how being in a cluster can affect their resilience or absorptive capacity

(Martinez-Sanchez et al., 2019; Taslimi et al., 2020). Finally, the impact of resilience on financial sustainability was investigated in wine industry e.g. (Golicic et al., 2017).

Finally, it is argued that the impact of sustainability on organisations' financial and non-financial performance requires further investigation in an supply chain cluster context (Das et al., 2019), especially that the relationship between sustainability and performance in supply chain management literature is under debate (Paulraj et al., 2017). In addition, research investigating the impact of sustainability and performance focused on green practices and financial performance (Albuquerque et al., 2020; Song & Choi, 2018).

Therefore, a holistic approach is needed to understand the impacts of dynamic capabilities on sustainability, and of sustainability on financial and non-financial organisational performance (Das et al., 2019), particularly in relation to supply chain clusters (Das et al., 2019; Golicic et al., 2017).

1.6 Thesis structure

This thesis consists of five chapters; the outline of each chapter is as follows:

Chapter 1: Introduction

This chapter gives an overview of the importance of sustainability to organisations, how organisations can use dynamic capabilities to develop sustainability and the motivation behind the research. In addition, it is a demonstration of the research problem and the importance of the study. Then, the research focus and objectives are stated in clear statements, and the originality of the research is highlighted, followed by a brief description of the proposed methodology. Finally, the thesis outline is presented.

Chapter 2: Literature Review

This chapter discusses in details the theoretical lenses used in formulating the framework, followed by a conceptual foundation to link the concepts in the theory to the main research variables, namely supply chain clusters, dynamic capabilities and sustainability. Furthermore, a discussion of the importance of supply chain clusters and sustainability is presented. Additionally, this chapter illustrates the concept of environmental uncertainty and the importance of applying dynamic capabilities to cope with the dynamic business environment. Moreover, the two dynamic capabilities, namely absorptive capacity and resilience, are discussed in details. Finally, the chapter illustrates the research gap and the theoretical and empirical contributions of the study.

Chapter 3: Conceptual Framework

This chapter presents the conceptual framework and discusses in details the link between the theoretical lenses and the formulation of the conceptual framework. In addition, it highlights the relationships between the research variables to develop the research hypotheses. Finally, the chapter is concluded with a list of the research hypotheses that need to be tested in order to achieve the main aim of the research.

Chapter 4: Research Methodology

This chapter gives a detailed explanation and a full description of the data collection technique and analysis. In addition, a description of the main constructs used is viewed and the research strategy is discussed. Moreover, the stages of the empirical analysis that are going to be used in data analysis are presented in details. Finally, ethical considerations for the research are illustrated.

Chapter 5: Findings and Analysis

This chapter presents the results of the empirical analysis, in addition to a detailed analysis of these results, shedding light on the nature of the relationships among supply chain cluster design characteristics, absorptive capacity, resilience, sustainability and financial and operational performance, in addition to illustrating the mediating role of absorptive capacity and resilience between design characteristics and sustainability.

Chapter 6: Research discussion

This chapter provides a discussion on the output of structural equation modelling by illustrating the links between the research constructs and explains the connections between these constructs, in addition to the implications of the statistical results.

Chapter 7: Conclusion and Recommendations

This chapter concludes the thesis and presents the contribution of the thesis results to both academia and practice. Then, the main limitations of the research are viewed. In addition, recommendations are given in light of the results reached, and finally implications for future research are discussed.

In summary, this chapter introduces background information in the research topic upon which the research problem is formulated, followed by a clear aim and articulated objectives of the study. Subsequently, the methodological approach and the data analysis techniques that will be used to achieve the aim and objectives of the research are presented. This chapter also highlights the research importance and the original practical and academic contributions that would be reached

when achieving the research aim and objectives. Finally, a brief outline of the thesis structure and design is presented.

The next chapter will discuss in details the theoretical foundation of the conceptual framework and published literature related to supply chain clusters, sustainability and environmental uncertainty that highlight the importance of dynamic capabilities. Based on the literature review and the theoretical foundation, the conceptual framework will be developed and the research gap will be highlighted to clearly illustrate this research's contribution to practice and knowledge.

CHAPTER TWO - LITERATURE REVIEW

2.1 Introduction

Clusters and supply chain management help put organisations in line to focus on a common goal (Tolossa et al., 2013), such as achieving high levels of sustainability (Beske & Seuring, 2014) and collectively apply recovery strategies to reduce the negative impact of disruptions on organisations as well as supply chains (Donadoni et al., 2019). Supply chain management focuses on the long-term performance of members in the supply chain in order to improve the whole supply chain performance through an efficient coordination of firms' business functions (Mentzer et al., 2001). However, clusters work as an alternative way to organise value chains, as the close proximity of organisations and collaboration increases their connectedness and trust, which eventually lead to an enhancement of organisational robustness that promotes flexibility, effectiveness and efficiency (Porter, 1998). This means that organisations' survival depends on their supply chain performance and creation of clusters (Tolossa et al., 2013).

The integration between clusters and supply chain management is mutually beneficial as the formation of a cluster enhances supply chain management performance (Geng et al., 2013a; Yan & Wang, 2008) and increases trust through the stable relationship among cluster members (Capone & Zampi, 2019). This leads to a decline in cost, enhances innovation, promotes efficient and effective use of resources and increases competitiveness and overall profit (Geng et al., 2013a; Han, 2009). These benefits of supply chain clusters can provide a fertile environment for improving organisational sustainability levels (Golicic et al., 2017; Grimstad & Burgess, 2014), which can eventually lead to an increase in organisational performance (Albuquerque et al., 2020).

Sustainability is related to increasing welfare for current and future generations from environmental, social and economic perspectives (Collier et al., 2013). Enhancing sustainability performance leads to environmental-friendly activities, financial success and employee and customer satisfaction (Sabaghi et al., 2016). In addition, it increases market share and profitability and creates good brand publicity without damaging the surrounding environment (Kusi-Sarpong et al., 2016). Furthermore, it allows organisations to perform better than their peers do during disruptions (Albuquerque et al., 2020) because high sustainability levels increase customer loyalty and make their products less price elastic and allow organisations to maintain their revenue growth (Albuquerque et al., 2019).

Building dynamic capabilities can help organisations achieve high levels of sustainability (Riikkinen et al., 2017; Teece, 2007; Zahra & George, 2002) as they support organisations long-run superior performance by adapting to the changing business environment through constantly enhancing, expanding and protecting organisations' tangible and intangible (knowledge base) assets (Helfat et al., 2007; Teece, 2007). Organisations' dynamic capabilities can be applied through absorptive capacity (Riikkinen et al., 2017; Shubham et al., 2018; Zahra & George, 2002) and resilience (Bag, 2019; Brusset & Teller, 2017; Santanu, 2017). Absorptive capacity can help supply chain cluster members gain an easier access to innovative technical knowledge and enhance overall cluster performance by boosting innovative capabilities of the cluster members (Belso-Martínez et al., 2016). Organisations need absorptive capacity to help gain the benefits of the knowledge acquired (Aliasghar et al., 2018) through collaboration and trust among supply chain cluster members (Johansson & Quigley, 2004; Lei & Huang, 2014; Porter, 1998; Zeinalnezhad et al., 2011).

It is also crucial to build resilience in order to thrive in a dynamic business environment (Østergaard & Park, 2013; Souza et al., 2017). Resilience focuses on the ability to cope with market changes (Chirisa et al., 2016; Elola et al., 2013; Souza et al., 2017) in order to achieve sustainable performance (Fiksel, 2006; Fiksel et al., 2014; Østergaard & Park, 2013; Souza et al., 2017), compete in the global market and operate efficiently under forces of global competition (Elola et al., 2013). Resilience will allow supply chain clusters to survive in times of crises and thrive in bad situations (Elola et al., 2013).

This research focuses on investigating the impact of supply chain cluster design characteristics on sustainability through achieving dynamic capabilities, in addition to investigating the impact of sustainability on organisational performance. Achieving sustainable performance is challenging in a constantly changing market environment (Golicic et al., 2017), especially when unpredictable events cause a decline in performance (Chowdhury & Quaddus, 2017). The proposed conceptual framework will be beneficial as it will help in linking design characteristics and dynamic capabilities to sustain organisational performance. This will incentivise organisations to achieve economic, social and environmental sustainability through forming supply chain clusters. Furthermore, the increase in cluster members' performance can lead to an increase in overall cluster performance (Um, 2017), eventually leading to the enhancement of economic growth as cluster success is directly linked to economic growth (Østergaard & Park, 2013).

The remainder of this chapter discusses the theoretical lenses that the framework will be built on. These theoretical lenses include systems theory, extended resource-based view and dynamic capabilities theory. The chapter then discusses the rationale for using these lenses that link supply chain cluster design characteristics, dynamic capabilities (resilience and absorptive capacity),

sustainability and organisational performance (financial and operational). Finally, this chapter discusses the supply chain cluster and its design characteristics, sustainability and its importance, uncertainty and the role of dynamic capabilities to cope in a constantly changing environment and resilience and absorptive capacity as dynamic capabilities.

2.2 Theoretical Lenses

Before establishing the framework, a number of theoretical views will be combined to support and guide the development and empirical investigation of the framework, in addition to forming a solid foundation for linking supply chain cluster design characteristics to sustainability through dynamic capabilities to enhance performance in environmental uncertainty. These theoretical views are systems theory, extended resource-based view and dynamic capabilities theory.

2.2.1 Systems theory

Systems theory focuses on the coordination of subsystems to reach the optimization of the whole system (Forrester, 1961), which can be applied in organisations by investigating individual parts to add value to the whole organisation (Emery & Trist, 1965). However, this theory can be extended beyond individual firms' boundaries (Fantazy et al., 2016; Rigby et al., 2000) to reach their business partners inside the whole supply chain (Bag et al., 2020; Fantazy et al., 2016; Rigby et al., 2000). This shifts the focus from close to open system (Rigby et al., 2000) as organisations need to adapt to their external environments in order to survive (Baier et al., 2020; Rigby et al., 2000), which is characterised to be dynamic (Bag et al., 2020; Emery & Trist, 1965). Open organisations can use external links with each other to overcome the dynamic market environment that they operate in (Tipu et al., 2019). The risk associated with market changes and uncertainty is the link that connects organisations together (Peck, 2005).

In this sense, supply chain members should collaborate to enhance the value of the supply chain as a whole, and not just focus on subsystems located inside their boundaries (Cooper et al., 1997). Systems theory is associated with supply chain management (Fantazy et al., 2016) as it promotes an efficient flow of information, material and capital throughout the supply chain (Mentzer et al., 2001). Supply chain is a system that contains several subsystems, such as physical components (factories and support facilities), flow components (materials and finances), conceptual components (total quality management and assembly), communication components (information technology and electronic data interchange), identification components (scanners and bar code system) and computation components (computers and software) (Hassan, 2006).

The integration and collaboration of supply chain subsystems (supply chain members and their different functions) help in enhancing their performance and eventually the supply chain overall performance (Flynn et al., 2010; Michalski et al., 2018). Supply chain must be designed to allow the integration of these components to maximise the overall value of the supply chain through building agility, quick processing of information (Hassan, 2006), joint learning and knowledge creation (Akande et al., 2010; Fantazy et al., 2016) and eventually maintain its long-term performance (Hassan, 2006). Supply chain flexibility, agility (Um, 2017) and knowledge creation (Akande et al., 2010; Fantazy et al., 2016), which depend on individual flexibility, agility and knowledge creation of its members (Fantazy et al., 2016; Spekman et al., 2002; Um, 2017), support organisations as well as the whole supply chain to reach a higher level of productivity and growth through allowing organisations to acquire the required resources (e.g. materials, skills and knowledge) (Fantazy et al., 2016).

Organisations are considered to be a system (Rouse, 2005) that works towards a specific common goal with the use of a pool of resources and processes (Vrijhoef & Ridder, 2007). Organisations need to acquire resources from the surrounding environment (Zsidisin & Ellram, 2003), build joint learning and create knowledge (Akande et al., 2010; Tipu et al., 2019) through collaboration and integration to achieve their goals (Michalski et al., 2018), sustain their operations (Akande et al., 2010; Tipu et al., 2019) and enhance performance through adapting to the changing environment (Michalski et al., 2018).

2.2.2 Extended resource-based view

Developed as an extension to industrial organisation view (Porter, 1979, 1985) and evolving through empirical studies and focused theoretical research (Ponomarov, 2012), resource-based view or resource-based theory (Barney, 1991; Barratt & Oke, 2007) is considered to be a commonly used framework to investigate topics in strategic management (Barney et al., 2001). Resource-based view focuses on how a firm can sustain competitive advantage through achieving superior performance (Bag, 2019; Xi et al., 2014) using internal resources and what makes a firm outperform its peers in the same industry (Kraaijenbrink et al., 2010). This view is different from the industrial organisation view as it focuses on external factors that affect the firm's performance (Porter, 1979, 1985). The internal resources are unique to every individual firm; they can range between tangible assets and intangible assets, such as skills, information and knowledge that the firm has. These resources can be controlled by the firm to sustain its competitive advantage (Barney, 1991).

In resource-based view, there is an assumption that organisations are being managed by rational individuals who focus on maximizing profits and sustaining an equilibrium state (Bromiley &

Papenhausen, 2003; Leiblein, 2003). Organisations can reach profit maximization by sustaining their competitive advantage through exploiting unequally distributed information in the market (Mahoney, 1995). The traditional approach of supply chain believed that the resources that can enhance or sustain competitive advantage are centralised inside the organisation, and supply chain management contributes to improve the use of these resources. However, the supply chain approach, based on resource-based view, assumes that the resources needed to enhance performance are located on a supply chain level, which makes the supply chain a tool for competitive advantage (Ketchen & Hult, 2007). This notion is discussed in the extended resource-based view as it stresses the fact that organisations mine for resources that can be outside the boundaries of the organisation to enhance their competitive advantage (Son et al., 2014). The extended resource-based view focuses on how organisations need to extend their resources through forming alliances with other entities, such as their suppliers (Mishra et al., 2019; Popli et al., 2017), governmental agencies and other entities inside the same geographical area or region (Mishra et al., 2019).

2.2.3 Dynamic capabilities theory

Organisations can create value, which is an important aim, according to extended resource-based view, through acquiring resources that exist outside organisations boundaries (Mishra et al., 2019; Son et al., 2014). Since the external environment of any organisation is extremely volatile (Ponomarov, 2012), organisations can only create value if they manage to integrate resources in order to seize opportunities and overcome uncertainties that present themselves in the dynamic environments surrounding the organisations (Barney, 1991; Chowdhury & Quaddus, 2017). The challenging dynamic environment is problematic for an organisation's adaptation (Ponomarov, 2012), which makes it hard to sustain competitive advantage (Eisenhardt & Martin, 2000; Fiol,

2001) and enhance performance (Bag, 2019; Xi et al., 2014) because it needs to focus on responding to any unexpected fluctuation in demand and supply, and not just survive (Ponomarov, 2012). However, organisations can still sustain their competitive advantage when they strategically apply dynamic capabilities (Eisenhardt & Martin, 2000). These capabilities will allow organisations to reconfigure their resources (Teece, 2019) in order to quickly adapt to market changes and leap forward before competitors (Eisenhardt & Martin, 2000).

2.2.4 Theoretical framework

Organisations can increase their performance through enhancing sustainability by forming alliances and external links (networks) outside their boundaries to share resources and interact with the external environment. However, since organisations operate in an uncertain environment, they need to focus on enhancing sustainability through dynamic capabilities, as dynamic capabilities allow organisations to develop their resources and maintain a desired level of sustainability in a constantly changing environment. Based on the above discussion, a corresponding theoretical framework is presented in Figure 2.1. This framework proposes that supply chain clusters can be considered a system in which its subsystems (clusters members) can form alliances through being interconnected in the same geographical location (systems theory (Rigby et al., 2000)). The formation of a supply chain cluster can help organisations acquire a unique bundle of resources to enhance their sustainability (extended resource-based view (Mathews, 2003)). This collaboration and availability of resources can help organisations to eventually achieve desirable performance outcomes through enhancing sustainability (systems theory (Rigby et al., 2000) and extended resource-based view (Mathews, 2003)). However, in order to maintain a high level of sustainability in a constantly changing environment, organisations need to protect and develop resources through building dynamic capabilities (dynamic capabilities theory (Teece et al., 1997)).

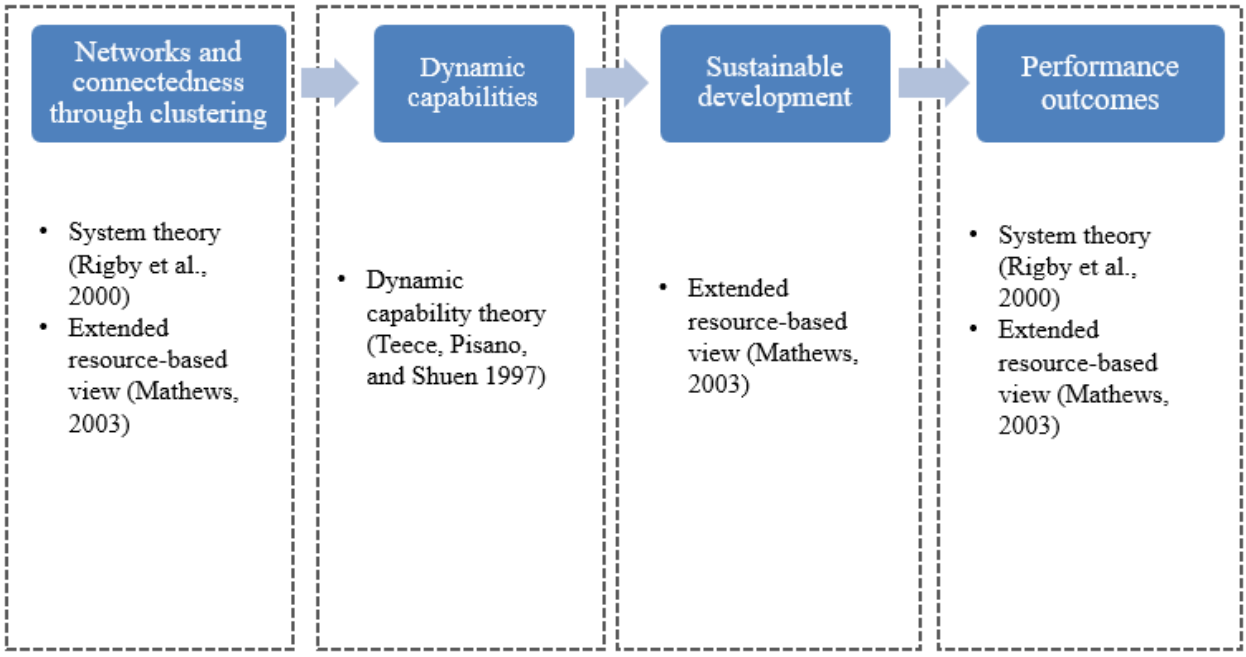

Figure 2.1 Theoretical framework

This theoretical framework represents general relationships among concepts of the research phenomenon under investigation (Sekaran & Bougie, 2016; Swanson & Holton, 2005), which is supported by a combination of theories (Sekaran & Bougie, 2016). A conceptual framework can be derived from this framework through operationalising the general concepts into specific constructs and their measurements, which can be used in theory testing (Swanson & Holton, 2005). A conceptual framework can also be used to investigate the relationships between constructs of the study (Fisher, 2010). The following sections will conceptualise the framework, through linking the theories used to develop the theoretical framework with the research variables, in addition to illustrating the research constructs' definitions and their indicators in order to develop the conceptual framework, which will be used to test the research hypotheses (Abidin & Afroze, 2018; Alghamdi, 2018).

2.2.5 Conceptual foundation

According to systems theory, organisations are an open system that seeks links with entities outside their organisational boundaries to overcome uncertain environments (Flynn et al., 2010; Tipu et al., 2019). The environmental uncertainty pushes organisations to form networks (Peck, 2005) in order to collaborate and align efforts and goals (Flynn et al., 2010). This form of networks can be achieved through a supply chain cluster, which interconnects organisations that operate in the same geographical location (Porter, 1998; Yan & Wang, 2008). A supply chain cluster provides its members with trust (Geng et al., 2013a) and facilitates the alignment of efforts towards a common goal (Huang & Xue, 2012; Yan & Wang, 2008). Supply chains are considered to be a system in which its subsystems (supply chain members) can collaborate to enhance their performance and the overall system's performance (Flynn et al., 2010; Michalski et al., 2018). Following the same logic, this research posits supply chain clusters as a system where the close proximity and connectedness between its members are the pillars that hold the system together and facilitate collaboration and sharing of information and resources to enhance performance.

A supply chain cluster provides capabilities, such as skilled labor, information, easy access to materials (Zeinalnezhad et al., 2011) and shared infrastructure (Han, 2009), which is why organisations seek to establish a supply chain cluster as they will not be able to cope with the constantly changing market needs and eventually collapse under the force of global competition (Huang & Xue, 2012; Villa et al., 2009). This means that these acquired resources can be also used as tools to maintain competitive advantage (Kraaijenbrink et al., 2010) through increasing sustainability levels (Xi et al., 2014), which will lead to a better performance (Bag, 2019; Xi et al., 2014). This notion is supported by extended resource-based view, as organisations can acquire

resources needed to enhance sustainability and eventually performance through forming links outside their boundaries (Xi et al., 2014), drawing on systems theory and extended resources based-view, in addition to the fact that supply chains contain resources needed to sustain competitive advantage (Ketchen & Hult, 2007). It can be argued that a unique bundle of resources can be located on a supply chain cluster's level. This argument is supported through the advantages that supply chain clusters provide to organisations, such as accessibility to resources, creating and sharing knowledge (Grimstad & Burgess, 2014; Mitchell et al., 2010) and enhancing innovation capabilities (Geng et al., 2013a; Han, 2009; Huang & Xue, 2012; Yan & Wang, 2008) that allow organisations to enhance their sustainability (Grimstad & Burgess, 2014) and eventually their performance (Ni & Sun, 2019). However, as organisational environments are dynamic (Bag et al., 2020; Eisenhardt & Martin, 2000), resources might be obsolete over time (Kraaijenbrink et al., 2010; Teece, 2007). Organisations need to develop their assets through building dynamic capabilities (Kraaijenbrink et al., 2010; Teece, 2007), namely resilience (Geng et al., 2013a; Yusuf et al., 2014) and absorptive capacity (Riikkinen et al., 2017) in order to be able to cope with the dynamic business environment and eventually sustain their competitive advantage (Bag, 2019; Teece, 2007; Xi et al., 2014) through increasing performance (Bag, 2019; Xi et al., 2014). Therefore, the dynamic capabilities theory was proposed to help organisations maintain competitive advantage in a dynamic business environment (Teece, 2007; Teece et al., 1997).

2.3 Supply Chain Cluster

This section presents the concept of clusters and its evolution to a supply chain cluster through combining it with supply chain management. In addition, it discusses the three supply chain cluster design characteristics.

2.3.1 Clusters

In Porter (1998) work, the author claimed that the concentration of entities in one geographical location that enhances competitive advantage is called clusters. This enhanced ability to compete comes from the fact that clusters collect local knowledge and build local relationships that other entities in different geographical locations cannot reach. This accumulated knowledge and these relationships create a unique comparative advantage, which leads to a strong global competitive position through pushing organisations to be more dynamic. Successful organisations across the world in different fields, such as electronics, wine, finance, fashion and entertainment are concentrated geographically. Although (Porter) is acknowledging that an organisation's internal environment is important, the external environment that the organisation is directly dealing with on a daily basis is also very important, which stresses the importance of location. Porter (1998) defined clusters as interconnected, geographically close businesses that operate in the same or similar industrial sector. Clusters also extend to include connection with upstream and downstream organisations through the supply chains. Finally, some clusters may include educational institutions and governmental agencies that support the cluster through technical support, education, information and specialised training. While Yan and Wang (2008) derived a definition for a cluster, Porter (1998)'s definition is as follows: "it is a combination of entities located in the same geographical location; these entities are working in the same or similar industrial sector". This combination includes upstream and downstream suppliers, who provide technology, components and raw materials; related service industries that provide maintenance and sales; and finally, other related organisations.

Geographical concentration paves the way for technological advancement, specialisation and reduction in transaction cost; in addition, it enhances collaboration. However, it should be emphasized that the formation of organisations in the same geographical location does not mean that they have formed a cluster, regardless of the fact that these organisations are operating in the same industrial sector or not. The key factors for the formation of clusters are that members are associated in the same demand and supply relationship, combine resources and increase competiveness for the industry to which they belong. In other words, if members of a supply chain are located in the same geographical location, it means that they are members inside the cluster. Simply put, if some members of supply chains are located in the same geographical location, they can form a cluster without the members in other geographical locations. However, it is not enough to be located in a close proximity; a high level of collaboration must take place (Han, 2009). The connectedness among cluster members through collaboration and networking creates synergies that increase their competitiveness and eventually the overall cluster competitiveness. However, clusters do not only enhance collaboration among their members; they also support competition among them, because without competition, clusters will decline (Porter, 1998). The competition between Coke and Pepsi is one of the fiercest competitions; however, they are still cooperating in inventing new technologies as they can be very expensive and still competing over marketing, distribution network and of course taste (Winston, 2014).

However, to gain the full benefits of a cluster, supply chain management needs to be integrated with it, as it will align individual entities' efforts and enhance cooperation among cluster members, instead of only working for their benefits. In addition, without supply chain management, members in the cluster might start to have destructive competition among themselves, which will decrease

the overall competitiveness of the cluster, as they will not be able to be more innovative, increase their efficiency and reduce cost (Huang & Xue, 2012; Yan & Wang, 2008).

The importance of supply chain management comes from the fact that organisations need collaboration networking in order to survive (Villa et al., 2009), due to the fact that single firms cannot face market needs on their own as this will be not practical, because the firm will collapse under the force of global rapid changes and competition (Huang & Xue, 2012; Villa et al., 2009). However, supply chain members are not by default in the same geographical area; if suppliers of raw materials are not local, transportation costs will increase and lead to an increase of the cost of the supply chain as a whole. Finding a local supplier with good quality and price, a firm can increase its profits and competitive advantage. In addition, firms can save costs and increase the value of the supply chain (Yan & Wang, 2008). If organisations joined a network in order to be more competitive, they might still face a problem of increased costs; however, this problem can be solved by finding a local supplier through joining a cluster. This argument is supported by (Villa et al., 2009) and (Yan & Wang, 2008) as they concluded that it is important for organisations to join a cluster in order to be able to compete properly. Wrobel (2013) argued that joining a network is beneficial, but not as beneficial as joining a cluster.

Although supply chains and clusters have some similarities, there are some different characteristics. A supply chain network can be scattered through different countries, which leads to different supply chain management styles according to the countries' culture. In addition, information exchange in a supply chain relies on the internet and local area networks. However, clusters are formed of local entities that form a local network and are based on local and similar cultures. Clusters also rely more on informal exchange of information and have more sense for

innovation than supply chains do (Han, 2009). The integration between the two created what is known as supply chain cluster, in which supply chain management is embedded inside a cluster as one of its components (Tolossa et al., 2013).

2.3.2 Clusters and supply chain management

Clusters provide the environment with the development of the supply chains and an increase in their overall performance as supply chain members can cooperate in terms of capital and information flow when they form a cluster, in addition to combining industrial infrastructure, managerial knowledge, intellectual property rights and human resources that are provided by supporting firms as part of cluster creation (Han, 2009). The importance of supply chain mamagement to clusters and vice versa pushed the integration between the two and created a supply chain cluster (Geng et al., 2013a; Huang & Xue, 2012; Villa et al., 2009) or a supply chain cluster network (Wang & Xiao, 2016). Winston (2014) also stressed this idea by pointing out that organisations must face disturbance together, even if they work with their greatest competitors, by applying precompetitiveness, which means working together to tackle specific issues to achieve common interest and compete somewhere else.

Organisations should join supply chain clusters for many reasons other than gaining competitive advantage as they face numerous threats caused by internal and/or external environments. These threats range from a simple human error to an economic recession and push the organisation off its normal course or equilibrium (Bhamra et al., 2011). This stresses the importance of the integration between supply chain management and clusters as geographical concentrations in supply chain clusters give their members specialisation, cooperation, flexibility and trust (Geng et al., 2013a). Organisations will greatly benefit from service enterprises and governmental facilities

located in clusters. In addition, collaboration is enhanced by shared interest and trust among cluster members, leading to formal and informal codes of conduct and practices and increasing the ability of organisations to seize opportunities in the market, as well as decreasing risk and the cost of business activities among members. Furthermore, collaboration enhances innovation as it makes acquiring knowledge more attainable. Finally, collaboration enhances sharing skills and resources and decreases cost through trust as it decreases negotiation and bargaining costs (Han, 2009). These characteristics give advantage to entities in supply chain clusters, make them more adaptive to unexpected market shocks and support their competitive advantage internationally, in addition to creating mutual trust, lowering cost, enhancing support among members (Geng et al., 2013a). Moreover, these characteristics enhance the entities' innovativeness, support the creation of new entities (Geng et al., 2013a; Lin et al., 2006), increase productivity and help in understanding the market (Lin et al., 2006). However, regardless of the advantages, geographical concentration and networked collaboration might have a negative impact on organisational performance. Because of the benefits that geographical concentration offer to organisations, they tend to create closed networks with local entities (Boschma, 2005). This limits the diversity of knowledge (Presutti et al., 2017) as they do not seek to acquire knowledge with entities outside their geographical location (Bathelt et al., 2004; Gilbert et al., 2008; Romanelli & Khessina, 2005). Regarding networked collaboration, organisations tend to withhold information and knowledge that they perceive to be valuable (Lei & Huang, 2014) in order to gain comparative advantage (Dyer & Hatch, 2006).

2.3.3 Supply chain cluster design characteristics

This introduced the idea of supply chain clusters and shifted the focus to its characteristics and design. He (2016), Huang and Xue (2012) and Tolossa et al. (2013) proposed three main

characteristics: geographical concentration, networked collaboration and supporting services. Geographical concentration is very critical when creating a supply chain cluster as the close physical proximity of its members makes it possible to increase cost efficiency, competitive advantage, trust and innovation. Networked collaboration means that there is upstream and downstream vertical cooperation within the supply chain and horizontal integration among different supply chains. This horizontal and vertical collaboration yields a competitive advantage and help organisations achieve a higher level of performance they could not reach on their own through interactive activities such as sharing resources and information (Dayasindhu, 2002; Xue et al., 2012a; Xue et al., 2012b). Supporting service systems are entities that enhance supply chain cluster members' collaboration by increasing coordination with related companies, facilitating access to information, increasing productivity and helping in the growth of new firms (He, 2016; Huang & Xue, 2012; Tolossa et al., 2013). However, Geng et al. (2013a) and Wang and Xiao (2016) argued that a supply chain cluster has two main characteristics: geographical concentration and networked collaboration. Furthermore, Altenburg and Meyer-Stamer (1999) proposed four cluster characteristics that are derived from various definitions of clusters: forward and backward linkages, information exchange, diversified institutional infrastructure and social and cultural identity made up of common values. While Han (2009), Huang and Xue (2012) and Xue et al. (2010) explained the design of the supply chain cluster, they argued that it consists of two parts: core enterprises and public service infrastructure; these two parts are actively interacting together. The core enterprises are mainly supply chain enterprises, which include any part of the supply chain, such as distribution, manufacturing, or procurement and their supporting organisation. The public service infrastructure includes academic institutions, training institutions, logistics companies, trade/ industry associations and financial institutions.

Some authors went beyond the benefits, design and characteristics of a cluster and focused on the factors that help in the creation of a cluster. Elola et al. (2012) argued that the emergence of clusters is a function of local (e.g. local entrepreneurship, demand and national policies) and global factors (e.g. new knowledge and cutting edge technology that come along with multinational companies into the region). Authors, such as DeWitt et al. (2006) and Patti (2006) constructed a case study to link between Porter's economic cluster theory and supply chain management. Patti (2006) concluded that the merge of these two fields will have a direct benefit to increase the influence on local and state government, education and training institutions, cost reduction, lead-time, quality, communication, new product and process development, risk and information sharing. However, DeWitt et al. (2006) study revealed that the supply chain management practices, integrated behavior and process, sharing of information, building and maintaining long-term relationships and sharing risks and rewards were enhanced through the formation of clusters.

Another case study was conducted by Huang and Xue (2012) regarding supply chain cluster with a focus on implementing supply chain cluster and not its benefits or the relationship between its two major components, supply chain management and clusters. In this case study, the authors investigated Global Industrial Supply (GIS) that acted as a supply chain cluster strategy through the supply of industrial logistic service solutions for the industry. The implementation of supply chain cluster strategy increased the effectiveness and efficiency and enhanced competitive advantage of clusters. The authors argued that the implementation of supply chain cluster is divided into four phases, starting from procurement and selection of materials to the delivery to the final consumer. The first phase is operating independently: every firm is responsible for its value chain. The second phase is outsourcing and division: any process that cannot be implemented

by the firm is outsourced to another firm inside the cluster. At this stage, the network is still not developed into a complete supply chain cluster yet. The third phase is aggression and collaboration: while more firms are joining the cluster, core firms are being demoted to a secondary position while services supporting firms are being promoted to a more dominant position. The fourth and final phase is service centric progress: a key competitive factor for SMEs to be successful in supply chain cluster is the development of a service system, which provides supply chain cluster members with the ability to compete globally through enhancing their cost efficiency.

Supply chain cluster research is blossoming, and it was tackled by researchers form different disciplines, each using his or her own theoretical scope, such as Information Science (Siau & Tian, 2004), Management Science (Towers & Burnes, 2008), Economic Science (Patti, 2006), and Social Science (Villa et al., 2009). Form the above discussion, it can be concluded that a supply chain cluster is a combination of supply chain management and clusters (Huang & Xue, 2012; Villa et al., 2009); in addition, it contains organisations that are closely working together in the same geographical location (Huang & Xue, 2012; Porter, 1998; Tolossa et al., 2013; Yan & Wang, 2008).

From research on industrial clusters and supply chain clusters, a practical definition on their design characteristics can be derived based on case studies illustrated in these research studies (see table 2.1). Geographical concentration focuses on close proximity (Craighead et al., 2007; Lei & Huang, 2014), which means that organisations located in the same geographical area are close enough to allow for sharing knowledge through face to face interactions (Johansson & Quigley, 2004; Lei & Huang, 2014; Porter, 1998). To be geographically concentrated, entities need to be located locally, within and around the city and belong to the same industrial sector (He, 2016; Huang & Xue,

2012). For example, low-voltage electric equipment cluster located in Wenzhou, Zhejiang is considered a supply chain cluster as there is a close proximity among its members (Huang & Xue, 2012). Any industrial zones/ districts located within or around cities can be considered clusters as they contain interrelated enterprises working in the same or similar industry with a level of cooperation and a presence of supporting entities (Kayvanfar et al., 2018; Shi & Ganne, 2009; Tao & Todeva, 2006). This means that organisations located in industrial zones or cities that govern industrial zones are geographically concentrated and can be considered a cluster if its members are collaborating with each other (Huang & Xue, 2012; Kayvanfar et al., 2018; Shi & Ganne, 2009; Tao & Todeva, 2006) and forms a crisscross network to facilitate vertical and horizontal collaboration (Wang & Xiao, 2016), in addition to the presence of supporting entities that actively provide support to enhance organisational and overall cluster development (Elola et al., 2012; Huang & Xue, 2012; Kayvanfar et al., 2018; Shi & Ganne, 2009; Tao & Todeva, 2006).

Supporting services are entities that offer training, education, technical support and research and information (Catherine et al., 2014; Rita et al., 2003; Yan & Wang, 2008). Supporting services entities include governments and their agencies, chambers of commerce and trade/ industry associations and research institutes and universities (Ai & Wu, 2016; Han, 2009; Huang & Xue, 2012; Østergaard & Park, 2013; Patti, 2006; Porter, 1998; Sheng et al., 2011; Tolossa et al., 2013; Wang et al., 2018). It is not necessary that all of the supporting entities are located in the same geographical location to form a supply chain cluster (He, 2016; Huang & Xue, 2012; Porter, 1998). However, the most important supporting institutions that support the development of organisations inside clusters are the governments and their agencies, chambers of commerce and trade/ industry associations and research institutes and universities (Ai & Wu, 2016; Ali, 2012; Han, 2009; Huang

& Xue, 2012; Østergaard & Park, 2013; Patti, 2006; Porter, 1998; Sheng et al., 2011; Tolossa et al., 2013; Wang et al., 2018).

Table 2.1 Supply chain cluster's design characteristics definitions

Supply chain cluster design characteristics	Author/s	Definition
Networked collaboration	(Belso-Martinez et al., 2018; Geng et al., 2013a; Han, 2009; Huang & Xue, 2012; Østergaard & Park, 2013; Patti, 2006; Porter, 1998; Tolossa et al., 2013; Wang et al., 2018; Wang & Xiao, 2016)	The number of open communication channels within and across the supply chain cluster.
Geographic concentration	(Ai & Wu, 2016; Geng et al., 2013a; Han, 2009; Huang & Xue, 2012; Østergaard & Park, 2013; Patti, 2006; Porter, 1998; Tolossa et al., 2013; Wang & Xiao, 2016)	Locally concentrated organisations working in the same or similar industry in or around a city, such as industrial districts or zones.
Supporting services	(Ai & Wu, 2016; Ali, 2012; Han, 2009; Huang & Xue, 2012; Østergaard & Park, 2013; Patti, 2006; Porter, 1998; Sheng et al., 2011; Tolossa et al., 2013; Wang et al., 2018).	Entities that enhance members' ability to use resources and information more efficiently, such as governmental agencies, academic institutions, chamber of commerce and trade /industry associations.

It can be concluded from the above discussion that supply chain cluster design characteristics are geographical concentrations of organisation workings in the same or similar industries, and these organisations form vertical and horizontal networks to collaborate and finally support entities (such as governmental institutions, universities and research institutions and trade/ industry associations) that enhance coordination and provide information and training (Ai & Wu, 2016; Ali, 2012; Belso-Martinez et al., 2018; Geng et al., 2013a; Han, 2009; Huang & Xue, 2012;

Østergaard & Park, 2013; Patti, 2006; Porter, 1998; Sheng et al., 2011; Tolossa et al., 2013; Wang et al., 2018; Wang & Xiao, 2016).

Cluster development support small and medium enterprises and generally enhance organisational performance (Foghani et al., 2017; Østergaard & Park, 2013); in addition, it leads to enhancement of regional and local economic activities (Branco & Lopes, 2013; Hsu et al., 2013). However, economic performance enhancement inside these clusters is associated with environmental pollution and excessive use of resources (Lin et al., 2020). That's is why it is very essential that supply chain cluster members coordinate in order to implement sustainability practices inside clusters (Worldbank, 2017a).

2.4 Sustainability

Sustainability implementation has recently grown, not just because of laws that force the organisations to implement it but also because of the increasing awareness and responsibility towards the environment (Agrawal et al., 2016), in addition to the stakeholders' demands that organisations apply sustainable practices (Bodhanwala & Bodhanwala, 2018). Sustainability ensures high quality of life and not just basic human needs through preserving the elements in the environment (animal and plant life, air, water and land) that support the survival of the human species (Liverman et al., 1988); accordingly, organisations are required to protect these elements (Carter & Rogers, 2008; Liverman et al., 1988; Seuring & Müller, 2008). In other words, organisations must take into consideration how their operations are affecting the surrounding environment; in addition, they must monitor their use of resources so that the stock of resources does not deteriorate and return to its former stock level (De Steiguer, 1995). This means that

organisations should be able to maintain their level of operations without causing any harm to their performance as well as individuals and nature (Taticchi et al., 2013). This pressures organisations to seek social welfare improvements and not just follow the rules (Ruiz-Benitez et al., 2019; Shafiq et al., 2014) or carry out audits to ensure applicability of codes of conduct (Sancha et al., 2015). Focusing on satisfying demands of current stakeholders without compromising the needs of future stakeholders can be achieved through applying social, environmental and economic sustainability (Bodhanwala & Bodhanwala, 2018).

Since sustainability focuses on the ability of future generations to satisfy their needs while satisfying the needs of current generations (WCED, 1987) it is considered practical and useful as it has a positive impact on organisational performance (Bodhanwala & Bodhanwala, 2018). This link between performance and sustainability practices pushes organisations to focus beyond traditional economic interests (Bodhanwala & Bodhanwala, 2018) to environmental, social and economic development (Gimenez et al., 2012). However, the link between sustainability and performance is still subject to debate as empirical evidence still confirms both positive and negative relationship (Ni & Sun, 2019). As uncertainty and high capital needed (Curkovic & Sroufe, 2007; Orsato, 2006) can lead to a decline in performance (Golicic & Smith, 2013; Pagell et al., 2004; Paulraj et al., 2017). On the other hand, investing in sustainability can increase customers' willingness to pay (Priem et al., 2012) and loyalty (Albuquerque et al., 2019) and leads to an increase in performance (Xi et al., 2014).

The integration of environmental, social and economic aspects is called triple bottom line (Carter & Rogers, 2008; Collier et al., 2013; Gimenez et al., 2012; Moldan et al., 2012). The triple bottom line approach can be used to measure sustainability performance (Colbert & Kurucz, 2007;

Hourneaux Jr et al., 2018), where organisations enhance social aspects for all stakeholders and reduce the negative impact on the surrounding environment while enhancing financial performance (Reefke & Sundaram, 2017) in other words, carrying out business operations while maintaining the three dimensions of sustainability- economy, environment and society- in the long-run (Hassini et al., 2012).

These three dimensions do not have a unified acceptable scale, and they were measured through different approaches other than developing a scale such as developing frameworks and elements that can measure environmental, social and economic sustainability (Ruiz-Benitez et al., 2019). Environmental sustainability usually focuses on reducing emissions, wastes and pollution (Gimenez et al., 2012), in other words, protecting the environment for the society (Bansal, 2002). When organisations are driven by environmental sustainability principles, they adapt a philosophy that focuses on increasing the efficiency of preserving the environment for them and for their business partners while managing market risks and decreasing their negative impact to enhance their goal of enhancing financial performance (Zhu et al., 2008a). Social sustainability is concerned with enhancing social welfare through promoting equality, creating and developing capabilities and skills (Closs et al., 2011) for future as well as current generations (Meacham, 2016). Regarding economic sustainability, it focuses on increasing organisational returns and competitive advantage (Gimenez et al., 2012; Vachon & Mao, 2008) through decreasing costs (Gimenez et al., 2012) to generate a healthily cash flow (Gimenez et al., 2012; Vachon & Mao, 2008). The importance of economic sustainability has grown, especially after the economic crises, during which the idea of sustainable economic growth has drawn the attention of politicians, practitioners and academics (Moldan et al., 2012).

In line with the three aspects of sustainability in supply chains (Beske, 2012), sustainability was integrated with supply chain management (Ahi & Searcy, 2015; Carter & Rogers, 2008), as an efficient way to implement sustainability principles in business operations (Tate et al., 2010); however, this integration is relatively recent (Ahi & Searcy, 2015). The focus of sustainable supply chain management is to reduce wastes and negative impacts on the environment throughout the supply chain, starting from raw materials purchase until the disposal of products after use (Hsu et al., 2013). It also focuses on using recyclable products and raw materials (Zhu et al., 2008b). Combining supply chain management and sustainability is a process of transforming traditional supply chain management into sustainable supply chain management, which makes organisations focus on enhancing sustainability levels (Busse et al., 2017). While sustainable supply chain management focuses on integrating social and environmental aspects as well as economic perspectives, traditional supply chain management mainly focuses on economic perspectives (Hsu et al., 2013; Seuring & Müller, 2008).

A definition for sustainable supply chain management was derived combining sustainability dimensions and supply chain management definitions (Beske, 2012) as follows: it is the management of cooperation among supply chain members: their exchange of capital, materials and information along the dimensions of sustainability, namely environmental, social and economic derived from stakeholders and customers' demands (Seuring & Müller, 2008). Ruiz-Benitez et al. (2019) argued that a frequent definition for sustainable supply chain management is the one derived by Carter and Rogers (2008), which states that it is the improvement of performance of organisations and their supply chain in the long run through systematic integration and coordination of organisational, social, environmental and economic goals.

2.4.1 Sustainability, performance and supply chain clusters

The coordination efforts between supply chain cluster members can also help in maintaining a high level of sustainability (Lin et al., 2020). Environmental-friendly clusters mainly focus on collaboration among organisations, along with the surrounding community and government entities to enhance environmental and social sustainability as well as economic gains (Lin et al., 2020). The main focus in the collaborative efforts among organisations, governments and communities to work together and promote the three aspects of sustainability (Hong & Gasparatos, 2020). Governments should contribute to the creation of environmental-friendly clusters or the development of already existing clusters through financial aid and advisory support and expand, mandate and monitor policies related to social services for workers, environmental impact, uses of resources and the impact on local community (Hong & Gasparatos, 2020; Lin et al., 2020).

Organisations should try to enhance their efforts towards improving local economy, efficiently using resources, deceasing waste, water and air pollution (Panyathanakun et al., 2013), which leads to lowering cost and energy consumption (Hollos et al., 2012) and enhancing operational performance (Carter & Liane Easton, 2011; Reuter et al., 2010) as well as financial performance (Albuquerque et al., 2020; Song & Choi, 2018), in addition to enhancing job creation and better work condition and generally improving community's quality of life (Panyathanakun et al., 2013). Furthermore, this will contribute in increasing overall organisational performance and economic growth (Panyathanakun et al., 2013). As for individuals inside the community, they should try to focus on investments that supports environmental and social aspects, spread awareness and apply pressure as customers on public as well as private policy makers (UNIDO, 2016).

This link between performance and sustainability practices pushes organisations to focus beyond traditional economic interests (Bodhanwala & Bodhanwala, 2018) to environmental, social and economic development (Gimenez et al., 2012). However, the link between sustainability and performance is still subject to debate as empirical evidence still confirms both positive and negative relationship (Ni & Sun, 2019). As uncertainty and high capital needed (Curkovic & Sroufe, 2007; Orsato, 2006) can lead to a decline in performance (Golicic & Smith, 2013; Pagell et al., 2004; Paulraj et al., 2017). On the other hand, investing in sustainability can increase customers' willingness to pay (Priem et al., 2012) and their loyalty (Albuquerque et al., 2019) and leads to an increase in performance (Xi et al., 2014). More importantly, providing job opportunities and efficiently using resources will increase the country's domestic product growth and enhance economic growth (Panyathanakun et al., 2013). Sustainability enhances organisational image (Reuter et al., 2010) as it allows organisations to focus on environmental and social aspects and not just economical aspects (Bag, 2019). This in return has a positive impact on organisations' financial performance as they gain investors' trust and attract more investments (Albuquerque et al., 2019; Albuquerque et al., 2020). In addition, sustainability increases customer loyalty, which secures a steady flow of revenue because of low price elasticity of demand (Albuquerque et al., 2019).

Ali et al. (2020) argued that the opportunity cost of not implementing sustainability practices is high, as it can enhance organisations' competitive advantage. Empirical studies clearly show the benefits of implementing sustainability practices; Song and Choi (2018) focused on green practices and their impact on organisational performance in manufacturing firms in South Korea. Results revealed that green practices can lead to better performance as they decrease cost and increase

revenue. Similar results were reported by Ni and Sun (2019) when they investigated the impact of sustainable supply chain management practices on organisational performance in the Chinese manufacturing sector, as empirical results illustrated that sustainability practices create value throughout the supply chain, which enhances organisational performance as customers are willing to pay more when their requirements are met by organisations without sacrificing environmental and social gains. Birou et al. (2019) investigated the impact of sustainability training on organisational performance in manufacturing sector in USA. Results revealed that sustainability training can enhance the efficiency of sustainable practices' implementation, which leads to benefits such as lower cost and efficient use of resources and eventually enhances organisational performance.

Because of the influence that sustainability has on survival and growth (Kolk & Pinkse, 2008), organisations were urged to develop sustainability (Cao, 2011; Chowdhury et al., 2019a; Teece, 2016) through dynamic capabilities (Di Stefano et al., 2014; Teece, 2016) as it will allow them to maintain high levels of sustainability during market shocks (Mari et al., 2016) through seizing opportunities in the market (Di Stefano et al., 2014; Teece, 2014), in addition to effectively aligning their strategies and capabilities to develop sustainability (Amui et al., 2017).

2.5 Environmental uncertainty and dynamic capabilities

Managing activities inside a company or a supply chain is challenging, especially that multiple activities such as physical and information coordination and financial flows within a single firm or across its supply chain need to be efficient and effective (Mentzer et al., 2008). Activities along the supply chain will inevitably face disturbance because of unexpected events, such as delays in receiving raw materials because of loss of major suppliers or equipment failure because of fires or

human errors. These events cause a decline in operational and financial performance as they directly decrease the firm's market share because of sales losses (Ponomarov & Holcomb, 2009). Disturbance in Ericsson's supply chain led to a loss of 400 million dollars because of production instability that resulted after the occurrence of a major fire in its supplier plant (Chopra & Sodhi, 2004). The eruption of Iceland volcano in 2010 caused a halt in flight schedules and air shipment. In addition, Japanese computer industry supply chain faced disturbance when Thailand suppliers were not able to provide hard disks because of the floods in 2011 (Chopra & Sodhi, 2014).

Risk and vulnerabilities inherited in the business activities decrease their effectiveness and efficiency (Craighead et al., 2007; Ponomarov, 2012), which means it is important to manage these risks and address potential vulnerabilities (Ponomarov, 2012). Risk does not have only one definition; rather, its definition depends on the field of study. For example, in engineering, environment, health and safety studies, risk is considered the possibility of unfavorable event occurring and the consequential damage that these events will inflect. In the field of finance, any fluctuations around the expected value of tangible and non-tangible assets and future income - either positively or negatively - represent risk (Heckmann et al., 2015). As for supply chains, risk is any unpredicted event on micro or macro scale that causes failure in any part of the supply chain (Ho et al., 2015). Regardless of the area of study, risk has a common element: it represents an unreal situation based on random possibility that can only exist in the future; it can be defined as any uncertainty of future outcome of a decision; in other words, uncertainty increases risk (Cardona, 2004).

One of the important methods to assess management ability to deal with risk in supply chains is supply chain risk management (Ponomarov & Holcomb, 2009). Supply chain risk management

aims to enhance management ability to predict future risks and take actions that eliminate potential vulnerabilities and uncertainty (Abhijeet et al., 2012). Vulnerability is the probability to be affected by internal or external risks that cause shocks on the normal level of operations (Christopher & Peck, 2004).

Any unexpected event that occurs on a small or a large scale that leads to a decline in the operation of all or any part of the supply chain is considered to be a supply chain risk (Ho et al., 2015). Unexpected events that cause supply chain disturbance could be caused by capacity issues, procurement failures, systems breakdowns, delays, forecasting errors and problems in acquiring inventory (Chopra & Sodhi, 2004). Risks can be assessed empirically through their possibility of occurrence and the ramifications of their occurrence (Ponomarov, 2012). Risk and uncertainty of supply chains are highly associated, and - in practice - organisations need to tackle them together (Simangunsong et al., 2012); certainty decreases risk as risk is the uncertainty of the future outcome (Cardona, 2004), which is why supply chain risk and supply chain uncertainty are used interchangeably (Jüttner et al., 2003; Peck, 2006).

However, other authors suggested that although uncertainty is considered to be the unknown probability that a risky event will take place at some point in the future, uncertainty needs a deeper investigation as a supply chain concept (Vilko et al., 2014). In other words, risk and uncertainty need to be clearly distinguished (Tang & Nurmaya Musa, 2011), which means providing details regarding the elements that cause uncertainty (Prater, 2005). Uncertainty that is caused by uncertainty in time, quality and quantity is a situation in which decision makers can not anticipate the consequences of their decisions because of the lack of information regarding the environment and the supply chains (Van der Vorst & Beulens, 2002).

In general, in the practical business environment risk and uncertainty must be tackled simultaneously (Wang et al., 2014) because they are interchangeable (Jüttner et al., 2003; Peck, 2006). Supply chain uncertainty and risk are caused by any event that disrupts output and performance of supply chains (Wang et al., 2014), such as rapid environmental and customer taste changes, delay of information and disruptions in logistics activities (Punniyamoorthy et al., 2013; Simangunsong et al., 2012). Customer-related uncertainty and risk aspects are concerned with unanticipated customer needs, forecast errors and receivables' delays (Manuj & Mentzer, 2008). Environmental uncertainty and risk are considered to be important (Simangunsong et al., 2012), because they are concerned with activities that occur between the supply chains and their external environment and events as natural disasters (Wang et al., 2014) and governmental regulations that might affect labor laws and fuel prices (Simangunsong et al., 2012).

Disruption in logistic activities can be caused by deviations from the normal flow of information (Ellegaard, 2008). Delay in information increase risk and uncertainty as it implies a communication issue and a lack of information visibility (Sanchez-Rodrigues et al., 2010). This means that accuracy and availability of information decrease uncertainty and risk (Wang et al., 2014). The importance of information in an uncertain environment (Wang et al., 2014) highlights the role of absorptive capacity in rapidly acquiring and utilizing information and resources (Riikkinen et al., 2017; Tu et al., 2006). Activities that occur between organisations and their external environments (Wang et al., 2014) also stress the importance of absorptive capacity, as it gives organisations the ability to effectively combine acquired information from external sources with existing knowledge (Albort-Morant et al., 2018) to enhance innovation (Albort-Morant et al., 2017; Albort-Morant et al., 2018). This ability allows organisations to effectively and efficiently

respond to competition and cope with changes in market conditions (Schleimer & Pedersen, 2013) such as changing in customer demand (Liu et al., 2018). Furthermore, absorptive capacity as a dynamic capability (Shubham et al., 2018; Zahra & George, 2002) does not just create the ability to respond to competitors but also helps in enhancing sustainability (Camisón & Forés, 2010; Elbaz et al., 2018) as it contributes to renewing and developing new products and technologies (Liu et al., 2018; Patel et al., 2012).

Environmental uncertainty and risk are inevitable and unavoidable, which stresses their importance (Wang et al., 2014). To tackle risks and vulnerabilities, efficient mitigation strategies (e.g. hedging) must be developed, as risk classification is just the first step to manage risk (Manuj & Mentzer, 2008); risk mitigation is concerned with decreasing the ramifications of risky events (Norrman & Jansson, 2004). However, managers can face a problem in assessing and mitigating some risks; this problem can be tackled through preparing firms to efficiently respond to disturbance and unforeseen events by building resilience (Ponomarov, 2012).

Resilience is considered to be a new discipline developed from risk management (Emmanuel-Yusuf, 2018; Mata et al., 2018). Resilience encloses risk management strategies (proactive, concurrent and reactive) that help organisations and/or supply chains to handle unexpected shocks (Ali et al., 2017), and it focuses on the ability to absorb disturbance and quickly leap back to normal operation after crises (Sheffi, 2005). Resilience is related to risk management (Pettit et al., 2010; Ponomarov & Holcomb, 2009) as it has evolved from it (Pettit et al., 2019; Ponomarov & Holcomb, 2009); however, it uses more efficient approaches to deal with risk and uncertainty (Pettit et al., 2019; Pettit et al., 2010; Ponomarov & Holcomb, 2009). Approaches used by risk management have become inefficient with the dramatic increase in vulnerabilities, risk and

uncertainty in today's complex dynamic business environment (Fiksel et al., 2015; Jüttner & Maklan, 2011; Pettit et al., 2013; Pettit et al., 2010). In addition, risk management cannot efficiently predict risky events that have low possibility of occurrence and huge ramifications (Kunreuther, 2006). Since resilience is directly linked to successfully managing organisational resources to overcome environmental uncertainties in the market to sustain performance, it is considered a dynamic capability (Mandal, 2017; Pettit et al., 2019).

2.6 Absorptive Capacity

Organisations cannot rely only on their internal knowledge to effectively operate in the dynamic business environment (Gebauer et al., 2012). Knowledge sharing is essential for adaptation to market change (Saenz et al., 2014) as it allows organisations to have access to important knowledge (Azadegan, 2011) and exploit it (Albort-Morant et al., 2018; Azadegan, 2011) through combining it with existing knowledge to create new knowledge (Albort-Morant et al., 2018). Absorptive capacity is considered to be the process of exploring new knowledge that can benefit the organisation identify, understand and then use this knowledge to generate new knowledge that enhances organisational performance (Alonso & Austin, 2017). This process helps the transfer of knowledge on an international level, which helps multinational corporations exchange knowledge through their branches scattered around the globe (Schleimer & Pedersen, 2014), which will enhance their competitiveness (Cordero P. & Ferreira, 2019). This process can also benefit small and medium enterprises through collaboration (Costa et al., 2016) and information sharing (Cordero P. & Ferreira, 2019).

In order to build effective absorptive capacity, organisations must be controlling some relevant knowledge to be able to exploit newly acquired knowledge to their benefit. The knowledge that

the organisation already owns includes technical knowledge by employees and general awareness of experts who can help with problems that could arise within the organisation (Cohen & Levinthal, 1990). Since the external environment contains a huge amount of knowledge (Azadegan, 2011), organisations must be able to evaluate the value of new knowledge through understanding, analysing and interpreting and then exploiting it to enhance performance (Cohen & Levinthal, 1990). Since absorptive capacity is important as it facilitates knowledge transfer and organisational learning through strategic alliances (Flatten et al., 2011; Lane et al., 2006), researchers tried to conceptualise it in various ways (Lane et al., 2006). Some researchers used R&D as a proxy for absorptive capacity (Lichtenthaler, 2009). However, another perspective for absorptive capacity states that organisations need organisation forms (functional grouping, grouping by product-market combinations and dual grouping of activities) and combinative capabilities (socialization capabilities, systems capabilities, coordination capabilities) to interact together over time in order to build absorptive capacity (Van den Bosch et al., 1999) while others used a process-based view to conceptualise absorptive capacity (Flatten et al., 2011; Volberda et al., 2010). This perspective is considered to be a reconceptualisation of the concept of dynamic capability, where building absorptive capabilities is considered a process of acquiring, assimilating, transforming and exploiting knowledge (Zahra & George, 2002). Todorova and Durisin (2007) assert that before acquiring knowledge, organisations should first recognize the value of that knowledge. Additionally, the authors suggested that before obtaining the benefits of acquired knowledge, there should be free movement between assimilation and transformation processes. This means the ability of subunits inside the organisation to share knowledge and process it as it is not enough to interact with the external environment to acquire knowledge (Hult et al., 2004).

The four capabilities, namely acquiring, assimilating, transforming and exploiting knowledge are integrated together to form the needed dynamic capabilities for the organisation (Zahra & George, 2002). Knowledge acquisition, which is considered to be the first stage in acquiring knowledge (Xie et al., 2018), involved actively interacting organisation's external environment with its internal environment while acquiring relevant knowledge (Buckley et al., 2009; Sherwood & Covin, 2008). Knowledge acquisition is the ability to selectively acquire knowledge that will significantly affect organisations' performance (Zahra & George, 2002), as it helps organisations develop their resources (Jansen et al., 2005) and innovation capabilities (Albort-Morant et al., 2017; Albort-Morant et al., 2018). In addition, it allows organisations to expand their knowledge base and technical abilities (Teece, 2007) in order to learn about the external environment and adapt to change more quickly (Schleimer & Pedersen, 2013). Knowledge assimilation allows organisations to quickly update their knowledge, which enhances the ability to solve problems and develop new products (Atuahene-Gima, 2003). It focuses on activities that are applied on the knowledge acquired, namely understanding, analysing, processing and interpreting (Zahra & George, 2002). It also helps organisations to efficiently use their intellectual resources (Huber, 2001) that enhance their innovativeness and competitiveness (Hoarau, 2014). Transformation of knowledge (combining existing knowledge and acquired and assimilated knowledge) can be achieved through social relationships (Chang et al., 2012) such as lunch with industry friends talks with trade partners and meetings with customers, consultants R&D institutions/ universities or third parties (Albort-Morant et al., 2018). As for knowledge exploitation, it is the ability to efficiently apply assimilated knowledge to enhance operations and performance (Zahra & George, 2002). This allows organisations to enhance their operations and create new ones (Camisón &

Forés, 2010) in order to enhance organisational innovativeness (Xie et al., 2018) and eventually their performance (Camisón & Forés, 2010).

2.6.1 Absorptive capacity and sustainability

In order to implement strategic proactive sustainability practices, absorptive capacity is needed (Delmas et al., 2011; Saenz et al., 2014), as it allows organisations to identify and acquire knowledge-related sustainability, such as new environmental compliance requirements located outside its boundaries from regulators and research institutions (Lee et al., 2014; Shubham et al., 2018). This interaction with the external environment will also help organisations achieve competitive advantage and higher organisational performance (Albort-Morant et al., 2018; Delmas et al., 2011). Absorptive capacity also plays an important role in enhancing sustainability (Chowdhury et al., 2019a) through collaborative practices (Kauppi et al., 2013) as it incentivises organisations to share sustainability knowledge (Beske et al., 2014; Sarkis, 2012). The acquired knowledge from the external environment is exploited to refine sustainability practices inside the organisation (Meinlschmidt et al., 2016; Reuter et al., 2010).

Riikkinen et al. (2017) investigated the impact of absorptive capacity on sustainability purchasing practices. Data were collected from four European countries (Italy, Finland, Ireland and Germany). Results indicated that enhancing organisational absorptive capacity can positively affect sustainability purchasing practices. Aboelmaged and Hashem (2019) investigated the relationship between absorptive capacity and environmental orientation represented in green innovation. Data were collected from small and medium enterprises operating in Egypt, the results revealed that absorptive capacity can positively enhance green innovation. The authors concluded that absorptive capacity can also influence other sustainable aspects. Albort-Morant et al. (2018) also

focused on absorptive capacity and green innovation; however, the data were collected from Spanish organisations operating in automotive industry. The authors concluded that absorptive capacity can significantly enhance green innovation. Finally, Walton et al. (2020) conducted case studies in New Zealand from different sectors e.g. agriculture, service and manufacturing to illustrate the need for learning and knowledge acquisition through absorptive capacity on energy eco-innovations.

2.7 Resilience

The origin of resilience comes from the discipline development of psychology and ecosystems (Ponomarov & Holcomb, 2009); it was imbedded in numerous disciplines, such as engineering, economics, ecology, psychology, and environmental sustainability (Conz et al., 2017). It is also closely related to different fields of study, such as risk management, disaster recovery and ecological and social vulnerability. However, resilience is surfacing as a theory of its own (Ponomarov & Holcomb, 2009). In general, resilience is a dynamic process and is negatively correlated to risk; the more you decrease risk, the more resilient your system is (Stewart et al., 1997).

The word resilience comes from the Latin word resilire, which means bounce back. It represents the systems or entities' ability to recover and return to original state after any kind of interference or interruption (Simmie & Martin, 2010). Martin (2012) reported that the vagueness around resilience comes from the fact that it has three different interpretations: engineering, ecological and adaptive.

Engineering resilience focuses on the equilibrium point of the system and its stability; in other words, it is the ability to return back to equilibrium quickly or move to a new one after the shock hits (Simmie & Martin, 2010). These shocks can be a technical failure, a flammable material released that causes fire/explosion (Dinh et al., 2012), a simple human error, an equipment failure (Bhamra et al., 2011), a pandemic disease, a natural disaster or a terrorist attack (Annarelli & Nonino, 2016). In this sense, shocks push the economy or the system off its equilibrium state, and the ability of the system to resist falling off the equilibrium point or its elasticity/responsiveness to shocks and its quick bounce back to the equilibrium point measures its resilience (Simmie & Martin, 2010).

The second interpretation for resilience is ecological resilience; it is concerned with whether shocks and disturbance can move the system to another domain. According to ecological perspective, resilience can be measured by the system's ability to absorb shocks before being forced to adapt to a different set of processes through changing its function and structure (Holling, 1973; Walker et al., 2006). A system's resilience measures its ability to absorb disturbance, while stability is its ability to return quickly to a stable state after shocks (Holling, 1973). Ecological resilience is defined by Cumming et al. (2005) as the system’s ability to preserve its identity when external or internal disruptions occur.

Resilience is not just a recovery to an old or a new stable state, but rather an ongoing process; this shifted the focus on how systems can adapt or survive through disturbance, not just how a system can be resilient, which led to adaptive resilience (Pendall et al., 2010).Adaptability is to appropriately customize for irregularities (Simmie & Martin, 2010). Adaptive resilience is considered to be the third interpretation for resilience; it focuses on the adaptive capabilities of the

system and the interconnectivity between the system's components and elements. It measures how the system's components and elements can reconfigure in order to adapt to external disturbance or internal irregularities. In light of this definition, economies can be resilient if they have the capacity to restructure their institutions, technologies, industries and firms to adapt to any shocks and stay on an acceptable growth rate path. The level of adaptive capacity or resilience of the economy depends on the availability of skilled labor, structure diversity, financial capacity, the ability and willingness of the firms in the economy to leap into new innovative sectors and production lines and finally formation of new firms and the level of entrepreneurship in the economy (Martin, 2012). Adaptive resilience focuses on the idea of connectedness between the system's elements; however, an increase in connectedness will decrease the overall adaptability. This means that there is an opportunity cost in choosing either resilience or connectedness (Simmie & Martin, 2010).

2.7.1 Organisational resilience

Organisations face mega challenges such as financial crises, unexpected shifts in demographic, climate change and limited access to resources. These events negatively affect organisations' profits and destabilise the global system, which forces organisations to establish new tactics and strategies (Winston, 2014). Successful organisations face complications due to disruptions, regardless of how well they are being managed. In order for organisations to successfully overcome these setbacks, they need to build resilience (Megele, 2014). The organisational perspective of resilience focuses on the ability of the organisations to adapt to changes (Sutcliffe & Vogus, 2003), and it has attracted a lot of attention in academic publications, which led to a number of definitions (Annarelli & Nonino, 2016) presented in table 2.2.

Table 2.2 Organisational resilience definition

Author/s	Field of study	Definitions
Rice and Caniato (2003)	Organisations	The ability to respond to unfavorable events occurring in the market and return back to normal operations after shocks.
Sheffi (2005)	Organisations	The ability to quickly bounce back to the original performance level after being disturbed through flexibility and redundancy.
Fiksel (2006)	Organisations	The survival capabilities, adaptive capacity and adaptability in times of crises.
Yang and Yang (2010)	Organisations	The ability to accurately predict and prepare for unfavorable events and return back to normal operations after shocks hit the market.
Gilly et al. (2014)	Organisations	A Reactive capacity to withstand external disturbance and an active capacity that helps in predicting changes and helps in opening new options.
Winston (2014)	Organisations	Avoiding all problems that might occur and pose a threat and not just recovering form disturbance.
Annarelli and Nonino (2016)	Organisations	Building strategic awareness on how to withstand disasters and undesirable events, expect them in advance, and reduce their impact and the probability of occurrence of shocks, in addition to taking control of the situation and bouncing back quickly, efficiently and with the lowest costs to the old equilibrium point or to a better one after disruptions.
Conz et al. (2017)	Organisations	The capability of maintaining an acceptable level of profitability during crises and finding a way to take advantage of the bad situation to their own benefit.

One drive for building resilience is the interconnectivity (Pettit et al., 2010) and the alignment of efforts and resources among organisations across the supply chain (Slone et al., 2007), especially that management activities, such as procurement, need to be highly coordinated beyond organisational boundaries (Mentzer et al., 2008). This means that building resilience is not limited to individual organisations; rather, it should be a coordinated effort across the supply chain as a whole.

2.7.2 Supply chain resilience

As supply chains are becoming more vulnerable and face more disturbance, the idea that supply chain management should evolve around efficiency and cost reduction only should be abandoned (Christopher, 2016). Because in order to be able to withstand market shocks and survive through crises, resilience must be embedded into the design of supply chains, even though it increases its overall cost (Carvalho et al., 2012). In addition, it gives supply chains the ability to respond and predict future events in the dynamic business environment (Carvalho et al., 2012; Li et al., 2017).

Christopher and Peck (2004) argued that in order for supply chains to achieve this adaptive capability, resilience must be imbedded into their design. Members in the supply chain must face risk as a single unit so that they can react quickly to gain competitive advantage when shocks hit the market. Even if building resilience increases cost on the long run, it will have more benefits, and these benefits will outweigh its expenses. In other words, focusing only on cost reduction will make supply chain more vulnerable to market turbulence. For example, depending solely on one supplier is cost efficient; however, it is not good for the resilience of the supply chain. The authors concluded that there are four features that can be used to build resilience into the design of the supply chain: choosing strategies that are not limited to only one pathway (which can be included under the umbrella of flexibility), taking a closer look into the tradeoff between efficiency and redundancy, enhancing the level of collaboration and finally agility, which consists of visibility and velocity. The first one is choosing strategies that are not limited to only one pathway: the focus on only one strategy will increase cost reduction, but the opportunity to withstand shocks when they occur will decrease. For example, when distribution facilities are centralised, they lower the overall cost of the supply chain but will force a limited number of options to be chosen from, which

will increase vulnerability of the supply chain. Second, taking a closer look into the tradeoff between efficiency and redundancy: it goes without saying that keeping excess capacity or inventory increases cost; however, it also increases resilience in the supply chain. Third, enhancing the level of collaboration among members of the supply chain: strong relationships among members of the supply chain and sharing of information decrease risks and the impact of disturbance on the market. Fourth, agility, which is the ability to react quickly to any shocks in supply and demand: delay in the response to demand or supply chain may lead to the failure of organisations as well as the whole supply chain. Agility has two main manifolds: visibility and velocity. Christopher and Peck (2004) and Iakovou et al. (2007) argued that the former means being aware of the environment surrounding the organisations or supply chains. It implies keeping track of inventories in upstream and downstream partners and changes in supply and demand. However, Christopher and Peck (2004) stated that the latter is concerned with the total time consumed to move the product and raw materials through the supply chain and responding quickly to any changes in supply and demand.

One of the factors that make supply chain more vulnerable and hence needs resilience is how big it is. The bigger the supply chain is, the more vulnerable it becomes; this increases the probability of risk and the occurrence of disturbance in the supply chain, which affects all members in the supply chain (Sheffi & Rice, 2005). It is crucial that resilience is built into the supply chain, as unexpected market events will affect it regardless of how well they are being managed. It is also important to build resilience as unexpected events can have a significant negative influence on the financial capabilities of all the members of the supply chain network (Christopher, 2016).

Hendricks and Singhal (2003) expanded this idea by investigating the impact of glitches in supply chains and their impact on shareholders' wealth. Results revealed that any glitches in the supply chain affect the financial position of the firm as they change shareholders' wealth as a consequence of negatively affecting stock return. The authors proposed four strategies to avoid supply chain glitches: reducing the probability of glitches, predicting glitches, decreasing time between the appearance of glitches and their detection and quickly resolving glitches. The first strategy, reducing the occurrence of glitches, is concerned with forecasting in order to be able to match between demand and supply. Forecasting methods, such as customer relationship management systems, can be very helpful as they enhance sharing of information, collaboration, synchronizing plans and accurate forecasting. Predicting glitches is the second strategy, which focuses on gathering information and gaining visibility along the supply chain. Reducing time between glitches and their detection means tracking events along the supply chain so that organisations can learn and respond appropriately. The fourth and final strategy is the time needed to actually solve the problem; the ability to quickly respond always limits the negative impact.

It can be concluded that organisations and consequently their supply chains need to be able to decrease the frequency of disturbance happening, detect them before happening, respond and solve them quickly. It can be easily detected that these strategies are in line with the resilience definitions (see table 2.2), which means that resilience is essential for supply chain and organisations as it affects their financial performance, argument supported by (Li et al., 2017).

Supply chain resilience enhances the ability of the supply chain to develop and adapt to be less vulnerable to changes. Hence, it is considered a tool for continuous competitive advantage (Pettit et al., 2013). Supply chain faces internal and external shocks that affect their operations and the

flow of materials. An internal shock is any event that affects one of the supply chain members such as a major fire disaster in a big manufacturing plant, while an external shock is related to events such as economic recessions (Hohenstein et al., 2015). The phenomenon of supply chain resilience has no universal definition; however, there are definitions that are similar (Hohenstein et al., 2015), which are presented in table 2.3.

Table 2.3 Supply chain resilience definition

Author/s	Field of study	Definitions
Peck (2005)	Supply chains	The ability to leap back to the desired state after shocks hit the market.
Sarathy (2006)	Supply chains	The ability to quickly return to the normal state after shocks hit the market.
Datta et al. (2007)	Supply chains	The ability to control and maintain performance in times of crises, in addition to adapting to unforeseen events and responding appropriately to unexpected shocks.
Ponomarov and Holcomb (2009)	Supply chains	The ability to adapt and be ready to unpredicted events and respond efficiently to these events, in addition to the ability to recover after disturbance to the same level of output and hold structures and functions intact.
Klibi et al. (2010)	Supply chains	Avoiding market shocks and bouncing quickly form failure.
Melnyk et al. (2010)	Supply chains	The ability to recover quickly with the lowest cost possible.
Ponis and Koronis (2012)	Supply chains	Responding appropriately to unfavorable events by predicting and adapting to unexpected disturbance, in addition to the ability to sustain control over structure, functions and operations and finally to achieve a higher operation level after disruptions, if possible.
Xiao et al. (2012)	Supply chains	Sustaining normal operational level through adaptability and recovery capabilities.
Hearnshaw and Wilson (2013)	Supply chains	The ability to maintain the flow of materials and products in times of crises.
Pettit et al. (2013)	Supply chains	Adapting to unexpected changes, surviving and thriving when disturbance occurs.
Hohenstein et al. (2015)	Supply chains	Predicting future events, preparing and responding to them appropriately, in addition to a quick recovery to normal state or a more desirable one after the shock.

Tukamuhabwa et al. (2015)	Supply chains	The ability to prepare and respond to unfavorable events, in addition to recovering from disruptions quickly and with the lowest possible cost to reach a more desirable level of operations.
Chowdhury and Quaddus (2016)	Supply chains	The ability to stop disturbance from occurring and enhance readiness and response to demolish the negative impact of the shock and leap back to normal operation in a reasonable time.
Kamalahmadi and Parast (2016)	Supply chains	Reducing the probability of crises occurring and withstanding disruptions by using adaptive capabilities and keeping control over functions and structures, in addition to reactively recovering and responding to limit the impact of crises and restore the robust state of operation.
Chowdhury and Quaddus (2017)	Supply chains	Limiting the negative impact of disturbance or reducing the probability of crises occurring and returning to a stable state.
Li et al. (2017)	Supply chains	The ability to be ready for future changes and adapt to them and build agility, in addition to the ability to respond to any unexpected shocks.

2.7.3 Cluster resilience

The importance of building resilience in clusters is as important as building it for individual firms. Researchers tried to investigate how clusters can survive these unexpected shocks with a very high probability to occur through risk management and resilience (Østergaard & Park, 2013). The authors investigated the cluster decline due to its inability to adapt to constant changes in the market. The study focused on a case study in Denmark, which was maturing and developing for over 40 years. The observation of the history of the cluster led the researchers to believe that it is in a declining phase because of the lack of resilience. Geng et al. (2013a) defined supply chain cluster resilience as the ability to adapt and quickly rebound to a new equilibrium state through the concept of self-organisation repair when cascading failure occurs because of disturbance, while

Wang and Xiao (2016) defined supply chain cluster resilience as the ability to quickly recover from disruptions to normal operation.

Østergaard and Park (2013) also defined cluster resilience as the cluster's ability to face internal and external disturbance through adaptability, while keeping its functions linked to the same industrial field it was operating in. This adaptive capability enhances the cluster's ability to make small or big changes or even transform completely. In order to be able to transform completely, clusters need to add new activities when the old ones are failing. The authors added that in addition to adaptability, these factors can also help in building cluster resilience, which includes formation of new firms, retention of employees, and coping with technological advancement (escaping lock-in phase) and new sources of knowledge (universities). It can be viewed from both definitions that adaptive capability is very important for cluster resilience, as clusters will have to use this ability to repair and make changes to cope with shocks.

Geng et al. (2013a) stated that supply chain clusters face two kinds of risks: internal and external. Internal risk is concerned with events that cause disturbance in supply and demand, such as human error, equipment failure etc. These kinds of internal conflicts disturb the flow of products and the production process, which in return affect the supply and demand of materials. The external risks are concerned with the external forces that cause disturbance, such as natural disasters, strikes etc. In order for supply chain clusters to overcome such vulnerability to internal or external shocks, they should control their structure and change it to absorb shocks, adapt to changes and recover in a reasonable time with the lowest price possible. Using these capabilities when cascading failure occurs and disrupts the whole network operation, they will be able to take the necessary adjustments quickly, by creating new entities and restructuring the old ones to create a new

network structure so that the supply chain cluster can emerge back to its operation as soon as possible. Noori and Weber (2016) argued that network coordination is very essential for recovery.

The failure of one of the organisations in the supply chain may lead to the shutdown of some other organisations in the supply chain and the decline of the supply chain as a whole (Jüttner & Maklan, 2011), a phenomenon known as cascading failure. Wang and Xiao (2016) point out that cascading failure occurs when one of the organisations in the network fails to meet the minimum production level required, leading to a shortage in the production of its downstream firms because they were not supplied with enough material to reach their normal production level. In addition, the upstream firms will face low demand on their production, which may lead to a delay in their operation and production level. Supply chain clusters should develop core competitiveness, enhance information flow and stress on emergency management in order to face cascading failure.

In their investigation regarding the link between cluster life cycle and technological life cycle, Suire and Vicente (2014) argue that clusters can be resilient if they achieved an acceptable attractive condition, structure and technology. In addition to detaching its cycle from the cycle of technology, a cluster can achieve that by collaboration with external audience effect (from mass market to early market) and network effect (structuring of the technological field) and focus on knowledge relationships. Clusters can be even more resilient when they can keep a resilient condition as their products decline, while Elola et al. (2013) reported that globalisation can be the reason for cluster failure and investigated how clusters can withstand the forces of globalisation by using resilience. Interviews in leading companies in the cluster revealed that some firms faced fierce competition, while others were successfully able to integrate themselves into the global supply chain and build resilience. As globalisation forces impose threats to firms with standardized

production, this may lead to a decline in clusters due to the split up of concentrated organisations. However, if appropriate strategies are implemented to control the situation and create new innovative policies, clusters can be kept intact. Table 2.4 summarizes resilience definitions adapted for research on clusters.

Table 2.4 Clusters resilience definitions

Author/s	Field of study	Definitions
Geng et al. (2013a)	Clusters	The ability to adapt and quickly rebound to a new equilibrium state through the concept of self-organisation repair when cascading failure occurs because of disturbance.
Østergaard and Park (2013)	Clusters	Facing internal and external disturbance through adaptability, while keeping functions linked to the same industrial field it was operating in.
Wang and Xiao (2016)	Clusters	The ability to recover from disruption to normal operation.

2.7.4 Resilience and sustainability

Building resilience in an organisation should be imbedded in the strategic plan that directly affects the operation, increases competiveness and reduces vulnerability. In order to build a strategic plan for better future results and gain competitive advantage, resilience needs to be incorporated into the organisation (Stoltz, 2004) but not only as a reaction for shocks in the market but also as a creation of competitive advantage (Teixeira & Werther, 2013), which means that it ensures the effectiveness of the operation through a proactive strategy and not just a reactive strategy (Annarelli & Nonino, 2016). Golicic et al. (2017) conducted case studies on wine industry clusters in the USA, Australia, New Zealand, Italy and Germany to link between resilience and business sustainability (financial sustainability) using grounded theory. The authors focused on

connectedness and how it can be used to maintain long term survivability (financial sustainability) during market shocks through developing resilience.

Enhancing sustainability levels can be achieved through resilience practices, such as flexible supply base, information control system, disaster recovery plan, contingency planning, alternative transportation routing and connectedness. These practices could lead to a decrease in purchasing and manufacturing cost, which eventually enhances economic sustainability (Ruiz-Benitez et al., 2019). In addition, it could lead to a decline in toxic materials used and wastes, in addition to rationalising the use of energy and materials and decreasing carbon emissions, which directly enhances environmental sustainability (Ruiz-Benitez et al., 2019; Winston, 2014). Finally, resilience practices help in reducing the negative impact on society through allowing business partners to recover quickly using a well-established coordinated plan to ensure public safety and a healthy environment (Ruiz-Benitez et al., 2019).

2.8 Conclusion

This chapter introduced three theoretical lenses, namely systems theory, extended resource-based view and dynamic capabilities theory, upon which the conceptual framework will be developed (more details on the conceptual framework is discussed in the next chapter). This chapter also discussed industrial clusters and how they evolved to supply chain clusters and the main difference between them. In addition, it demonstrated the advantages of a supply chain cluster and how its design characteristics can help organisations collaborate and connect. Furthermore, the chapter discussed sustainability and its importance to organisational performance, in addition to the three pillars of sustainability and how environmental uncertainty can interrupt sustainability development. Moreover, this chapter introduced resilience and absorptive capacity in details and

how these dynamic capabilities can help organisations to maintain their performance under environmental uncertainty. This chapter contributed in achieving the first objective as it illustrated the main themes based on the theoretical lenses and in discussing how these main themes can be operationalised through evidence from previous studies, which will help in developing the conceptual framework.

This research has a number of theoretical as well as empirical contributions; empirical studies used systems theory, extended resource-based view and dynamic capabilities theory e.g. (Bag, 2019; Bag et al., 2020; Chen et al., 2019; Hong et al., 2018); however, these studies did not combine these theories together, especially in a supply chain cluster context. Because of the lack of research linking sustainability and dynamic capabilities (Aboelmaged & Hashem, 2019; Albort-Morant et al., 2018; Golicic et al., 2017), measuring the impact of dynamic capabilities on organisational sustainability will contribute to this link (Cezarino et al., 2016). It will also contribute to the link between dynamic capabilities theory and sustainability. In addition, it will practically contribute to the link between sustainability and performance and give incentives to organisations to pursue high levels of sustainability (Esfahbodi et al., 2016), especially, with the ongoing debate around the nature of the relationship between sustainability and performance (Ni & Sun, 2019). Furthermore, it contributes to the debate on the impact of geographical concentration (Presutti et al., 2017) and networked collaboration (Lei & Huang, 2014) on performance (Lei & Huang, 2014; Presutti et al., 2017). Moreover, it considers the environmental, social and economic dimensions of sustainability rather than focusing on just one dimension (Ruiz-Benitez et al., 2019; Touboulic & Walker, 2015). The study will also fill the literature gap regarding the relationship between sustainability and performance in a supply chain cluster context (Das et al., 2019; Elgazzar & Tipi,

2014). Finally, even though operational and financial performances were considered in previous research under these theoretical perspectives e.g. (Fantazy et al., 2016; Kangkang et al., 2018; Liu et al., 2018; Mani et al., 2018; Miemczyk & Luzzini, 2019; Ni & Sun, 2019; Sheu, 2014), the impact of the three dimensions of sustainability on performance was not tested while taking into consideration the impact of supply chain cluster design characteristics (Das et al., 2019). Previous studies did not focus on illustrating how cluster design characteristics can be linked to operational and financial performances through dynamic capabilities and sustainability e.g. (Capone & Zampi, 2019; Chandrashekar & Mungila Hillemane, 2018; Golicic et al., 2017; Liao, 2015). In addition, testing this framework will practically and theoretically contribute to the relationship between absorptive capacity and sustainability, as only few studies tackled this issue (Riikkinen et al., 2017) based on the reviewed literature studies that focused on supply chain clusters, mostly studies in high-technology sector clusters in developing countries (Capone & Zampi, 2019; Chandrashekar & Mungila Hillemane, 2018; Patti, 2006). This means that the relationship between dynamic capabilities and sustainability in a supply chain cluster context needs to be further examined in different regions and industries (Golicic et al., 2017), especially that previous studies were related to wine industries and used only resilience as a dynamic capability and just focused on financial sustainability e.g. (Flint et al., 2011; Golicic et al., 2017).

Entities as well as economies need to adapt quickly and leap forward after crises, in other words build resilience to maintain their normal level of operation. Testing and verifying this framework will have huge benefits for businesses and economies as clusters play an important role in the development and growth of organisations and economies. In addition, this framework can be applied on any type of clusters, such as logistics clusters, as it focuses on linking characteristics to

sustainability, dynamic capabilities and performance. A logistics cluster is a type of clusters formed by members in logistics service activities, such as logistics operations and third party logistic providers, forwarders etc. (Sheffi, 2012).

CHAPTER THREE – CONCEPTUAL FRAMEWORK

3.1 Introduction

This chapter presents the conceptual framework that was developed from the literature review and a combination of theoretical lenses: systems theory, extended resource-based view and dynamic capabilities theory. It also discusses the developed research hypotheses driven from the framework. In addition, it illustrates the relationships between the research constructs, supply chain cluster design characteristics, absorptive capacity, resilience, sustainability, operational performance and financial performance.

3.2 Conceptual Framework

According to the systems theory perspective, organisations' goals are supported through collaboration and alignment of efforts (Flynn et al., 2010). This collaboration allows an organisation to acquire resources otherwise hard to be acquired by a single organisation, which is why it seeks strategic alliances in order to reach maximum profits (Fynes et al., 2004; Pfeffer & Salancik, 1978) and build relationships to achieve organisational goals (Ketchen & Hult, 2007). In this sense, organisations can use their own resources and combine them with resources obtained from business partners to enhance sustainability (Ni & Sun, 2019). This will lead to an increase in performance as sustainability activities create value to the customer through collaborative efforts (Ni & Sun, 2019; Priem et al., 2012). The notion of acquiring a unique bundle of resources to enhance organisational sustainability and performance is supported by extended resource-based view (Chen et al., 2019; Ni & Sun, 2019). These resources are located on a subsystem (organisational) level and on a system level (supply chain level) (Ketchen & Hult, 2007).

Following the same logic, resources can be located on a supply chain cluster level. The stress on collaboration, resources sharing and interacting with the external environment can build a foundation for enhancing sustainability (Esfahbodi et al., 2016; Hsu et al., 2013).

The environment surrounding the organisation is dynamic, which means that the organisation is surrounded by high-velocity markets associated with unpredictable changes and non-linear directions (Eisenhardt & Martin, 2000). This means that the acquired resources might be obsolete over time (because of constant change in the external environment), and the assumptions of extended resource-based view that hold in a static environment might not be successful in a dynamic environment (Teece, 2007). Since organisations operate in a constantly changing environment (Shubham et al., 2018), they need to frequently enhance, expand and protect their tangible and intangible (knowledge base) assets through dynamic capabilities (Helfat et al., 2007; Teece, 2007), namely resilience (Yusuf et al., 2014) and absorptive capacity (Riikkinen et al., 2017). This introduced the concept of dynamic capabilities and how it can be used to cope with dynamic environments and sustain organisational performance (Di Stefano et al., 2014; Teece, 2016; Teece, 2007). Dynamic capabilities are the set of capabilities that the organisation needs to adapt and sustain competitive advantage through increasing their performance (Bag, 2019; Xi et al., 2014) by altering resources to fit to the market condition surrounding the organisation (Barney, 1991; Helfat et al., 2007).

Dynamic capabilities allow an organisation to make this alteration through creating and extending its resources (Helfat et al., 2007) to enhance performance (Teece, 2007). Since resilience is directly linked to successfully managing organisational resources to overcome environmental uncertainties in the market and to sustain performance, it is considered a dynamic capability (Mandal, 2017).

Absorptive capacity is also considered to be a dynamic capability (Shubham et al., 2018; Zahra & George, 2002) as it develops organisational sustainability (Elbaz et al., 2018) through changing resources to increase innovative performance (Belso-Martínez et al., 2016) and cope with the environmental uncertainties (Riikkinen et al., 2017). Supply chain cluster characteristics are linked to absorptive capacity (Kohlbacher et al., 2013) as they promote local networks, research and development (Belso-Martinez et al., 2018; Wang et al., 2018) and attract skilled workers (Presutti et al., 2017; Zeinalnezhad et al., 2011). In addition, shared knowledge between cluster members can be exploited efficiently and effectively through absorptive capacity as it facilitates organisational learning (Flatten et al., 2011; Lane et al., 2006). Cluster characteristics can also build resilience as they make organisations more adaptive to the surrounding environment (Geng et al., 2013a) through enhancing collaboration and information sharing among members (Huang & Xue, 2012; Yan & Wang, 2008), in addition to enhancing connectedness through the quick movement of materials (Yan & Wang, 2008).

Since collaboration among organisations is needed to enhance sustainability levels (Gupta et al., 2013), forming clusters can be a milestone for organisations to build sustainability through dynamic capabilities (Anderies et al., 2013; Golicic et al., 2017) because it allows organisations to share resources and information and generate knowledge (Grimstad & Burgess, 2014; Mitchell et al., 2010). Pursuing sustainability (environmental, social and economic issues) is important, because focusing only on financial gains can initiate a rapid economic growth (Feizpour & Mehrjardi, 2014; Geng et al., 2013b), but organisations will neglect important environmental issues, which will lead to public unrest (Esfahbodi et al., 2016). However, pursuing sustainability will create value to the customer (Priem et al., 2012), which increases his loyalty (Albuquerque et

al., 2019) and leads to an increase in his willingness to pay (Priem et al., 2012). In addition, sustainability enhances employees' productivity through motivation (Rodrigo & Arenas, 2007). Based on the above argument, it can be concluded that sustainability can enhance organisational performance (Winnard et al., 2018; Zhu et al., 2013). Additionally, since organisations play a key role in economic growth (Hsu et al., 2013), it can be argued that sustaining organisational performance is strongly related to economic growth (Moldan et al., 2012). The correspondent research model is presented in figure 3.1.

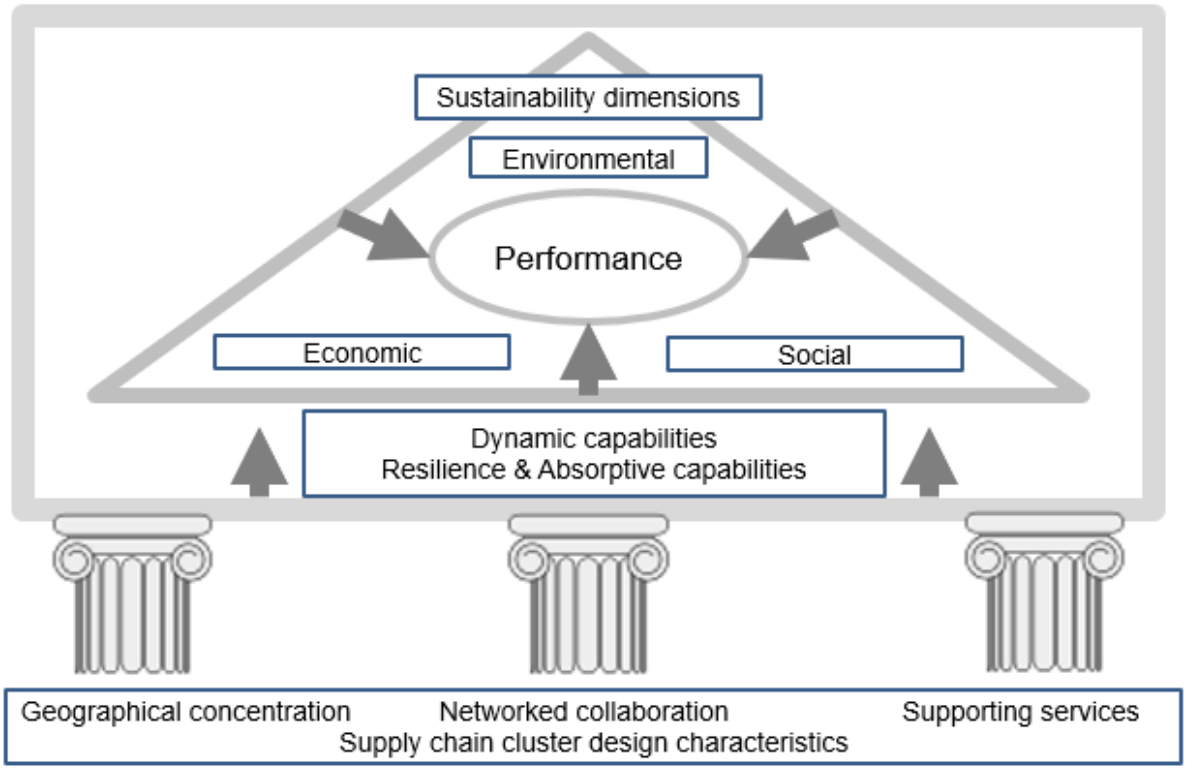

Figure 3.1 Research model "The role of supply chain cluster design characteristics in sustaining organisational performance through dynamic capabilities"

3.3 Hypothesis development

In the previous chapter, a holistic framework for enhancing organisational sustainability through dynamic capability in a supply chain cluster context was illustrated. However, to empirically analyse the relationship in the model, main hypotheses must be developed, namely the impact of supply chain cluster design characteristics on absorptive capacity and resilience, the impact of absorptive capacity and resilience on sustainability, the impact of sustainability on financial and operational performance and the mediating role of absorptive capacity and resilience between design characteristics and sustainability. Figure 3.2 shows the hypothesised relationships.

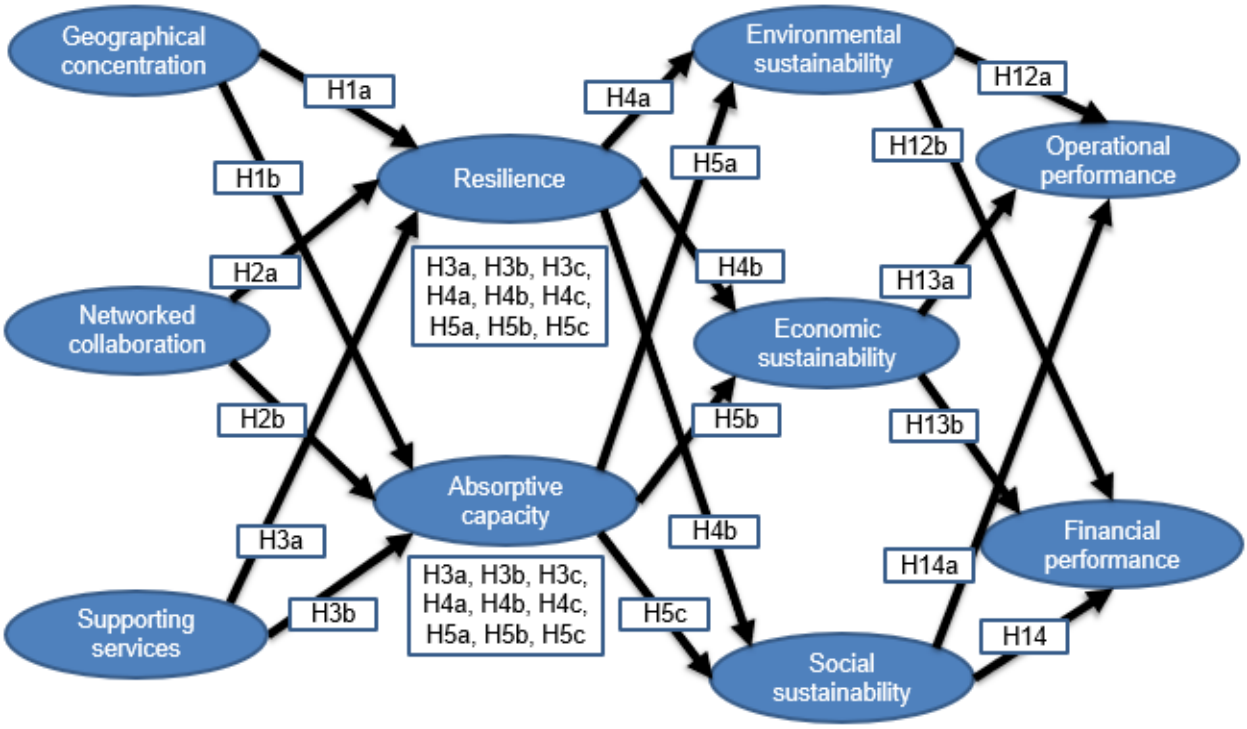

Figure 3.2 Hypothesised relationships

3.3.1 The relationship between design characteristics and dynamic capabilities

Drawing on systems theory, organisations inside a system need to be interconnected to overcome the dynamic business environment (Tipu et al., 2019). The integration and coordination of resources between a system's members are essential as they enhance organisations' capabilities (Fantazy et al., 2016; Spekman et al., 2002). In this sense, through introducing dynamic capabilities theory (Teece et al., 1997), organisations will be able to use this advantage until they build dynamic capabilities in order to renew and protect their resources to cope with the disruptions in the market (Helfat et al., 2007; Teece, 2007). Based on this argument, this research posits supply chain cluster as a system where its subsystems (cluster's members) can use the established alliances and availability of resources to cope with the business environment through building dynamic capabilities.

Cluster characteristics allow for an easy access to information and resources, which creates knowledge and builds trust. In addition, it reduces the overall costs and creates synergies; furthermore, it provides skilled labor and services, raw materials and equipment (Zeinalnezhad et al., 2011). Geographical concentration and networked collaboration allow members to focus on specialisation as they can rely on each other through cooperation and facilitate the optimal flow of information and skilled labor (Geng et al., 2013a; Huang & Xue, 2012; Tolossa et al., 2013), which builds trust and allows them to be more flexible to adapt to dramatic changes in the dynamic business environment (Geng et al., 2013a). The close proximity also allows for easy access to resources and information (Tolossa et al., 2013), including skilled employees and reliable suppliers who increase their productivity (Patti, 2006).

The networked collaboration creates synergies by allowing members to use their collective skills and resources in harmony (Porter, 1998), which enhances the ability to face risk and limits the impact of shocks (Carvalho et al., 2012; Chowdhury & Quaddus, 2016, 2017; Christopher & Peck, 2004; Conz et al., 2017; Hohenstein et al., 2015; Jüttner & Maklan, 2011; Pettit et al., 2013; Tang, 2006; Tukamuhabwa et al., 2015). In addition, networked collaboration enhances the ability to take advantage of market opportunities and share information (Han, 2009). Clusters also give their members access to public institutions (Patti, 2006) that provide managerial knowledge, training and specialised training (Han, 2009). Based on the above discussion and the underlying logic in systems theory and dynamic capabilities theory, it can be argued that organisations inside a supply chain cluster can use their charactersitics to build dynamic capabilities (Flint et al., 2011; Golicic et al., 2017). As the advantages that the supply chain cluster design characteristics provide to the organisations, such as trust, collaboration and availability of skilled labor, knowledge, training and support from government, research institutions and industry associations can enhance organisations' ability to adapt to changes and seize opportunities, which in return help organisations facilitate absorptive capacity (Cordero P. & Ferreira, 2019; Costa et al., 2016; Elbaz et al., 2018; Kohlbacher et al., 2013) and build resilience (Golicic et al., 2017; Yusuf et al., 2014) and eventually enhance performance (Lin, 2018). Thus, it can be hypothesised that:

H1a: Geographical concentration positively impacts organisational resilience.

H1b: Geographical concentration positively impacts organisational absorptive capacity.

H2a: Networked collaboration positively impacts organisational resilience.

H2b: Networked collaboration positively impacts organisational absorptive capacity.

H3a: Supporting services positively impact organisational resilience.

H3b: Supporting services positively impact organisational absorptive capacity.

3.3.2 The relationship between dynamic capabilities and sustainability

Dynamic capabilities allow organisations to cope with the constantly changing environment through acquiring, reconfiguring, integrating and releasing resources (Vanpoucke et al., 2014). The use and control of resources will help organisations create and develop new resources (Helfat et al., 2007; Vanpoucke et al., 2014), in addition to recombining resources owned by organisations to enhance their competitiveness (Vanpoucke et al., 2014). Dynamic capabilities allow organisations to acquire knowledge, anticipate market changes and seize opportunities in the market, which help in enhancing organisations' sustainability (Song & Choi, 2018). Following the logic of dynamic capabilities theory, organisations can use dynamic capabilities to create and develop new resources that can help enhance the level of sustainability.

3.3.2.1 The relationship between resilience and sustainability

Achieving long-term sustainability in constantly changing environments is challenging as organisations need to modify environmental, social and economic sustainability processes whenever the market changes (Fiksel, 2006; Fiksel et al., 2014). Since organisations struggle to sustain their operations, resilience allows a solution to adapt to the business environment (Flint et al., 2011; Golicic et al., 2017). This leads to the important role of resilience in helping organisations adapt their sustainable practices to cope with environmental uncertainty (Souza et al., 2017). As previously mentioned, in order to build resilience, organisations must imbed it into their strategic plan (Li et al., 2017) through establishing strategies, such as a recovery plan, sharing of information and resources (Eshetu et al., 2017). This will ensure a quick leap back to the point before the crisis hits (Pettit et al., 2013; Rose, 2007; Yu et al., 2003). Resilience helps in building a decision support system to reach recovery solutions. The system allows organisations to keep

original production schedules with the lowest cost possible, which leads to customer satisfaction (Tang, 2006). This recovery plan enables organisations to leap back to original operation after shocks (Yu et al., 2003).

One of the important practices in resilience is monitoring supply and demand conditions, which helps organisations to better understand customer needs and respond quickly to their demands (Li et al., 2005). It will also help organisations overcome glitches in any part of the supply chain (Carvalho et al., 2012; Christopher & Peck, 2004; Iakovou et al., 2007), which will eventually lead to the ability to anticipate changes in supply or demand in the market (Carvalho et al., 2012). Resilience also enhances efficient reactions during shocks (Jüttner & Maklan, 2011) and quickens response to market shocks (Li et al., 2005), which will lead to an increase in production quality through better understanding of customer needs (Boon-itt, 2009). This speed of adaptation (or quick response) that organisations gained through building resilience (Stevenson & Spring, 2007) helps organisations adapt to disruptions, thrive after and prepare for unforeseen events (Manuj & Mentzer, 2008). The importance of resilience comes from the fact that it focuses on the speed of adaptation and not just flexible adaptation, because when organisations move more quickly than competitors, they will gain the advantage of exploiting opportunities in the market and enhance performance (Gligor & Holcomb, 2012; Ponomarov & Holcomb, 2009). All these benefits of building resilience help organisations achieve their main goal of enhancing sustainability (Anderies et al., 2013; Golicic et al., 2017). Thus, it can be hypothesised that:

H4a: Resilience positively impacts environmental sustainability.
H4b: Resilience positively impacts economic sustainability.
H4c: Resilience positively impacts social sustainability.

3.3.2.2 The relationship between absorptive capacity and sustainability

Organisations must build dynamic capabilities (Bhupendra & Sangle, 2015) through integrating different resources (Cezarino et al., 2016) and implementing innovative technologies to achieve higher sustainability levels (Bhupendra & Sangle, 2015) and cope with environmental changes (Ben-Menahem et al., 2013; Cezarino et al., 2016). Dynamic capabilities can be built through implementation of absorptive capacity (Delmas et al., 2011; Riikkinen et al., 2017). Any capabilities that organisations can use to cope with disruption in the market or change the business environment are considered dynamic capabilities (Beske et al., 2014; Helfat et al., 2007), such as knowledge acquisition and assessment, collaboration and planning among business partners (Beske et al., 2014). Organisations need to change their business processes to develop sustainability (Delmas et al., 2011; Riikkinen et al., 2017). Acquiring external knowledge and assessing it is part of absorptive capacity (Shubham et al., 2018; Zahra & George, 2002). Sustainability adaptation needs a high level of absorption capacity (Riikkinen et al., 2017) in order to exploit sustainability-related knowledge and information (Abareshi & Molla, 2013; Haugh & Talwar, 2010), which means that absorptive capacity facilitates the implementation of sustainability practices (Delmas et al., 2011; Kauppi et al., 2013; Schiele, 2007). Organisations acquire knowledge such as new regulations regarding reduction of hazardous substances or registration, evaluation, authorization and restriction of chemicals (Lee et al., 2014) and exploit this new knowledge to transform their practices and capabilities towards achieving higher sustainability (Carter & Rogers, 2008).

The way that organisations search for knowledge and acquire it allows organisations to understand the demands of stakeholder regarding sustainability and the expectations of customers regarding

the service and/or product (Riikkinen et al., 2017). Sustainability-related knowledge needed for enhancing sustainability might not be owned by organisations; this pushes organisations to enhance their absorptive capacity in order to acquire the missing knowledge needed to achieve the acceptable levels of sustainability (Pace, 2016). Sustainability-related information could be new standards and certificates, new materials and resources that are environmental-friendly (Riikkinen et al., 2017) and new requirements regarding corporate social responsibility (Boyd et al., 2007). Absorptive capacity is considered an antecedent for green practices (Gold et al., 2013) because it allows information about the product's life cycle to flow smoothly between supply chain members (Delmas et al., 2011) and cross functional teams (Gold et al., 2013). In addition, it helps organisations gather sustainability-related information from trade/ industry associations/and third party organisations (Boyd et al., 2007). Absorptive capacity allows knowledge related to sustainability to be acquired and spread within and across organisations, which facilitates the implementation of sustainable practices (Lee et al., 2014; Pagell et al., 2010). Thus, it can be hypothesized that:

H5a: Absorptive capacity positively impacts environmental sustainability.
H5b: Absorptive capacity positively impacts economic sustainability.
H5c: Absorptive capacity positively impacts social sustainability.

3.3.3 The relationship between design characteristics and sustainability through dynamic capabilities

According to the extended resources-based view, organisations need to acquire a unique bundle of resources to achieve competitive advantage (Popli et al., 2017). These resources can be acquired through forming alliances with entities outside their boundaries (Ketchen & Hult, 2007; Popli et

al., 2017) such as organisations inside the same supply chain, which means the required resources can be located at a supply chain level (Ketchen & Hult, 2007), following the same logic since supply chain clusters facilitate access to pooled resources and information (Tolossa et al., 2013; Xue et al., 2012b). It can be argued that the resources needed to enhance sustainability can be located on a supply chain cluster level. However, in order to take advantage of external resources, organisations need to build their internal capabilities (Lai et al., 2012). In this sense, organisations (sub systems) can take advantage of being in supply chain clusters (system) to facilitate collaboration among each other through cluster design characteristics. This collaboration will help in enhancing organisations' capabilities (Fantazy et al., 2016; Spekman et al., 2002). This means that organisations can benefit from being in a cluster to build dynamic capabilities (Flint et al., 2011; Golicic et al., 2017). Then, organisations will be able to efficiently develop their resources and increase their benefit from available external resources to enhance their sustainability levels through using their internally enhanced capabilities, resilience (Golicic et al., 2017) and absorptive capacity (Saenz et al., 2014).

Working inside a cluster can help organisations maintain their operations (Grimstad & Burgess, 2014) through networked collaboration (Dangelico et al., 2013) supporting services (government, universities and industrial associations) (Grimstad & Burgess, 2014) and geographical concentration (Grimstad & Burgess, 2014; Mitchell et al., 2010). These characteristics allow for an easier access to resources, information (Grimstad & Burgess, 2014; Tolossa et al., 2013) and knowledge generation (Lei & Huang, 2014; Mitchell et al., 2010), since forming clusters is also related to dynamic capabilities (Flint et al., 2011; Golicic et al., 2017) as organisations seek to join a supply chain cluster to cope with the constantly changing market needs (Huang & Xue, 2012;

Villa et al., 2009). It can be argued that the creation of supply chain clusters allows organisations to maintain performance during and after crises (Geng et al., 2013a), which means that building dynamic capabilities through clustering can help organisations develop sustainability (Flint et al., 2011; Golicic et al., 2017) and promote sustainability practices, policies and regulations (Grimstad & Burgess, 2014). Dynamic capabilities are essential for enhancing sustainability as they help in facilitating the sustainability practices (Riikkinen et al., 2017; Teece, 2007; Zahra & George, 2002). Achieving a certain level of sustainability requires acquisition of sustainability-related knowledge (Haugh & Talwar, 2010; Riikkinen et al., 2017). Absorptive capacity can be used to acquire needed knowledge for adaptation of sustainability practices (Delmas et al., 2011). Knowledge and information absorbed from the environment can help in changing business processes and practices in order to enhance sustainability (Delmas et al., 2011; Kauppi et al., 2013). Resilience also plays an important role in enhancing sustainability levels (Park et al., 2013) because without resilience, risk will lead to fragile sustainability (Ahern, 2013; Blackmore & Plant, 2008). Sustainability is considered to be the main goal that sets organisations' objectives; incorporating resilience into the strategic plan of the organisation will help in achieving these objectives (Anderies et al., 2013). Thus, it can be hypothesised that:

H6a: Geographical concentration affects environmental sustainability through resilience.

H6b: Geographical concentration affects economic sustainability through resilience.

H6c: Geographical concentration affects social sustainability through resilience.

H7a: Networked collaboration affects environmental sustainability through resilience.

H7a: Networked collaboration affects environmental sustainability through resilience.

H7c: Networked collaboration affects social sustainability through resilience.

H8a: Supporting services affect environmental sustainability through resilience.

H8b: Supporting services affect economic sustainability through resilience.

H8c: Supporting services affect social sustainability through resilience.

H9a: Geographical concentration affects environmental sustainability through absorptive capacity.

H9b: Geographical concentration affects economic sustainability through absorptive capacity.

H9c: Geographical concentration affects social sustainability through absorptive capacity.

H10a: Networked collaboration affects environmental sustainability through absorptive capacity.

H10b: Networked collaboration affects economic sustainability through absorptive capacity.

H10b: Networked collaboration affects economic sustainability through absorptive capacity.

H11a: Supporting services affect environmental sustainability through absorptive capacity.

H11b: Supporting services affect economic sustainability through absorptive capacity.

H11c: Supporting services affect social sustainability through absorptive capacity.

3.3.4 The relationship between sustainability and organisational performance

Reaching high levels of sustainability can be achieved through collaborative efforts, as customers hold organisations responsible for not abiding by sustainable standards even if the problem originated from the supplier (Paulraj et al., 2017). This means that supply chain members need to help each other and work jointly to achieve high levels of sustainability (Gimenez & Sierra, 2012; Luzzini et al., 2015). High levels of sustainability through collaborative activities will eventually lead to better organisational performance (Xi et al., 2014) as it creates value to the customers and increases their willingness to pay (Priem et al., 2012). In other words, organisations need to seek alliances to acquire resources outside their boundaries in order to enhance their sustainability (Miemczyk & Luzzini, 2019) and eventually achieve higher performance levels (Ni & Sun, 2019). This notion is discussed in systems theory and extended resource-based view as systems theory

emphasises the integration and collaboration among organisations to enhance their performance (Flynn et al., 2010; Michalski et al., 2018). Regarding extended resource-based view, it argues that higher performance can be achieved when combining acquired external resources with organisational internal resources (Yang et al., 2019). The combination of external resources acquired through collaboration and internal resources can help in enhancing sustainability levels, which creates value to the customer and eventually leads to higher performance (Ni & Sun, 2019). Following the logic of systems theory and extended resource-based view, organisations inside a supply chain cluster can collaborate and use available resources to enhance sustainability levels and eventually increase performance.

Based on the above discussion, it can be argued that sustainability positively affects organisational performance (Golicic et al., 2017; Moneva & Ortas, 2008; Paulraj et al., 2017; Reefke & Sundaram, 2017) as enhancing sustainability positively affects organisational image (Kusi-Sarpong et al., 2016), which in turn has a positive impact on its financial performance as it gains investors' trust and attracts more investments (Aguinis & Glavas, 2012; Albuquerque et al., 2019; Albuquerque et al., 2020). In addition, it increases customer loyalty which secures a steady flow of revenue because of low price elasticity of demand (Albuquerque et al., 2019). It is important to monitor the operational performance level as the overall financial performance measure is not enough because it is influenced by other factors (Pettit et al., 2019). Investing in sustainability also enhances operational performance (Carter & Liane Easton, 2011; Reuter et al., 2010) through focusing on increasing productivity with lower cost, energy, resources, and a higher product lifespan (Hollos et al., 2012).

Sustainability promotes reduction of resource usage and waste reduction (Kleindorfer et al., 2005; Tachizawa & Wong, 2015), in addition to enhancing quality (Pullman et al., 2009). Even though there are empirical evidence indicating that sustainability enhances organisational performance (Paulraj et al., 2017), there are some organisations that do not invest in sustainability because of uncertainty and high capital needed (Curkovic & Sroufe, 2007; Orsato, 2006). In other words, investing in sustainability decreases organisational performance (Golicic & Smith, 2013; Pagell et al., 2004; Paulraj et al., 2017), especially financial performance (Paulraj et al., 2017). However, sustainability can be used to achieve higher performance (Zhu et al., 2013) as it attracts new suppliers and enhances customer satisfaction (Kumar et al., 2012). Since there is contradicting evidence on how sustainability affects performance, it is important to test the nature of the relationship between them (Ni & Sun, 2019). Thus, it can be hypothesised that:

H12a: Environmental sustainability positively impacts operational performance.
H12b: Environmental sustainability positively impacts financial performance.
H13a: Economic sustainability positively impacts operational performance.
H13b: Economic sustainability positively impacts financial performance.
H14a: Social sustainability positively impacts operational performance.
H14b: Social sustainability positively impacts financial performance.

3.4 Conclusion

This chapter illustrated how the conceptual framework was developed from previous studies and theoretical lenses. In addition, it emphasised on operationalising the main concepts presented in the theoretical lenses. Finally, this chapter illustrated the relationships between the research constructs and presented the developed hypotheses (see table 3.1). This chapter contributed to

achieving the first objective as it constructed a conceptual framework to investigate the nature of the relationship among supply chain cluster design characteristics, absorptive capacity, resilience, sustainability and organisational performance. This conceptual framework will be used to test the relationships among the research constructs. In addition, it helps in structuring the overall research, developing of the hypotheses and guiding the testing of the research hypotheses through selecting the appropriate methodology. The appropriate research methodology and strategy will help in ensuring the contribution to the body of knowledge through achieving the research aim and objectives (Grix, 2001).

To achieve the main aim of the research, main themes were formulated using theoretical lenses (networks and connectedness, dynamic capabilities, sustainability and performance outcomes). These main themes will help in selecting the research constructs (supporting services, geographical concentration, networked collaboration, resilience, absorptive capacity, economic sustainability, social sustainability, environmental sustainability, operational performance and financial performance) and their measurements using previous studies, which will help in developing the research questionnaire. The data collected from the questionnaire will be analysed to investigate the relationship among the research constructs and generalise the findings. More details on research philosophy, approaches, strategies and data analysis techniques will be discussed in the next chapter.

Table 3.1 Summary of research hypotheses

Hypothesis	Description
H1a	Geographical concentration positively impacts organisational resilience.
H1b	Geographical concentration positively impacts organisational absorptive capacity.
H2a	Networked collaboration positively impacts organisational resilience.
H2b	Networked collaboration positively impacts organisational absorptive capacity.
H3a	Supporting service positively impacts organisational resilience.
H3b	Supporting service positively impacts organisational absorptive capacity.

H4a	Resilience positively impacts environmental sustainability.
H4b	Resilience positively impacts economic sustainability..
H4c	Resilience positively impacts social sustainability.
H5a	Absorptive capacity positively impacts environmental sustainability.
H5b	Absorptive capacity positively impacts economic sustainability..
H5c	Absorptive capacity positively impacts social sustainability.
H6a	Geographical concentration affects environmental sustainability through resilience.
H6b	Geographical concentration affects economic sustainability through resilience.
H6c	Geographical concentration affects social sustainability through resilience.
H7a	Networked collaboration affects environmental sustainability through resilience.
H7b	Networked collaboration affects economic sustainability through resilience.
H7c	Networked collaboration affects social sustainability through resilience.
H8a	Supporting services affects environmental sustainability through resilience.
H8b	Supporting services affects economic sustainability through resilience.
H8c	Supporting services affects social sustainability through resilience.
H9a	Geographical concentration affects environmental sustainability through absorptive capacity.
H9b	Geographical concentration affects economic sustainability through absorptive capacity.
H9c	Geographical concentration affects social sustainability through absorptive capacity.
H10a	Networked collaboration affects environmental sustainability through absorptive capacity.
H10b	Networked collaboration affects economic sustainability through absorptive capacity.
H10c	Networked collaboration affects social sustainability through absorptive capacity.
H11a	Supporting services affects environmental sustainability through absorptive capacity.
H11b	Supporting services affects economic sustainability through absorptive capacity.
H11c	Supporting services affects social sustainability through absorptive capacity.
H12a	Environmental sustainability positively impacts operational performance.
H12b	Environmental sustainability positively impacts financial performance.
H13a	Economic sustainability positively impacts operational performance.
H13b	Economic sustainability positively impacts financial performance.
H14a	Social sustainability positively impacts operational performance.
H13b	Social sustainability positively impacts financial performance.

CHAPTER FOUR – RESEARCH METHODOLOGY

4.1 Introduction

Research methods help in answering research questions and achieving the research aim and objectives; in addition, they establish a guidance to carry out the research (Creswell & Creswell, 2018). Research approaches help in designing the research to be conducted (Saunders et al., 2016). In addition, they help in reaching a conclusion and an interpretation through comprehensive analysis of the data collected (Creswell & Creswell, 2018). This research will follow the positivist paradigm; moreover, quantitative strategies under the deductive research approach will be adapted.

The remainder of this chapter will present different research philosophies, research approaches and research strategies, upon which the research methodology for this research will be based. In addition, it will present the research constructs and the data analysis techniques to test the proposed developed hypotheses.

4.2 Research Philosophy

The research philosophy affects the process of the research as it helps in choosing the most suitable research design; in addition, it helps in selecting methods for collecting data; furthermore, it helps the researcher choose appropriate techniques to interpret data (Easterby-Smith et al., 2015; Saunders et al., 2016). Finally, research philosophy plays an important role in the adaptation of the research design to constraints that might appear through appropriate adjustments (Easterby-Smith et al., 2015). The research philosophy is encompassed by ontological, epistemological and axiological beliefs (Abidin & Afroze, 2018; Saunders et al., 2016; Wilson, 2014).

Epistemology is the theory of knowledge (Bell et al., 2018); it is knowledge that is considered to be valid and acceptable in a specific field of study (Bell et al., 2018; Saunders et al., 2016). Epistemology is concerned with how a researcher can obtain knowledge about reality (Sekaran & Bougie, 2016). The epistemological position that follows the principles and guidelines of natural science is associated with the positivist philosophical stance; however, the epistemological position that believes that social aspects are complex and need a more in-depth approach to understand how individual interpretations affect their view of the world is associated with the interpretivist philosophical stance (Bell et al., 2018; Saunders et al., 2016; Wilson, 2014). The positivism philosophy assumes that observations of reality are the only way to collect valid knowledge and general law, and the theory can be developed and generalised, which can explain the cause and effect between two or more variables (Eriksson & Kovalainen, 2015). Positivism seeks to determine the variables that influence a specific outcome (cause and effect). In order to reach a conclusion, measurable data are collected through observation, and analysed by appropriate techniques (Creswell & Creswell, 2018). Positivism philosophy depends only on observable phenomena when collecting data; these data are used to test a hypothesis derived from established theories and previous studies; the findings will develop the theory, and future research can further develop and test the theory (Saunders et al., 2016). In other words, in positivism, the researcher develops a hypothesis/assumption and collects data to accept or reject it or develop many hypotheses/assumptions and collects data to accept one of them; this philosophy is more associated with quantitative data collection using methodologies such as surveys (Easterby-Smith et al., 2015).

In interpretivist philosophical view, individuals have different meanings and interpretations to the world according to their experiences, memories and expectations (Creswell & Creswell, 2018). The researcher's role is to understand the world from the point of view of individuals; although these interpretations are not generalisable and highly contextual (Saunders et al., 2016), the researcher's job is to determine how these different interpretations are established (Easterby-Smith et al., 2015). This means that qualitative data collection using methodologies such as case study is more likely to be used in interpretivism philosophy (Eriksson & Kovalainen, 2015). In general, according to their nature, positivism is associated more with deductive approach, and interpretivism is related more to inductive approach (Saunders et al., 2016)..

Ontology is concerned with how researchers understand social reality and the perception of what the world is (Wilson, 2014). In other words, it focuses on how reality is perceived (Blaikie, 2010; Wilson, 2014) and the assumptions formulated by the researcher regarding the nature of reality (Easterby-Smith et al., 2015). In the ontological belief, social phenomena are either external of social factors or created by actions and perceptions of social factors (Saunders et al., 2016; Wilson, 2014). The objective view considers organisations as entities that contain procedures and structures that individuals inside these organisations follow (Kuhn, 1970; Saunders et al., 2016). This view is related to realism, which argues that natural science principles are the best way to develop knowledge (Bell et al., 2018; Bryman, 2012; Saunders et al., 2016; Thomas, 2004) and that reality exists independent of individuals' knowledge (Bell et al., 2018; Bryman, 2012; Easterby-Smith et al., 2015; Saunders et al., 2016; Thomas, 2004). These procedures and structures or organisations' reality exists externally from individuals inside them (Bell et al., 2018; Saunders et al., 2016). On the other hand, the subjective ontological view gives more weight to individual interpretation on

organisations' reality (Denzin & Lincoln, 2005; Kuhn, 1970; Saunders et al., 2016; Wilson, 2014) as this reality is not pre-given and social actors play a role in creating it (Bell et al., 2018; Benton & Craib, 2001; Saunders et al., 2016; Wilson, 2014). This subjective view is known as subjective ontology (Denzin & Lincoln, 2005) or relative realism (Howell, 2012), which is related to constructivism (Creswell & Creswell, 2018), where it assumes the existence of multiple realities (Denzin & Lincoln, 2005; Howell, 2012).

Saunders et al. (2016) argues that there are two main forms of realism: direct realism and critical realism. The former argues that individual senses can accurately paint reality while the latter argues that human senses must be followed by mental processes to interpret what these senses portray about the world. In other words, although reality is independent of individuals' beliefs, it cannot be understood without interpretations (Thomas, 2004) that give meaning to this reality (Saunders et al., 2016; Thomas, 2004). Critical realism is considered the more appropriate in business and management research (Saunders et al., 2016).

Axiology is mainly concerned with ethics and values (Benton & Craib, 2001) and how values guide the researcher's actions (Heron, 1996). It focuses on the nature of value (Wilson, 2014) and how the researcher's values and perception play a role in the research (Saunders et al., 2016; Wilson, 2014). In axiological belief, the researcher can conduct the research in a value-free way independent of the research process (positivists) or undertake the research while being part of the research itself through making judgment regarding the social world (Saunders et al., 2016; Wilson, 2014).

If the researcher believes that reality is independent of social actors and the only way to create knowledge is through following principles of social science, it is likely that the researcher is

adapting the epistemological positivist approach combined with objective ontological perspective and a value-free way axiological belief, where data are collected objectively (Saunders et al., 2016; Wilson, 2014). Under this philosophical stance, a quantitative research strategy under deductive approach will be used (Easterby-Smith et al., 2015; Saunders et al., 2016; Wilson, 2014). On the other hand, if the researcher believes that reality is affected by social actors and an in-depth investigation is needed to understand how these social actors affect individuals' view of the world, it is likely that the researcher will follow epistemological interpretivist approach combined with the subjective ontological belief and the biased axiological belief where the researcher is part of what is being researched (Saunders et al., 2016; Wilson, 2014). Under this philosophical stance, a qualitative research strategy under inductive approach will be used (Bryman, 2012; Saunders et al., 2016; Wilson, 2014).

Saunders et al. (2016) argued that there are four types of research philosophies, namely positivism, realism, interpretivism and pragmatism. Positivism and interpretivism are the most common in management and business research (Easterby-Smith et al., 2015; Wilson, 2014). However, if the researcher believes that the research undergoing is not aligned with a particular philosophical position, then a pragmatic view is likely to be adapted (Saunders et al., 2016; Wilson, 2014). In a pragmatic view, the main focus is on the research problem and questions (Wilson, 2014), which allows the researcher to use a combination of methods to reach the research objectives (Johnson & Onwuegbuzie, 2004) and significantly generate deep understanding on the topic under investigation (Wilson, 2014). In this view, the researcher uses both quantitative and qualitative research strategies by mixing deductive and inductive approaches (Creswell & Clark, 2007), as it combines both objective and subjective views (Wilson, 2014).

In order to achieve the main aim of this thesis, measurements for the research variables will be identified from previous studies (see tables 4.2, 4.3, 4.4 and 4.5). The focus here is to prove statistically the significance of the relationships between the research constructs. This can be achieved through the use of a questionnaire in which the positivist view will be maintained and the objective stance will be adapted so that the researcher will not influence the respondents and will be independent of the data collection and analysis (value free).

4.3 Research Approach

Deductive and inductive approaches are the two main research approaches and are considered to be important parts in any research; induction is more appropriate when the researcher is trying to establish a theory while deduction is used when a theory needs to be tested (Sekaran & Bougie, 2016; Wilson, 2014). Deduction tries to explain the cause and effect between two or more variables, which requires observations and quantitative data collection (Sekaran & Bougie, 2016); however, the researcher must maintain objectivity when collecting data (Wilson, 2014). On the other hand, the inductive approach starts with observed data regarding a specific case and generates conclusions based on these observations (Sekaran & Bougie, 2016). It is more likely to collect qualitative data to illuminate different views of the situation (Wilson, 2014) and interpret these data to make sense of a specific situation in order to formulate a theory (Saunders et al., 2016).

One of the main differences between the deductive and the inductive approaches is that the deductive approach is more associated with quantitative studies with generalisable conclusions while the inductive approach operates using qualitative studies with less concern for generalisability (Creswell & Creswell, 2018; Saunders et al., 2016). Some studies use deductive

and inductive approaches in their methodology; this combination of the two approaches might be beneficial (Saunders et al., 2016).

This research follows the positivism philosophy as it focuses on investigating the impact of supply chain cluster design characteristics on sustainability through resilience and absorptive capacity, in addition to the nature of the relationship between sustainability and organisational, financial and operational performance. Furthermore, it aims to generalise the developed framework established through a combination of theoretical views. To achieve this, clear and measurable hypotheses must be developed (see chapter 3), followed by the research strategy, methods and data collection that will help in testing these hypotheses. This also rationalizes the use of the deductive approach, since it is based on generating hypotheses form existing theory, establishing measures, collecting data and analysing them and finally testing the theory through interpretation of the results (Sekaran & Bougie, 2016). The research plan that will help achieve the research aim is presented in figure 4.1, which is also known as research design (Jayawickrama, 2015; Jones et al., 2006). Generating the conceptual framework and hypotheses form existing theories will be established in the first four boxes. Validation of the measures and the framework will be carried out during the pretest and the pilot study. Finally, testing and developing the theory can be achieved after data collection and analysis.

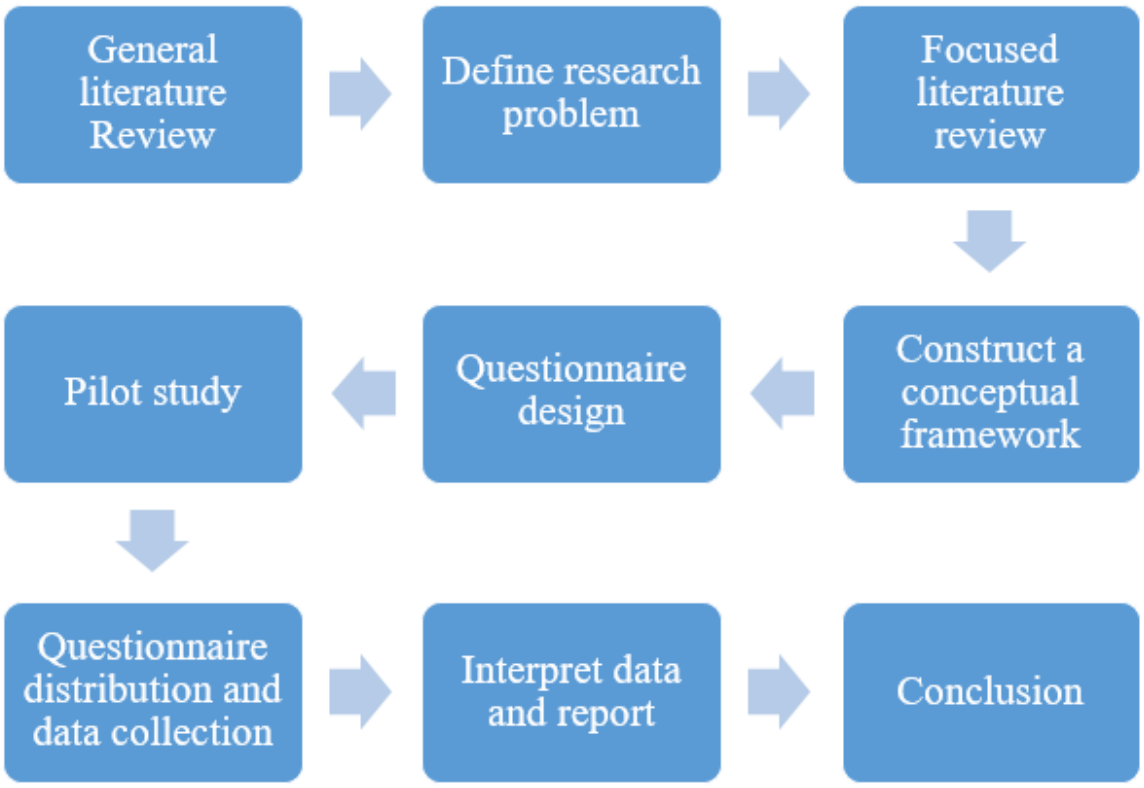

Figure 4.1 Research plan

4.4 Research Strategy

There are two strategies in business research, quantitative and qualitative, which focus on numeric and non-numeric data, respectively (Saunders et al., 2016). In quantitative research, the aim is to examine the relationship between two or more variables; numerical data are collected to reflect these measurable variables and the relationship is explained and/or investigated by using statistical methods to analyse these data; the findings must be generalisable and replicable. On the other hand, qualitative research is more concerned with social and/or human problems; it explores these problems by collecting data from the participants' environments and interpreting these data by focusing on the individuals' interpretations to their own environment (Creswell & Creswell, 2018).

The qualitative strategy provides an in-depth understanding and focuses on more details than does the quantitative strategy. This makes the qualitative strategy more appropriate when investigating a specific topic or idea as it tries to answer questions of how and why types (Yin, 2009). The qualitative methods' results are less generalisable than those of the quantitative strategy as they focuse on exploring perceptions of participants in details (Liouka, 2007). On the other hand, the quantitative strategy is more concerned with what question type as it aims to study facts and to investigate the relationships between these facts (Yin, 2009). The quantitative strategy tries to simplify facts, and the results obtained can be generalised as results are collected on a large scale, which makes it more appropriate when carrying out a research on a broad scale (Liouka, 2007). When the researcher uses both strategies (quantitative and qualitative), it means that the research is applying a mixed-method approach and is using data collection tools and analysis methods from both strategies. This can be done by using one after the other or using both at the same time (Saunders et al., 2016). However, in a mixed-method approach, the main research approach will be regulated by the dominating strategy. Any research that includes both strategies can combine both inductive and deductive processes (Creswell & Creswell, 2018). Since this research focuses on investigating the statistical significance of the relationships between the research constructs, it will adopt the deductive process to test the developed hypotheses, using quantitative data collection tools and analysis (Creswell & Creswell, 2018). This will also help in testing (Eriksson & Kovalainen, 2015; Sekaran & Bougie, 2016), developing and generalising the theories (Eriksson & Kovalainen, 2015) used to develop the hypotheses (Sekaran & Bougie, 2016).

4.5 Research Methods

This section will discuss the quantitative data analysis and collection methods adapted, and how the instruments will help in achieving the research aim and objectives. The data collection method will be a survey questionnaire. The literature review and theoretical lenses provided definitions and conceptual links presented in the conceptual framework; in addition, the conceptual framework helped in selecting the appropriate construct and its formative variables for the questionnaire.

A survey questionnaire will be used to test the developed hypotheses (Ponomarov, 2012), as it allows two or more variables to be measured; in addition, it helps in exploring the nature of the relationship among them (Easterby-Smith et al., 2015). It also helps in reaching a large number of participants quickly and with low cost (Otieno, 2010). The questionnaire will be self-administered, allowing participants to complete the questionnaire, and then the questionnaire is collected by the researcher (Abidin & Afroze, 2018; Saunders et al., 2016).

The questionnaire will be divided into three main sections. The first one will focus on general information regarding the position of the participant in his or her organisation, size of the organisation, its type and location. The second will focus on supply chain cluster design characteristics. The third will focus on resilience, absorptive capacity, sustainability and operational and financial performance (see appendix A). The second and the third parts will be a 7-point Likert scale (1 strongly agree and 7 strongly disagree).

The questionnaire is originally written is English, but it will be translated into Arabic, and translated back again to English (Gaber, 2017; Huo et al., 2019; Miemczyk & Luzzini, 2019;

Yubing & Baofeng, 2018; Zhang et al., 2019). This back translation approach will ensure that there are no semantic differences between the English and Arabic versions and ensure the quality of the measuring instrument (Huo et al., 2019). This translation process will be done by the help of academics with knowledge of both languages (Huo et al., 2019).

The quantitative data collected from the questionnaire will be analysed using the Structural Equation Model (SEM). SEM helps in validating the structure and constructs of the developed framework, in addition to testing the developed hypotheses (Chowdhury & Quaddus, 2016; Ponomarov, 2012; Wallenburg & Weber, 2005). The choice of SEM in this research was based on the fact that it allows for complex structure modelling, including mediating variables (Ponomarov, 2012). In addition, it is used to develop and test theories in disciplines, such as supply chain management, logistics and other related areas (Ponomarov, 2012; Wallenburg & Weber, 2005). SEM can help in measuring theoretical constructs or abstract concepts (Gimenez et al., 2005; Ponomarov, 2012) that are latent variables (Babin et al., 2008; Wallenburg & Weber, 2005). Latent variables are considered to be abstract concepts that need a set of indicators or measures as they are not directly measurable (Gimenez et al., 2005; Wallenburg & Weber, 2005). SEM can measure the relationship among latent variables (Babin et al., 2008) as well as how measurements represent their constructs (Wallenburg & Weber, 2005). SEM can also help in validating the model by separating errors such as specification errors from measurement errors (Gimenez et al., 2005; Ponomarov, 2012). In addition, it measures the correlation and causal effect between the variables and tests all developed hypotheses simultaneously, while separating the direct from the indirect effect of the independent variables on the dependent variable (Wallenburg & Weber, 2005).

SEM can be carried out using two approaches: covariance-based (CB-SEM) and partial least square-based (PLS-SEM) (Chowdhury & Quaddus, 2016; Wallenburg & Weber, 2005). PLS-SEM is more appropriate to deal with reflective and formative measures, while covariance-based SEM is limited to the use of formative measures (Wallenburg & Weber, 2005). In addition, PLS-SEM can deal with high factor correlation (Wetzels et al., 2009). Furthermore, unlike CB-SEM, PLE-SEM does not require a large sample size or data distribution prerequisites (Wallenburg & Weber, 2005). Finally, model quality and fitting in PLS-SEM is based on coefficient of determination (R^2) or the ability of model predictability (Hair et al., 2014c; Hair et al., 2019; Ringle et al., 2020; Sarstedt et al., 2014). In contrast with CB-SEM, goodness fit is not a key feature in PLS-SEM as it does not have a standard goodness fit statistics (Hair et al., 2011; Hair et al., 2019; Henseler & Sarstedt, 2013). In addition, goodness fit statistics for PLS-SEM is not sufficiently developed (Hair et al., 2019). In general, PLS-SEM is more appropriate when the research model is complex (Chin et al., 2003; Chowdhury & Quaddus, 2016; Hair et al., 2014c; Peng & Lai, 2012; Roberts et al., 2010; Sarstedt et al., 2014), with multiple mediators (Chin et al., 2003; Chowdhury & Quaddus, 2016; Gaber, 2017; Hair et al., 2014c; Nadeesha et al., 2019; Nitzl, 2016), contains formative variables, data is not normal (Hair et al., 2014a; Peng & Lai, 2012; Roberts et al., 2010), and sample size is small (Hair et al., 2014a; Wallenburg & Weber, 2005). Since the research model is complex and has multiple mediation variables, it is appropriate to use PLSSEM (Chowdhury & Quaddus, 2016; Hair et al., 2014c; Peng & Lai, 2012; Roberts et al., 2010; Sarstedt et al., 2014). Figure 4.2 summaries the research methods used.

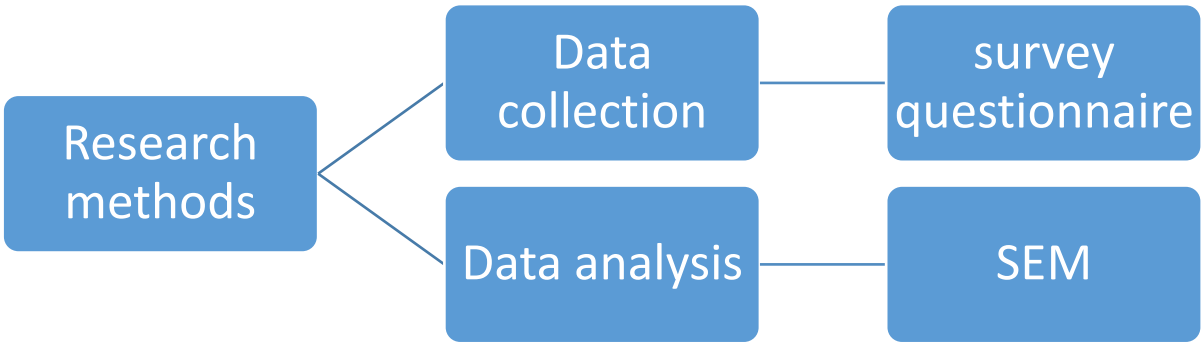

Figure 4.2 Research methods adopted

4.6 Sampling and procedures

Non-probability sampling techniques (self-selecting sampling and snowball sampling) will be adopted in this research for both pilot testing and main study. Even though that these techniques were criticised as being biased and subjective, they were used in this research as there is no sampling frame available (no availability of organisations databases operating in Egypt) (Saunders et al., 2016). In non-probability sampling, the sample size tends to be dependent on the research objectives and their focus (Patton, 2005). Non-random sampling tends to select specific participants that would help in collecting in-depth information to answer the research questions (Miles & Huberman, 1994; Saunders et al., 2016), unlike random sampling techniques that focuse on randomly selecting participants from the identified population (Miles & Huberman, 1994).

The sampling techniques that will be used in this study are self-selecting sampling and snowball sampling, following similar studies, e.g. (Frei et al., 2019; Tipu et al., 2019). In self-selecting sampling, participants for the questionnaire declare their willingness to join the research (Bradley, 1999; Saunders et al., 2016). Participants declare their desire to be part of the research because they are interested in the research objectives and/or questions (Saunders et al., 2016). This means that they will be willing to devote time to contribute in achieving the research aim (Saunders et

al., 2016; Thornhill et al., 1997). The publication of participants needed in both phases will be through intermediary channels, such as chambers of commerce, alumni association and emails to colleagues and personal contact, in addition to personally asking participants in business related events and conferences to be a part of this research. The snowball sampling will allow for data collection from individuals who could not be reached through publicizing. Participants who declared their desire to join the research will be asked to identify other participants who could be willing to contribute through providing adequate information (Fossey et al., 2002; Saunders et al., 2016).

4.6.1 Target Population

For the pilot testing and main study, participants will be individuals in senior management positions with more than 10 years of experience, following similar studies, e.g. (Bhupendra and Sangle (2015); Mandal (2015); Wang et al. (2015b); Mathivathanan et al. (2017); Abidin and Afroze (2018)). The selection of senior management positions, such as vice presidents, directors and general managers (Bag, 2019; Cheng & Lu, 2017; Dubey et al., 2018; Maryam & Soroosh, 2018; Um, 2017) is based on the knowledge they have for the whole organisation (Bag, 2019; Liu et al., 2018), in addition to their ability to provide reliable information (Maryam & Soroosh, 2018). Senior managers are responsible for achieving the organisations' goals and ensuring the efficient use of resources (financial, non-financial and human resources) (Augier & Teece, 2009; Bangchokdee & Mia, 2016; Carmeli & Halevi, 2009; Colwell & Joshi, 2013; Liu et al., 2018; Ponomarov, 2012). In addition, they are responsible for evaluating subordinates and the overall organisational performance (Bangchokdee & Mia, 2016; Colwell & Joshi, 2013; Liu et al., 2018; Ponomarov, 2012). Finally, they ensure the achievement of the organisations' goals in a dynamic

business environment (Augier & Teece, 2009; Carmeli & Halevi, 2009). Regarding pretesting, participants will have the same characteristics; however, years of experience will be at least 20 years (Abidin & Afroze, 2018).

4.6.2 Sample size

For SEM, a sample size greater than 100 and less than 200 observations is considered to be the optimal sample size (Gimenez et al., 2005). Other authors asserted that a rule of thumb indicates a minimum of 5 or 10 observations per measurement (Nicolaou & Masoner, 2013). However, 10 observations per measurement increase the accuracy of the results (Kline, 2011). Kline (2011) added in general a minimum of 200 observations are recommended for SEM. It is also appropriate to examine sample sizes in similar studies (see table 4.1) to help determine the sample size of a new research study (Gaber, 2017; Zhou et al., 2018).

Applying the rule of 5, the sample size for this research will be 250, and if the rule of 10 is applied, the sample will be 500. A sample of 250 exceeds the average number of observations used in previous research studies. According to the above discussion, the sample size of 250 (5 * 50 measurement) will be targeted for the pilot study and 500 (10 * 50 measurement) for the main study.

Table 4.1 Sample size of previous studies

Author	Sample size
Nadeesha et al. (2019)	89
Albort-Morant et al. (2018)	112
Hourneaux Jr et al. (2018)	149
Maryam and Soroosh (2018)	151
Aliasghar et al. (2018)	171
Brusset and Teller (2017)	171
Chowdhury and Quaddus (2016)	172
Mandal (2017)	207
Hong et al. (2018)	209

Zhou et al. (2018)	222
Tipu et al. (2019)	259
Liu et al. (2018)	278
Miemczyk and Luzzini (2019)	305
Riikkinen et al. (2017)	305
Um (2017)	363
Ponomarov (2012)	451
Alghamdi (2018)	506

4.6.3 Time horizons

This study adopts a single cross-sectional time horizon that enables data to be collected from many participants at a single time point in order to test the hypotheses developed in section 3.3 (Bryman, 2012). The data will be collected for the pilot study; once the targeted sample size is reached, the data will be analysed. Based on the results of the pilot study, modifications will be applied if necessary, and then the questionnaire will be administered for the main study to test the hypotheses developed.

4.7 Research constructs

This section illustrates the review of literature regarding the measurements of the research constructs that support the adapted scales to make sure that these measurements/ scales are actually related to their constructs (Abidin & Afroze, 2018; Chowdhury et al., 2019b; Huo et al., 2014). To further ensure the validity and reliability of the adapted and translated measurements/ scales, a rigorous translation process will be carried out to ensure accuracy (Gaber, 2017; Huo et al., 2019). In addition, a thorough process in the pretest and pilot study will be carried out to ensure face and content validity (Abidin & Afroze, 2018; Haynes et al., 1995; Lawshe, 1975; Polit et al., 2007; Tipu et al., 2019) and add any missing scales if needed based on experts' opinions (Abidin & Afroze, 2018) so that it can be more appropriate to be applied in the Egyptian business

environment. Furthermore, these measurements/ scales will be tested through a detailed statistical techniques which will be used to ensure convergent validity, discriminant validity (Tipu et al., 2019; Zhang et al., 2019) and reliability (Mandal et al., 2016; Tipu et al., 2019). More detailed information will be presented in sections 4.8, 4.9 and 4.10.

In general, the scale for geographical concentration was mainly adapted from (Lei & Huang, 2014). Networked collaboration scale was adapted from (Belso-Martinez et al., 2018; Boehe, 2007; Lei & Huang, 2014; Wang et al., 2018) and scales for supporting service were adapted from (Li & Atuahene-Gima, 2001; Shu et al., 2019). Regarding dynamic capabilities, resilience scales were adapted from (Brusset & Teller, 2017; Golgeci & Ponomarov, 2013; Ponomarov, 2012) and the scales for absorptive capacity were adapted from (Albort-Morant et al., 2018; Aliasghar et al., 2018; Elbaz et al., 2018). As for sustainability, environmental sustainability was adapted from (Chen et al., 2019; Diane & Abby, 2009; Hourneaux Jr et al., 2018; Vachon & Mao, 2008; Zhu et al., 2005), economic sustainability from (Chen et al., 2019; Zhu et al., 2005; Zhu et al., 2008b) and social sustainability from (Abdul-Rashid et al., 2017; Chen et al., 2019; Hourneaux Jr et al., 2018). Finally, scales for operational performance were adapted from (Flynn et al., 2010; Huo et al., 2014) and financial performance scales were adapted from (Al-Shboul, 2017; Flynn et al., 2010; Huo et al., 2014). More details regarding constructs' measurements/ scales and their supported literature are discussed below.

4.7.1 Supply chain cluster characteristics measurements

Organisations can be geographically concentrated if they are operating within or around a city, especially if they are located in an industrial zone/ district (Huang & Xue, 2012; Kayvanfar et al., 2018; Shi & Ganne, 2009; Tao & Todeva, 2006). Entities operating within close proximity to each

other within or around a city are considered to be geographically concentrated (Huang & Xue, 2012; Kayvanfar et al., 2018; Shi & Ganne, 2009; Tao & Todeva, 2006). In other words, organisations operating in an industrial zone or a city that governs industrial zones are geographically concentrated (Ali, 2012; Huang & Xue, 2012; Kayvanfar et al., 2018; Shi & Ganne, 2009; Tao & Todeva, 2006). Since being a geographically concentrated area is not enough (Han, 2009), industrial zones must have collaboration among their members to be considered supply chain clusters (Kayvanfar et al., 2018; Shi & Ganne, 2009; Tao & Todeva, 2006). Organisations should form a networked collaboration that focuses on building a network among organisations located inside a supply chain cluster, whether these organisations belong to single or different supply chains (Belso-Martinez et al., 2018; He, 2016; Huang & Xue, 2012; Tolossa et al., 2013; Wang et al., 2018; Wang & Xiao, 2016). This form of collaboration can benefit organisations through pooling production capacities and sharing resources, information and services (Dayasindhu, 2002; Xue et al., 2012a; Xue et al., 2012b).

Supply chain clusters include supporting services, which are represented in the government and its agencies, chamber of commerce, trade/ industry associations and research institutes and universities; these are considered to be the most important supporting entities (Ai & Wu, 2016; Han, 2009; Huang & Xue, 2012; Østergaard & Park, 2013; Patti, 2006; Porter, 1998; Sheng et al., 2011; Tolossa et al., 2013; Wang et al., 2018). Table 4.2 illustrates supply chain cluster design characteristics' measurements.

Table 4.2 Geographical concentration, networked collaboration and supporting services measurements

Research variables	Measurements and supporting literature	
Perceived geographical concentration	GC1	Supply chain partners (Boschma, 2005; Lei & Huang, 2014; Presutti et al., 2017; Rallet & Torre, 1999).
	GC2	Local research institutes and universities (Boschma, 2005; Lei & Huang, 2014; Presutti et al., 2017; Rallet & Torre, 1999).
	GC3	Competitors (Boschma, 2005; Lei & Huang, 2014; Presutti et al., 2017; Rallet & Torre, 1999).
	GC4	Local industry associations (Boschma, 2005; Lei & Huang, 2014; Presutti et al., 2017; Rallet & Torre, 1999).
Perceived networked collaboration (network within the same city or any industrial zones/ districts under its governance)	NC1	Supply chain partners (Belso-Martinez et al., 2018; Boehe, 2007; Lei & Huang, 2014; Wang et al., 2018).
	NC2	Local research institutes and universities (Ai & Wu, 2016; Belso-Martinez et al., 2018; Boehe, 2007; Lei & Huang, 2014; Wang et al., 2018).
	NC3	Competitors (Ai & Wu, 2016; Belso-Martinez et al., 2018; Knoben, 2009; Lei & Huang, 2014; Nyuur et al., 2018; Wang et al., 2018).
	NC4	Local industry associations (Ai & Wu, 2016; Lei & Huang, 2014; Sobrero & Roberts, 2001; Wang et al., 2018).
Perceived supporting services	SS1	Governmental bodies (Li & Atuahene-Gima, 2001; Shu et al., 2019).
	SS2	Trade associations (Ai & Wu, 2016; Li & Atuahene-Gima, 2001; Shu et al., 2019).
	SS3	Educational or research institutions (Ai & Wu, 2016; Li & Atuahene-Gima, 2001; Shu et al., 2019).

4.7.2 Dynamic capabilities measurements

Resilience focuses on how organisations can cope with changes in the market such as fluctuations in demand and supply by maintaining their productivity during disruptions and responding adequately and quickly to these unexpected shocks, in addition to having the ability to track changes in the market, evaluate and identify risks, forecast possible future changes and establish contingency plans to eliminate the shocks' negative impact. Finally, building resilience allows organisations to keep their vertical and horizontal ties and coordinate efforts during disruption to achieve a desirable outcome and avoid wastefulness of resources that might occur during the

disruptions (Chowdhury & Quaddus, 2016; Hohenstein et al., 2015; Pettit et al., 2013; Wieland, 2013; Wieland & Marcus Wallenburg, 2012).

Absorptive capacity is the process of accumulating and processing of knowledge and enhancing learning activities (Branzei & Vertinsky, 2006; Eisenhardt & Martin, 2000; Teece, 2007), in addition to sharing practical experience (Albort-Morant et al., 2018; Aliasghar et al., 2018; Delmas et al., 2011; Kohlbacher et al., 2013; Riikkinen et al., 2017; Shubham et al., 2018). It helps organisations learn and understand changes in the dynamic business environment (Albort-Morant et al., 2018; Chandrashekar & Mungila Hillemane, 2018; Supartha & Ratih, 2017; Tsai, 2012) as the acquired knowledge helps organisations recognize and understand shifts in the market (Albort-Morant et al., 2018; Aliasghar et al., 2018; Delmas et al., 2011; Kohlbacher et al., 2013; Riikkinen et al., 2017; Shubham et al., 2018). Table 4.3 illustrates dynamic capabilities' measurements.

Table 4.3 Resilience and absorptive capacity measurements

Research variables	Measurements	
Perceived resilience	RES1	Maintaining normal operation (Golgeci & Ponomarov, 2013; Ponomarov, 2012; Santanu, 2017).
	RES2	Responding to unexpected disruptions (Golgeci & Ponomarov, 2013; Mandal, 2017; Ponomarov, 2012).
	RES3	High level of preparation for disruptions (Golgeci & Ponomarov, 2013; Mandal, 2017; Ponomarov, 2012).
	RES4	Desired level of connectedness among business partners (Bag, 2019; Pettit et al., 2013; Ponomarov, 2012).
	RES5	Alternative plans (Brusset & Teller, 2017; Chowdhury & Quaddus, 2016).
	RES6	Evaluating the level of risk (Brusset & Teller, 2017; Dabhilkar et al., 2016; Eshetu et al., 2017).
Perceived absorptive capacity	AC1	Sharing knowledge and practical experience (Albort-Morant et al., 2018; Riikkinen et al., 2017; Shubham et al., 2018).
	AC2	Informal collection of information (Albort-Morant et al., 2018; Riikkinen et al., 2017; Shubham et al., 2018).

	AC3	Meetings with customers, consultants R&D institutions/ universities or third parties (Albort-Morant et al., 2018; Riikkinen et al., 2017; Shubham et al., 2018).
	AC4	Recognizing shifts in the market (Such as competition, regulation, demography) (Albort-Morant et al., 2018; Riikkinen et al., 2017; Shubham et al., 2018).
	AC5	New opportunities in the market (Albort-Morant et al., 2018; Riikkinen et al., 2017; Shubham et al., 2018).
	AC6	Recording and storing knowledge (Albort-Morant et al., 2018; Riikkinen et al., 2017; Shubham et al., 2018).
	AC7	Merge external knowledge to existing knowledge (Albort-Morant et al., 2018; Riikkinen et al., 2017; Shubham et al., 2018).
	AC8	Monitor new market trends and new product/service development (Albort-Morant et al., 2018; Riikkinen et al., 2017; Shubham et al., 2018).
	AC9	Performing activities easily (Albort-Morant et al., 2018; Riikkinen et al., 2017; Shubham et al., 2018).

4.7.3 Sustainability measurements

Economic sustainability focuses on efficient and effective use of resources, which means using the minimum amount of resources to achieve maximum output and using resources in the best way possible (Duflou et al., 2012). This can be achieved by decreasing the energy use cost (Zhu et al., 2008a) and preserving renewable resources (Tam, 2018) through conservation of energy use (Bodhanwala & Bodhanwala, 2018). Economic sustainability also focuses on decreasing the operational cost that is associated with saving resources and materials in short-term business operations (Azevedo et al., 2012; Lozano & Huisingh, 2011; Sajan et al., 2017; Sezen et al., 2012; Wang et al., 2015b; Zhu et al., 2008a) and the logistics cost that focuses on cost reduction in activities such as acquisition, collection, inspection, and transportation of products, inventory and materials (Agrawal et al., 2016; Azevedo et al., 2012; Tajbakhsh & Hassini, 2015). Maintaining a

low cost so that it does not exceed organisational revenue is essential for achieving long-term economic sustainability (Gotschol et al., 2014; Haugh & Talwar, 2010).

Environmental sustainability revolves around avoiding damage to the nature in the surrounding environment as resources in the ecosystem are scarce and should be preserved (Abidin & Pasquire, 2007; Wang et al., 2015b). In order to preserve the environment, organisations need to focus on practices, such as the use of recyclable components and materials, and measure their green emission footprint (Abidin & Pasquire, 2007; Liao et al., 2013; Zhao & Chen, 2011; Zhu et al., 2007). These practices will not only save the environment but also contribute to the organisational financial performance (Liao et al., 2013; Zhao & Chen, 2011; Zhu et al., 2007). Environmental sustainability can be achieved through focusing on waste management, emission, saving energy consumption, resources, switching to renewable energy and complying with environmental standards (Agrawal et al., 2016; Despeisse et al., 2012; Duflou et al., 2012; Hajmohammad et al., 2013; Hourneaux Jr et al., 2018; Wang et al., 2015b). The efficient use of resources in environmental sustainability context aims to secure the next generations' future (Wang et al., 2015b).

Social sustainability focuses on the responsibility of the organisation towards the community (improving relationships (Abdul-Rashid et al., 2017; Hutchins & Sutherland, 2008) and life quality of the community (Abdul-Rashid et al., 2017; Lozano & Huisingh, 2011) by promoting equality, social justice, customer safety and employees' benefits and stability (Workforce health and safety, (Agrawal et al., 2016; Akenji, 2014). Social sustainability revolves around effectively responding to society, workers and other stakeholders (improving relationships with all stakeholders (Abdul-Rashid et al., 2017; Hutchins & Sutherland, 2008)) needs (Abidin & Pasquire, 2007), in addition

to giving future generations a chance to have more access to social aspects, such as human rights, health and safety (Tam, 2018). Achieving social sustainability will prevent degradation to the society as well as improve social gains for organisations (Tsai et al., 2009) as it ensures quality of life improvements while giving proper attention to the environment (Yusuf et al., 2013). Table 4.4 illustrates sustainability measurements.

Table 4.4 Environmental, economic and social sustainability measurements

Research variables	Measurements	
Perceived environmental sustainability	Env1	Reduction of CO2 emissions (Abdul-Rashid et al., 2017; Ruiz-Benitez et al., 2019; Zhu et al., 2008a).
	Env2	Waste reduction (Abdul-Rashid et al., 2017; Ruiz-Benitez et al., 2019; Zhu et al., 2008a).
	Env3	Use of renewable energy (Chen et al., 2019; Kamali & Hewage, 2017; Vachon & Mao, 2008).
	Env4	Reduction of energy/ fuel consumption (Abdul-Rashid et al., 2017; Amrina & Vilsi, 2015; Kamali & Hewage, 2017; Ruiz-Benitez et al., 2019).
	Env5	Optimising use of materials (Abdul-Rashid et al., 2017; Hourneaux Jr et al., 2018; Zhu et al., 2005).
	Env6	Improved compliance with environmental standards (Abdul-Rashid et al., 2017; Diane & Abby, 2009; Hourneaux Jr et al., 2018).
Perceived economic sustainability	Eco1	Decrease of cost for energy consumption (Ruiz-Benitez et al., 2019; Zhu et al., 2005; Zhu et al., 2008a).
	Eco2	Operational cost (Kamali & Hewage, 2017; Ruiz-Benitez et al., 2019; Zhu et al., 2008a).
	Eco3	Total logistics cost (Chen et al., 2019; Ruiz-Benitez et al., 2019; Zhu et al., 2008a).
Perceived social sustainability	Soc1	Community complaints (improving relationships with community) (Abdul-Rashid et al., 2017; Hourneaux Jr et al., 2018; Kamali & Hewage, 2017).
	Soc2	Customer health and safety (Abdul-Rashid et al., 2017; Hourneaux Jr et al., 2018; Kamali & Hewage, 2017; Ruiz-Benitez et al., 2019).
	Soc3	Stakeholders' participation (improving relationships with all stakeholders to work as a team to enhance social aspects) (Abdul-Rashid et al., 2017; Kamali & Hewage, 2017; Vinodh, 2011).
	Soc4	Employment stability (fair labor practices and equality to remove pressure on employees) (Raj & Srivastava, 2018; Rajak & Vinodh, 2015; Ruiz-Benitez et al., 2019; Vachon & Mao, 2008).

	Soc5	Donations to community (improving living quality) (Abdul-Rashid et al., 2017; Agrawal et al., 2016; Kamali & Hewage, 2017).
	Soc6	Employee benefits (improving work environment and safety, decent working conditions, and reasonable wages) (Abdul-Rashid et al., 2017; Kamali & Hewage, 2017; Ruiz-Benitez et al., 2019).

4.7.4 Organisational performance measurements

Organisational performance is divided into operational performance and financial performance as the key performance measures (Ferreira & Otley, 2009). The division of performance into operational and financial will allow for more in-depth investigation regarding how different performance measures can be affected by different aspects of sustainability. The focus on these two performance measures is because they are considered to be key performance measures (Ferreira & Otley, 2009). In addition, they were empirically proven to vary among organisations that work inside and outside clusters (Liao, 2015). Furthermore, the enhancement of performance discussed in the theoretical lenses- systems theory, extended resources-based view and dynamic capabilities theory- was operationalised as organisational performance (operational and financial performance) (Fantazy et al., 2016; Kangkang et al., 2018; Liu et al., 2018; Mani et al., 2018; Miemczyk & Luzzini, 2019; Ni & Sun, 2019; Sheu, 2014). The focus of operational performance is on the quality enhancement efficiency, productivity and customer satisfaction (Gligor & Holcomb, 2014; Huo et al., 2014). As for financial performance, it focuses on market share, sales and return on investment (Huo et al., 2014; Li et al., 2017). Table 4.5 illustrates organisational performance measurements.

Table 4.5 Operational and financial performance measurements

Research variables	Measurements	
Perceived operational performance	OP1	Product modification to meet customer requirements (Flynn et al., 2010; Huo et al., 2014; Yu & Huo, 2019).
	OP2	Quickly introducing new products into the market (Flynn et al., 2010; Huo et al., 2014; Yu & Huo, 2019).
	OP3	High product quality growth (Huo et al., 2014; Yubing & Baofeng, 2018; Zhu et al., 2008a).
	OP4	High level of customer service (Flynn et al., 2010; Huo et al., 2014; Yubing & Baofeng, 2018).
	OP5	Short lead time for fulfilling customers' orders (Flynn et al., 2010; Huo et al., 2014; Yu & Huo, 2019).
	OP6	Fulfilling delivery commitments (Flynn et al., 2010; Huo et al., 2014; Yu & Huo, 2019).
Perceived financial performance	FP1	Growth in return on investment (Al-Shboul, 2017; Flynn et al., 2010; Huo et al., 2014).
	FP2	Sales growth (Al-Shboul, 2017; Flynn et al., 2010; Huo et al., 2014).
	FP3	Growth in market share (Al-Shboul, 2017; Flynn et al., 2010; Huo et al., 2014).

4.7.5 Control variables

Firm size and industry type will be control variables as they affect performance since larger companies generally own more resources, which eventually leads to a higher sustainability levels (Grimstad & Burgess, 2014; Mousavi et al., 2018). In addition, organisations in different industries have different levels of response towards building sustainability (Dangelico et al., 2013; Mousavi et al., 2018). Furthermore, size and industry affect the organisation's ability to process information and cope with a dynamic business environment (Liu et al., 2018; Shubham et al., 2018). These control variables are not the scope of the study; however, since they may influence the results, they are included as dummy variables (Liu et al., 2018; Mousavi et al., 2018; Shubham et al., 2018).

4.8 Pretest and pilot study

Pretesting will be carried out in this research to make sure that participants will not face any difficulties reading and understanding the questionnaire while completing it (Bryman, 2012; Gray, 2014), as the questionnaire is self-administered, and the researcher will not be available to clarify any raised questions (Bryman, 2012; Wilkins, 2013). The pretest will be carried out to ensure the face and content validity of the questionnaire (Hair et al., 2014a; Huo et al., 2019) while the pilot study will help in ensuring convergent and discriminant validity (Chowdhury et al., 2019b) and reliability (Wu & Law, 2019). The following subsections will illustrate the steps taken for the pretest and pilot study.

4.8.1 Validity

The combination of the comprehensive literature review and the pretest will help in achieving face and content validity of the questionnaire (Abidin & Afroze, 2018; Li et al., 2006). The measurements of the research variables were captured from the literature reviewed (see tables 4.2, 4.3, 4.4 and 4.5) to ensure content validity of the measurements (Abidin & Afroze, 2018; Cheng & Lu, 2017; Chowdhury et al., 2019b; Deshpande, 2018; Flynn et al., 2010; Golgeci & Ponomarov, 2013; Hong et al., 2018; Huo et al., 2014; Saunders et al., 2016; Scarpin & Brito, 2018; Tzempelikos & Kooli, 2018; Yubing & Baofeng, 2018). The adaptation of previously used measurements ensures the use of high quality measurements that were piloted and tested for their reliability and validity (Bryman, 2012; Cheng & Lu, 2017; Deshpande, 2018; Flynn et al., 2010; Golgeci & Ponomarov, 2013; Hong et al., 2018; Yubing & Baofeng, 2018).

In addition to identifying research constructs and their measurements from previous studies, the questionnaire will be presented to at least five to six experts, including practitioners and academics,

to assess its face validity (Bell, 2005; Hair et al., 2014a; Lawshe, 1975; Maryam & Soroosh, 2018; Nyuur et al., 2018; Sajan et al., 2017; Tipu et al., 2019) through ensuring the instruments' clarity, complexity and readability (Bell, 2005; Chowdhury & Quaddus, 2016; Nyuur et al., 2018; Ponomarov, 2012; Saunders et al., 2016; Scarpin & Brito, 2018; Tipu et al., 2019; Tzempelikos & Kooli, 2018). These experts will also be asked to evaluate the appropriateness of the operationalised items for each construct to further increase content validity (Bell, 2005; Dubey et al., 2018; Flynn et al., 2010; Huo et al., 2014; Zhu et al., 2008a) and add any missing items or remove inappropriate items (Abidin & Afroze, 2018). After completing the questionnaire, experts will be asked to answer questions regarding clarity and appropriateness of the content and purpose of the questionnaire, in addition to the relevance of the questions to their corresponding construct and the time taken to complete the questionnaire. Furthermore, they were asked to suggest any improvement or missing scales if needed. These questions are derived from relevant previous studies (Abidin & Afroze, 2018; Tipu et al., 2019). In addition to the qualitative method to ensure content validity, a quantitative method will also be used in the pretest to assess content validity of the questionnaire (Abidin & Afroze, 2018; Haynes et al., 1995) using item content validity index (I-CVI) and scale content validity index (S-CVI) (Polit et al., 2007). Content validity index is very useful to measure content validity of adapted scales by a panel of experts (Abidin & Afroze, 2018; Haynes et al., 1995; Lawshe, 1975; Polit et al., 2007). I-CVI involves determining the level of relevance of the scales (not relevant, somewhat relevant, quite relevant, highly relevant) under the construct, in addition to the overall construct content validity using the average of I-CVI (S-CVI) through presenting the questionnaire to a panel of experts (4 practitioners and 2 academics) (Polit et al., 2007). The cut-off point for S-CVI is equal or greater than 0.9 (Polit et al., 2007; Waltz et al., 2005) and equal or greater than 0.78 for I-CVI (Polit et al., 2007).

The questionnaire will be piloted to ensure convergent and discriminant validity (Chowdhury et al., 2019b; Tipu et al., 2019; Wang et al., 2015a; Zhang et al., 2019), using exploratory factor analysis (EFA) (Tipu et al., 2019; Wang et al., 2015a; Zhang et al., 2019). EFA will be carried out (Wang et al., 2018; Zhang et al., 2019) to help in determining the specific group of items that measures the same construct; in addition, when items are loaded under one construct, it means that they are recognizably different but correlated with each other, which will help in avoiding collinearity (Cudeck, 2000). Furthermore, it helps in validating the items that fit under the construct (Field, 2013; Tipu et al., 2019); it will also help in detecting and eliminating items that do not load properly under a construct (Pallant, 2011; Tipu et al., 2019). In order to achieve convergent validity, factor loadings must be greater than 0.4; any items with less than 0.4 will be eliminated (Hair et al., 2014a; Wu & Law, 2019). Additionally, Kaiser-Meyer-Olkin (KMO) and Bartlett's test is going to be carried out to make sure that the data are appropriate for factor analysis techniques (Williams et al., 2010). KMO test must have a value of greater than 0.5 (Supartha & Ratih, 2017; Urban & Naidoo, 2012), and Bartlett's test must have a significant value of less than or equal to 5 percent (Yong & Pearce, 2013).

4.8.2 Reliability

In order to ensure consistency and stability of the results and goodness of the measurement, reliability (Sekaran & Bougie, 2016) will be assessed in the pretest study using Cronbach’s alpha (Tipu et al., 2019; Zhou et al., 2018), were it must exceed 0.7 to ensure reliability (Mandal et al., 2016; Tipu et al., 2019; Wu et al., 2018; Wu & Law, 2019; Ye et al., 2019; Zhang et al., 2019). After conducting EFA and the reliability test, necessary adjustments will be made to the research

questionnaire through removing items with low alpha and factor loading, which will optimize the measurement model (Gaber, 2017).

After validating the questionnaire and the model, the questionnaire will be ready to be administered to test the research hypotheses (Nyuur et al., 2018; Tipu et al., 2019) through collecting standardised data after identifying the dependent and independent variables (Creswell & Creswell, 2018). A 7-point Likert scale will be used in this questionnaire (1- Strongly agree, 2- Agree, 3- Somewhat agree, 4- Neither agree nor disagree, 5- Somewhat disagree, 6- Disagree, 7- Strongly disagree) as it allows to explore the relationship among variables using regression and structural equation models (Weijters et al., 2010); in addition, it helps participants to give sufficient answers with ease and within a short time (Chyung et al., 2017). Furthermore, precision (Hair, 2015) and reliability (Cicchetti et al., 1985) increases as the number of scale increases (Cicchetti et al., 1985; Hair, 2015); however, there were no significant changes in reliability beyond 7-point Likert scale (Cicchetti et al., 1985). Finally, studies in similar fields used 7-point Likert scales (Gligor & Holcomb, 2014; Lei & Huang, 2014; Yubing & Baofeng, 2018).

4.9 Data analysis techniques

The first step in SEM is to focus on specifying inner model/ structural model and an outer model/ measurement model. The former deals with the relationships among constructs while the latter deals with constructs and their (measurements) indicator variables. The second step is to evaluate the outer and inner models (Hair et al., 2014c).

4.9.1 Model specification

The inner model is the relationships among the research variables' geographical concentration, networked collaboration, supporting services and resilience, absorptive capacity, sustainability, operational performance and financial performance. The outer model is the relationship between these constructs and their measurements.

4.9.2 Measurement model

In the measurement model, PLS structural equation modelling will be carried out, which includes factor analysis that ensures that the measurements in the questionnaire are captured under their construct (Hair et al., 2014a). In addition, it will help in assessing convergent and discriminant validity (Zhou et al., 2018) through average variance extracted, factor loadings (Hair et al., 2014c), square root of average variance extracted (Chowdhury & Quaddus, 2016) and Heterotrait-Monotrait ratio of correlations (Henseler et al., 2015) and reliability through calculating Cronbach's alpha and composite reliability (Tipu et al., 2019; Zhou et al., 2018). Table 4.6 illustrates statistical guidelines for the techniques used in the study.

Table 4.6 Statistical techniques

	Test type	Guidelines
1	Reliability (Mandal et al., 2016; Tipu et al., 2019; Wu et al., 2018; Wu & Law, 2019; Ye et al., 2019; Zhang et al., 2019)	Composite reliability (CR), Cronbach's alpha (CA) > 0.7
2	Convergent validity (Fornell & Larcker, 1981; Hair et al., 2014a; Hair et al., 2014c; Wu & Law, 2019)	Item's loading > 0.4
		Average variance extracted > 0.5
3	Discriminant validity (Fornell & Larcker, 1981; Henseler et al., 2015; Mandal et al., 2016; Tipu et al., 2019; Wu et al., 2018; Wu & Law, 2019; Ye et al., 2019; Zhang et al., 2019)	The square root of the AVE of a construct should be greater than the correlations between the construct and other constructs in the model
		Heterotrait-Monotrait ratio of correlations (HTMT) < 0.85

4	R^2 (Hair et al., 2014b; Hair et al., 2016; Hair et al., 2011)	0.75 substantial, 0.50 moderate and 0.25 weak.

4.9.3 Structural model

The most common measures for structural model evaluation are path coefficient and R^2 (Hair et al., 2011; Hourneaux Jr et al., 2018; Nitzl, 2016). Path coefficient and the corresponding t-values are used to test the developed hypotheses (Chowdhury & Quaddus, 2016; Hourneaux Jr et al., 2018; Wu et al., 2013). R^2 is used to assess the accuracy of predictability for the model (Hair et al., 2014b; Hair et al., 2016; Hair et al., 2011; Hourneaux Jr et al., 2018; Nitzl, 2016). The predictive accuracy of the model increases as R^2 increases (Hair et al., 2014b; Hair et al., 2016; Hair et al., 2011).

4.9.4 Mediation effect

In general, a mediation analysis is a process that investigates the impact of an independent variable on a dependent variable through a mediator (Collins et al., 1998; Preacher & Hayes, 2008). There are several methods to measure the mediation effect of the significance of the indirect impact: Baron and Kenny (1986) approach that involves measuring the impact of the independent variable on the dependent variable; second, evaluating the influence of the independent variable on the mediator; and third, investigating the impact of mediator on the dependent variable while controlling the independent variable. Finally, the effect of the independent variable on the dependent variables must decrease when predicting the dependent variable using both the independent and the mediator.

Another method is joint significance test, which includes testing the significance of the direct effect between the independent and the mediator and then the significance of the direct impact of the

mediator on the dependent variable. If these two paths are significant, it means that the independent variable is affecting the dependent variable through the mediator (MacKinnon et al., 2002; Taylor et al., 2008). Sobel (1982) also presented a method to test the mediation effect through dividing the indirect effect (which is equal to the direct effect of the independent on the mediator multiplied by the direct effect of the mediator in the dependent) by its standard error. Finally, the bootstrapping method was presented, which involves a resampling technique, where every bootstrap sample is generated using a resampling procedure until the number of cases is reached (Preacher et al., 2007). It generates a large number of equal-sized samples from the original sample, in which each sample may exclude or include duplicates from other samples. The relationship under investigation is estimated in each sample; in addition, it is used to generate confidence intervals and perform significant tests (Taylor et al., 2008).

Baron and Kenny's (1986) test was criticised as some scholars argue that a significant direct effect between the independent and the dependent variable is not a prerequisite to test a mediation effect (Collins et al., 1998; Shrout & Bolger, 2002; Zhao et al., 2010). In addition, it has a low statistical power compared with other methods (Fritz & MacKinnon, 2007). This method is not appropriate for this study as it contains multiple mediators, and this method is commonly used when the model contains a single mediator (Taylor et al., 2008). In addition, it is more precise to include all mediators and test them simultaneously than to test each mediator separately (Preacher & Hayes, 2008). Joint significance is easy to use with a moderate test statistical power (Fritz & MacKinnon, 2007; Taylor et al., 2008); however, it is difficult to estimate confidence intervals of the mediation effect (Taylor et al., 2008). (Sobel) test also has a moderate statistical power (Fritz & MacKinnon, 2007); however, it requires a larger sample size than other methods (Preacher & Hayes, 2008) and

assumes normality of the data (Preacher & Hayes, 2004). Regarding the bootstrapping technique, it has no normality distribution requirement and presents a good statistical power; it also allows multiple mediators to be tested simultaneously (Preacher & Hayes, 2008). In addition, bootstrapping and joint significance have a higher performance based on the assessment of statistical power and type I error (Taylor et al., 2008). Furthermore, bootstrapping is more superior than other methods such as (Sobel) when it comes to estimating indirect effects (Preacher & Hayes, 2004, 2008). In order to test the mediation role of dynamic capabilities in this study, joint significance along with bootstrapping technique will be used. Figure 4.3 shows research analysis steps.

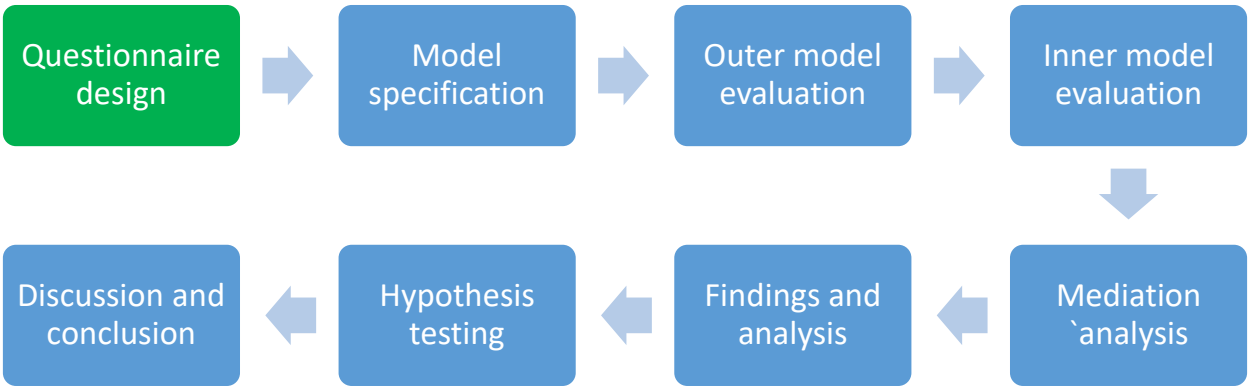

Figure 4.3 Research analysis steps

4.10 Ethical consideration

All stages in this research were carried out while taking careful consideration of all ethical issues. Before the data collection process, the questionnaire was presented to the ethics committee. A cover letter was added to make sure that participation is voluntary and to help participants understand the aim of the study, inform them that the data collected will be used for research purposes only and that their anonymity and confidentially will be ensured (see appendix B). A soft

copy of the collected data will be password protected and the hard copy data will be stored in locked filing cabinets to ensure their protection. In disposing of the data, the soft copy data will be deleted and overwritten. As for the hard copy data, shredders will be used to physically destroy files in accordance with the required standard code of ethics.

4.11 Summary

This chapter described the methodology used in this research in details and presented justification for the appropriateness of the selected philosophy and methods adopted to achieve the research aim and objectives. The deductive approach has been adopted under the positivist paradigm as the research developed a conceptual framework upon which the research hypotheses have been formulated. The chapter also presented the research questionnaire that will be used as a uniformity data collection technique that will help in testing the developed hypotheses. Pre-test and pilot study steps was illustrated, in addition, data analysis techniques and sample size for the pilot study and the main survey were discussed; furthermore, the chapter illustrates how the questionnaire is going to be distributed and collected. Finally, ethical issues were discussed to ensure careful consideration of all ethical issues. In the next chapter, data from the pilot study and main survey will be revealed and a full analysis of these data will be presented.

CHAPTER FIVE – FINDINGS AND ANALYSIS

5.1 Introduction

This chapter will present the findings of the data analysis based on the methods described in the previous chapter. First, the chapter presents the results of the pretest and the pilot study, then the sample characteristics of the main study, in addition to the descriptive statistics and normality test for all constructs. Second, the assessment of validity and reliability of the data will be illustrated. Third, the chapter tests the developed hypotheses through presenting the results of partial least square structural equation modelling. Finally, a summary of the chapter is provided.

5.2 Results of the pretest

After the questionnaire was developed using previous studies, the questionnaire was presented to nine experts (four academics and five practitioners) to ensure clarity, complexity, readability and appropriateness of the data collection instrument and to test its content and face validity. A semi-structured interview lasted for an average of 80 minutes with each expert. At the beginning, participants were asked to read and solve the questionnaire and then were asked to present their understanding regarding the main purpose of the questionnaire to make sure that the questionnaire is achieving what it intended to achieve. Furthermore, they were asked to answer questions regarding appropriateness and clarity of the questionnaire.

As mentioned earlier, the questionnaire was designed in English, and then professional translators translated it into Arabic. A back translation process was carried out from Arabic to English to ensure translation accuracy. In order to further ensure the quality of the measuring instrument, academics and practitioners who participated in the pretest were asked to compare the Arabic with

the English version. The translation was accurate; however, minimal changes were recommended in the Arabic version for ease of understanding. Based on the feedback of the experts, the items of the questionnaire were ensured that they are actually measuring what they were supposed to measure. Additionally, experts' feedback helps in ensuring that the operationalised items are related to the aim of the research and their appropriateness for each construct. Furthermore, there were no recommendations regarding adding and/or removing any of the scales. Finally, experts agreed that the data collection instrument is appropriate for the Egyptian business environment. In general, all experts agreed that the content of the questionnaire is clear and appropriate to its purpose, except for some terminologies in the Arabic version, which were reworded. In addition, there were no recommendations to change, remove, or add any of the items, which means items are relevant to their correspondent constructs.

I-CVI and S-CVI were computed to further enhance validity of the data collection instrument through measuring its relevance and clarity, in addition to ensuring whether these items are actually measuring what they were supposed to be measuring, especially after translating the questionnaire from English (original scale language) to Arabic. I-CVI was computed through asking 4 practitioners and 2 academics to rate whether the scales are not relevant, somewhat relevant, quite relevant, or highly relevant. In addition, S-CVI was calculated for each construct using the mean of I-CVI. The results of I-CVI revealed that all experts highly rated the appropriateness of each scale and found them quite or highly relevant, and the index met the required threshold of 0.78. In addition, S-CVI also ensured construct validity as its value for all constructs did not fall below the threshold of 0.9 (Polit et al., 2007). Results of the I-CVI and S-CVI are illustrated in table 5.1.

Table 5.1 Results of item content validity index (I-CVI) and scale content validity index (S-CVI)

Research variables	Measurements	I-CVI	S-CVI
Geographical concentration	GC1	1.00	0.96
	GC2	1.00	
	GC3	0.83	
	GC4	1.00	
Networked collaboration	NC1	1.00	0.96
	NC2	1.00	
	NC3	0.83	
	NC4	1.00	
Supporting services	SS1	1.00	0.94
	SS2	0.83	
	SS3	1.00	
Resilience	RES1	1.00	0.94
	RES2	0.83	
	RES3	0.83	
	RES4	1.00	
	RES5	1.00	
	RES6	1.00	
Absorptive capacity	AC1	1.00	0.94
	AC2	0.83	
	AC3	1.00	
	AC4	0.83	
	AC5	1.00	
	AC6	1.00	
	AC7	0.83	
	AC8	1.00	
	AC9	1.00	
Environmental sustainability	Env1	0.83	0.94
	Env2	1.00	
	Env3	1.00	
	Env4	1.00	
	Env5	0.83	
	Env6	1.00	
Economic sustainability	Eco1	1.00	1.00
	Eco2	1.00	

	Eco3	1.00	
Social sustainability	Soc1	1.00	0.97
	Soc2	1.00	
	Soc3	0.83	
	Soc4	1.00	
	Soc5	1.00	
	Soc6	1.00	
Operational performance	OP1	1.00	0.97
	OP2	1.00	
	OP3	1.00	
	OP4	0.83	
	OP5	1.00	
	OP6	1.00	
Financial performance	FP1	1.00	1.00
	FP2	1.00	
	FP3	1.00	

Practitioners were very interested in the research aim, and they stressed the importance of sustainability and how it has recently become an important issue in the Egyptian market. The experts also stressed the importance of clusters in business success and economic growth. Additionally, experts mentioned that Egypt has established clusters surrounding important cities such as Cairo and Alexandria that have not reached their full potential yet and organisations that are operating inside clusters are still unable to take full advantage of being in a cluster.

5.3 Statistical results of the pilot study

After the expert review stage, data were collected for the aim of testing the scales in the study and ensuring their validity and reliability. The data collection took place from September 2019 to October 2019. A total of 254 completed questionnaires were collected for the pre-test stage of the study, which were used to assess the validity and reliability of the scales using Cronbach alpha, factor loadings. As mentioned earlier, EFA will be carried out to ensure that items fit under the

constructs using factor loadings. Items with factor loadings of 0.4 will be considered to be correlated with the identified factor. Cutoff points for factor loadings (convergent validity), and Cronbach alpha (reliability) are 0.4 (Hair et al., 2014a; Wu & Law, 2019), and 0.7 (Mandal et al., 2016; Tipu et al., 2019; Wu et al., 2018; Wu & Law, 2019; Ye et al., 2019; Zhang et al., 2019), respectively.

Factor loadings for the three constructs of cluster characteristics geographical concentration, network collaboration and supporting services ranged between 0.739 and 0.898. In addition, the P value of Bartlett's test of Sphericity and KMO measure of sampling adequacy had significance at less than 5 percent and a minimum value of 0.714, respectively. Furthermore, Cronbach alpha value ranged between 0.783 and 0.843. Table 5.2 shows the results of pretest analysis for cluster characteristics.

Table 5.2 Pilot testing results for geographical concentration constructs

	Factor loadings	KMO	Bartlett's Test P-value	Cronbach Alpha
Geographical concentration		0.788	0.000	0.801
GC1	0.796			
GC2	0.813			
GC3	0.796			
GC4	0.757			
	Factor loadings	KMO	Bartlett's Test P-value	Cronbach Alpha
Networked collaboration		0.786	0.000	0.783
NC1	0.806			
NC2	0.766			
NC3	0.739			
NC4	0.803			
	Factor loadings	KMO	Bartlett's Test P-value	Cronbach Alpha
Supporting services		0.714	0.000	0.843
SS1	0.840			

SS2	0.882			
SS3	0.898			

Regarding dynamic capabilities (resilience and absorptive capacity), Factor loadings had a minimum value of 0.646 and a maximum value of 0.871; however, the two items AC2 and AC7 were removed, as they did not exceed the cutoff point of 0.4. The P value of Bartlett's test of Sphericity indicated significance at less than 5 percent, and KMO measure of sampling adequacy had a value of 0.868 for absorptive capacity and 0.821 for resilience. In addition, Cronbach alpha of absorptive capacity and resilience was 0.895 and 0.869, respectively. Table 5.3 shows the results of pretest analysis for dynamic capabilities.

Table 5.3 Pilot testing results for dynamic capabilities constructs

	Factor loadings	KMO	Bartlett's Test P-value	Cronbach Alpha
Resilience		0.821	0.000	0.869
RES1	0.784			
RES2	0.855			
RES3	0.646			
RES4	0.806			
RES5	0.871			
RES6	0.749			
	Factor loadings	KMO	Bartlett's Test P-value	Cronbach Alpha
Absorptive capacity		0.868	0.000	0.895
AC1	0.753			
AC3	0.738			
AC4	0.791			
AC5	0.835			
AC6	0.817			
AC8	0.794			
AC9	0.766			

The three sustainability constructs, namely environmental, economic and social had factor loadings of a minimum of 0.772 and a maximum of 0.937. However, item Soc3 under social sustainability construct and item Env1 under environmental sustainability construct were removed

as they had a low factor loading (less than 0.4). The three constructs had a P value of Bartlett's test of Sphericity that indicated significance at less than 5 percent, and KMO ranged between 0.735 and 0.860. In addition, reliability of the three constructs reported a Cronbach alpha of 0.903 for environmental sustainability, 0.9 for economic sustainability and 0.887 for social sustainability. Table 5.4 shows the results of pretest analysis for the three sustainability dimensions.

Table 5.4 Pilot testing results for sustainability constructs

	Factor loadings	KMO	Bartlett's Test P-value	Cronbach Alpha
Environmental sustainability		0.860	0.000	0.903
Env2	0.852			
Env3	0.810			
Env4	0.847			
Env5	0.889			
Env6	0.875			
	Factor loadings	KMO	Bartlett's Test P-value	Cronbach Alpha
Economic sustainability		0.735	0.000	0.900
Eco1	0.937			
Eco2	0.908			
Eco3	0.897			
	Factor loadings	KMO	Bartlett's Test P-value	Cronbach Alpha
Social sustainability		0.862	0.000	0.887
Soc1	0.855			
Soc2	0.825			
Soc4	0.889			
Soc5	0.772			
Soc6	0.816			

Factor loadings for the operational and financial performance constructs had a P value of Bartlett's test of Sphericity and a significance level of less than 5 percent, and KMO measure of sampling adequacy reported a value of 0.911 for operational performance and 0.762 for financial performance. Furthermore, Cronbach alpha was 0.929 and 0.920 for operational and financial

performance, respectively.. Table 5.5 shows the results of pretest analysis for organisational performance.

Table 5.5 Pilot testing results for organisational performance constructs

	Factor loadings	KMO	Bartlett's Test P-value	Cronbach Alpha
Operational performance		0.911	0.000	0.929
OP1	0.932			
OP2	0.844			
OP3	0.903			
OP4	0.801			
OP5	0.806			
OP6	0.888			
	Factor loadings	KMO	Bartlett's Test P-value	Cronbach Alpha
Financial performance		0.762	0.000	0.920
FP1	0.930			
FP2	0.933			
FP3	0.924			

In summary, the pretest results indicate that the data collection tool is appropriate and applicable, as reliability and validity tests had reasonable results.

The four deleted items had a factor loadings less than 0.4, which justifies their elimination (Hair et al., 2014a; Hair et al., 2011; Sarstedt et al., 2014; Wu & Law, 2019). In addition, the panel of experts in the pretest were consulted regarding the elimination of these four items (Izogo, 2016). After their feedback and according to the statistical results, the four items were removed from the questionnaire that will be distributed in the main study. Furthermore, since the constructs in this study are reflective and not formative, items can be deleted based on factor loadings (Hair et al., 2016; Hair et al., 2014c; Sarstedt et al., 2014). Researchers should be using caution when removing items from a formative construct (Hair et al., 2014c; Sarstedt et al., 2014) as the items should be capturing 100% of the construct and not just reflecting part of its variations (Hair et al., 2014c; Sarstedt et al., 2014).

5.4 Sample characteristics of the main study

This section represents the distribution of respondents in terms of their position, years of experience, size and location of the organisation they are working in, in addition to its role and type. A total of 811 respondents were surveyed with an average of 22 years of experience; 680 of the respondents were holding senior management positions, representing 84% of the total sample, and 131 were managing their own organisations, representing 16% of the total sample. Small and medium enterprises represent around 45% of the total sample, with 363 organisations, while organisations with more than 250 employees represent around 37% of the total sample, with 303 organisations, and finally organisations with less than 10 employees were 145 organisations, which represent 18% out of the total sample. Of the 811 organisations, 285 (35%) are located in Alexandria, while Cairo and Giza have 252 (31%) and 156 (19%) organisations, respectively; only 118 are located in other cities that represent 15% of the total sample. Manufacturing organisations represented 44%, with 328 organisations; service providers were 453 with 56% of the total population. The 811 organisations were divided into 6 different sectors based on information from the Central Bank of Egypt and consulting practitioners from the pretest: service sector, construction, pharmaceuticals, trade, transformative industries and others with 216 (26%), 80 (10%), 157 (19%), 145 (18%), 193 (24%), 20 (3%) organisations, respectively. Sample characteristics' statistics are illustrated in table 5.6. Service sector includes telecommunication, tourism, transportation and warehousing); construction includes all activities of building and construction and related industries such as rebar steel and cement; pharmaceuticals include semi and fully manufacturing of drugs and medical tools;, trade includes retail and wholesale trade; transformative industries include petrochemicals and manufacturing process from raw materials to useful product and others include mining, quarrying, personal services and education. In general,

service sector, construction, pharmaceuticals, trade and transformative industries sectors represent around 90 percent of Egyptian gross domestic product (CBE, 2020). According to the Ministry of Trade and Industry (2019), the Egyptian government has begun creating 21 environmental-friendly clusters around these sectors. Almost half of them include transformative industries as the government is focusing on enhancing its exports along with the main goal of sustainability development plan mentioned in the introduction section. The rest of these clusters focused on other sectors; however, inside transformative industry sectors-based clusters, the government tries to create a global center that includes, for example, organisations from the trade sector in order to enhance international competitive advantage.

Table 5.6 Sample characteristics

Characteristics	Criteria	Frequency	Percentage
Position	General manager/owner	131	16.15
	Directors and general managers	680	83.85
Size	More than 250	303	37.36
	51-250	199	24.54
	10-50	164	20.22
	Less than 10	145	17.88
City	Cairo	252	31.07
	Alexandria	285	35.14
	Giza	156	19.24
	Other	118	14.55
Role	Service provider (Ser)	453	55.86
	Manufacturing (Manuf)	358	44.14
Type	Service sector (Ser)	216	26
	Construction (Cons)	80	10
	Pharmaceuticals (Phar)	157	19
	Trade	145	18
	Transformative Industries (Transf)	193	24
	Other	20	3
Years of experience	Mean	22.36	
	Standard deviation	7.05	

5.5 Descriptive statistics and normality test

The data collected were first screened as they included two negatively- worded questions, RES3 and OP4, which were included to help attract the attention of participants. These questions were reverse-coded using SPSS so that all questions in the questionnaire are worded towards the same direction; in other words, the same value will have the same meaning in all questions. After reverse coding the questions, descriptive statistics were calculated for all constructs including mean, standard deviation, minimum, maximum, skewness and kurtosis.

The descriptive statistics for the ten constructs have been obtained for empirical investigation and are presented in the Table 5.7. It is found that supply chain cluster design characteristics standard deviation values are 1.3613, 1.5390 and 1.7886 for geographical concentration, networked collaboration and supporting services, respectively. As for dynamic capabilities resilience and absorptive capacity have a standard deviation of 1.2743 and 1.2393, respectively. Regarding sustainability, standard deviation values are 1.5032, 1.2593 and 1.2537 for environmental sustainability, economic sustainability and social sustainability, respectively. Finally, operational performance and financial performance have standard deviations of 1.3655 and 1.5792.

The mean of geographical concentration is 2.5749, networked collaboration mean is 2.9393 and supporting services is 3.3292. Regarding dynamic capabilities, resilience has a mean of 2.5039 and absorptive capacity has a mean of 2.3826. Sustainability, environmental sustainability, economic sustainability and social sustainability reported means of 2.6491, 2.3436 and 2.3477, respectively. Finally, organisational performance has a mean of 2.4379 and 2.5656 for operational and financial performance, respectively.

The test for normality was carried out using the values of skewness and kurtosis as they can indicate the lack of symmetry in the data distribution. If the skewness coefficient is greater than one, it is considered extreme. High or low kurtosis value indicates extreme leptokurtic or extreme platykurtic, respectively (Hair et al., 2014a). From Table 5.7, it is found that the observed frequency distribution for all constructs is not symmetric as they have a value for skewness and kurtosis greater than +,-1 except for networked collaboration and supporting services (Aboelmaged, 2018; Aboelmaged & Hashem, 2019; Hair, 2015). Another normality test was carried out using Shapiro-Wilks test and Kolmogorov-Smirnov, which reported a significant P-value of less than 5%, which means that the null hypothesis that the data are normal is rejected (Hair et al., 2014a; Tipu et al., 2019). The violation of normality assumption emphasises the use of SEM-PLS as it is appropriate to use when data are not normal because it does not assume data normality (Hair et al., 2014a; Peng & Lai, 2012; Roberts et al., 2010).

Table 5.7 Descriptive statistics

	Mean	Std. Deviation	Skewness	Kurtosis	Kolmogorov-Smirnova		Shapiro-Wilk	
	Statistic	Statistic	Statistic	Statistic	Statistic	Sig.	Statistic	Sig.
Geographical concentration	2.57	1.36	1.41	1.61	0.18	0.00	0.86	0.00
Networked collaboration	2.94	1.54	0.93	-0.10	0.17	0.00	0.89	0.00
Supporting services	3.33	1.79	0.57	-0.92	0.15	0.00	0.91	0.00
Resilience	2.50	1.27	1.60	3.04	0.14	0.00	0.85	0.00
Absorptive capacity	2.38	1.24	1.80	3.87	0.16	0.00	0.83	0.00
Environmental sustainability	2.65	1.50	1.30	1.06	0.15	0.00	0.86	0.00
Economic sustainability	2.34	1.26	1.39	2.07	0.20	0.00	0.86	0.00
Social sustainability	2.35	1.26	1.65	2.79	0.17	0.00	0.83	0.00

Operational performance	2.44	1.37	1.72	2.69	0.19	0.00	0.80	0.00
Financial performance	2.57	1.58	1.39	1.24	0.22	0.00	0.82	0.00

5.6 Reliability and validity assessment

Before testing the research hypotheses through structural equation modelling, the research model must be validated first by conducting reliability and convergent and discriminant validity tests (Hair et al., 2011). These tests will be investigated through Cronbach's alpha and composite reliability for reliability assessment, average variance extracted and factor loadings for convergent validity and the square root of the AVE, and Heterotrait-Monotrait ratio of correlations (HTMT) for discriminant validity.

5.6.1 Reliability assessment

Uni-dimensionality of each construct is a necessity when conducting PLS-SEM; Cronbach's alpha and CR can test whether the construct is uni-dimensional or not (Tenenhaus et al., 2005). Reliability assessment results are shown in table 5.8, where each construct has its correspondent Cronbach's alpha and CR. Financial performance has the highest Cronbach's alpha and CR with values of 0.946 and 0.965, respectively. While geographical concentration has the lowest scores for Cronbach's alpha and CR with values of 0.820 and 0.881, respectively. Based on the results, it can be argued that all constructs are uni-dimensional as they have Cronbach's alpha and CR values greater than 0.7, which indicates good scale reliability (Mandal et al., 2016; Tenenhaus et al., 2005; Tipu et al., 2019; Wu et al., 2018; Wu & Law, 2019; Ye et al., 2019; Zhang et al., 2019).

Table 5.8 Reliability assessment for the main study

	Cronbach's alpha	Composite Reliability
Geographical concentration	0.820	0.881
Networked collaboration	0.872	0.912
Supporting services	0.900	0.937
Resilience	0.928	0.944
Absorptive capacity	0.936	0.948
Environmental sustainability	0.928	0.946
Economic sustainability	0.854	0.910
Social sustainability	0.904	0.928
Operational performance	0.929	0.944
Financial performance	0.946	0.965

5.6.2 Convergent Validity

Convergent validity of the constructs will be assessed using AVE and factor loadings as shown in table 5.9. Factor loadings for the three constructs of cluster characteristics geographical concentration, network collaboration and supporting services range between 0.769 and 0.916, and the lowest AVE was 0.650. Regarding dynamic capabilities (resilience and absorptive capacity), AVE has a value of 0.722 for absorptive capacity and 0.738 for resilience. Factor loadings has a minimum value of 0.733 and a maximum value of 0.912. The three sustainability constructs, namely environmental, economic and social have factor loadings of a minimum of 0.784 and a maximum of 0.936. Regarding AVE, environmental sustainability has a value of 0.777 and economic sustainability has a value of 0.773 while social sustainability has a value of 0.722. Factor loadings for the operational and financial performance constructs has a minimum value 0.756 and a maximum value of 0.953. AVE is 0.740 and 0.903 for operational and financial performance, respectively. These results indicate that convergent validity is adequate and that all constructs achieved convergent validity based on the threshold of 0.4 for factor loadings (Hair et al., 2014a;

Wu & Law, 2019) and 0.5 for AVE (Fornell & Larcker, 1981; Hair et al., 2014a; Hair et al., 2014c; Wu & Law, 2019).

Table 5.9 Convergent validity for constructs in the main study

	Factor loadings	AVE
Geographical concentration		
GC1	0.769	0.650
GC2	0.818	
GC3	0.786	
GC4	0.850	
Networked collaboration		
NC1	0.869	0.721
NC2	0.828	
NC3	0.821	
NC4	0.877	
Supporting services		
SS1	0.912	0.833
SS2	0.916	
SS3	0.911	
Resilience		
RES1	0.866	0.738
RES2	0.907	
RES3	0.733	
RES4	0.873	
RES5	0.912	
RES6	0.851	
Absorptive capacity		
AC1	0.831	0.722
AC2	0.854	
AC3	0.859	
AC4	0.883	
AC5	0.867	
AC6	0.835	
AC7	0.815	
Environmental sustainability		
Env1	0.888	0.777
Env2	0.830	
Env3	0.867	

Env4	0.911	
Env5	0.909	
Economic sustainability		
Eco1	0.936	0.773
Eco2	0.911	
Eco3	0.784	
Social sustainability		
Soc1	0.861	0.722
Soc2	0.853	
Soc3	0.874	
Soc4	0.798	
Soc5	0.861	
Operational performance		
OP1	0.928	0.740
OP2	0.872	
OP3	0.918	
OP4	0.756	
OP5	0.777	
OP6	0.895	
Financial performance		
FP1	0.953	0.903
FP2	0.951	
FP3	0.946	

The AVE of geographical concentration is 65%, which means that the four items (GC1, GC2, GC3 and GC4) can express geographical concentration as 65% of their total available information can be extracted by using one factor. In other words, instead of expressing geographical concentration in four items, it can be identified by using only one factor and still maintain 65% of the total information. Regarding networked collaboration, AVE is 72%, which means that the four items (NC1, NC2, NC3 and NC4) can express networked collaboration as 72% of their total available information can be extracted by using one factor. In other words, networked collaboration can be expressed in one factor instead of four and still maintain 72% of the total information. As for

supporting services, its AVE is 83%, which means that it can be expressed in one factor instead of the three items (SS1, SS2 and SS3) and 72% of the information will still be kept.

The AVE of resilience is almost 74%, which means that the six items (RES1, RES2, RES3, RES4, RES5 and RES6) can express resilience as 74% of their total available information can be extracted by using one factor. Therefore, by reducing the six items of resilience into one factor, it can still maintain 74% of the total information. Regarding absorptive capacity, AVE is 72%, which means that 72% of the total information available by the seven items (AC1, AC2, AC3, AC4, AC5, AC6 and AC7) can be expressed in one factor. Accordingly, absorptive capacity can be expressed in one factor instead of seven and still maintain 72% of the total information.

Environmental sustainability AVE is almost 78%, which means that the five items (Env1, Env2, Env3, Env4 and Env5) can express environmental sustainability as 78% of their total available information can be extracted by using one factor. In other words, instead of expressing environmental sustainability in five items, it can be identified by using only one factor and still maintain 78% of total information. Regarding economic sustainability, AVE is 77%, which means that the three items (Eco1, Eco2 and Eco3) can express economic sustainability as 77% of their total available information can be extracted by using one factor. Accordingly, by reducing the three items of economic sustainability into one factor, it can still maintain 77% of the total information. As for social sustainability, its AVE is almost 72%, which means that it can be expressed in one factor instead of the three items (SS1, SS2 and SS3) and 72% of the information will still be kept.

Finally, organisational performance AVE is 74% and 90% for operational and financial performance, respectively. This means that the six items (OP1, OP2, OP3, OP4, OP5 and OP6) can express operational performance as 74% of their total available information can be extracted

by using one factor. Therefore, by reducing the six items of operational performance into one factor, it can still maintain 74% of the total information. Regarding financial performance, its 90% AVE score means that 90% of the total information available by the three items (FP1, FP2 and FP3) can be expressed in one factor. Accordingly, financial performance can be expressed in one factor instead of three and still maintain 90% of the total information.

5.6.3 Discriminant Validity

In order to assess the discriminant validity of the construct, the square root of construct's AVE will be examined to ensure that it exceeds the value of correlation between the construct and other constructs (Fornell & Larcker, 1981). If the square root of AVE is greater than the correlation value, this ensures the discriminant validity of the construct. In other words, participants were able to discriminate between the different research constructs. In addition to examining the square root of AVE, HTMT will be also assessed as a more reliable method to ensure discriminant validity in PLS-SME; any value of HTMT below 0.85 indicates discriminant validity (Henseler et al., 2015). Table 5.10 shows that all square roots of the construct's AVE are greater than the correlation between it and other constructs in the model; additionally, all HTMT values are less than 0.85 for all constructs as shown in table 5.11. Based on these results, it can be argued that discriminant validity is adequately verified.

Table 5.10 Discriminant validity for constructs in the main study

	GC	NC	SS	RES	AC	Env	Eco	Soc	OP	FP	SQR AVE
GC	1.000	0.625	0.464	0.516	0.470	0.380	0.391	0.454	0.313	0.347	0.806
NC	0.625	1.000	0.697	0.601	0.516	0.400	0.430	0.487	0.347	0.432	0.849
SS	0.464	0.697	1.000	0.540	0.501	0.408	0.408	0.446	0.324	0.446	0.913
RES	0.516	0.601	0.540	1.000	0.777	0.517	0.521	0.679	0.561	0.567	0.859
AC	0.470	0.516	0.501	0.777	1.000	0.555	0.544	0.712	0.546	0.513	0.850

Env	0.380	0.400	0.408	0.517	0.555	1.000	0.690	0.650	0.429	0.386	0.881
Eco	0.391	0.430	0.408	0.521	0.544	0.690	1.000	0.691	0.461	0.439	0.879
Soc	0.454	0.487	0.446	0.679	0.712	0.650	0.691	1.000	0.529	0.464	0.850
OP	0.313	0.347	0.324	0.561	0.546	0.429	0.461	0.529	1.000	0.641	0.860
FP	0.347	0.432	0.446	0.567	0.513	0.386	0.439	0.464	0.641	1.000	0.950
SQR AVE	0.806	0.849	0.913	0.859	0.850	0.881	0.879	0.850	0.860	0.950	

Table 5.11 Heterotrait-Monotrait ratio of correlations in assessing discriminant validity

	GC	NC	SS	RES	AC	Env	Eco	Soc	OP	FP
GC	1	0.732	0.537	0.586	0.53	0.431	0.447	0.522	0.355	0.393
NC	0.732	1	0.788	0.653	0.554	0.445	0.49	0.543	0.373	0.473
SS	0.537	0.788	1	0.587	0.539	0.451	0.456	0.5	0.348	0.483
RES	0.586	0.653	0.587	1	0.83	0.551	0.56	0.732	0.603	0.604
AC	0.53	0.554	0.539	0.83	1	0.587	0.577	0.76	0.586	0.543
Env	0.431	0.445	0.451	0.551	0.587	1	0.766	0.694	0.451	0.409
Eco	0.447	0.49	0.456	0.56	0.577	0.766	1	0.757	0.496	0.472
Soc	0.522	0.543	0.5	0.732	0.76	0.694	0.757	1	0.57	0.509
OP	0.355	0.373	0.348	0.603	0.586	0.451	0.496	0.57	1	0.681
FP	0.393	0.473	0.483	0.604	0.543	0.409	0.472	0.509	0.681	1

5.7 Structural equation modelling

Structural equation modelling was used to test the significance of the relationship between the constructs in the conceptual framework. As mentioned earlier, PLS-SEM is appropriate to use when the model is complex (Chowdhury & Quaddus, 2016; Hair et al., 2014c; Peng & Lai, 2012; Roberts et al., 2010; Sarstedt et al., 2014) and data is not normally distributed (Hair et al., 2014a; Peng & Lai, 2012; Roberts et al., 2010).

5.7.1 Direct effects

Table 5.12 shows the results of direct relations using a 5000 bootstrapping sample to compute path coefficients (β-value) and t-value and its correspondent p-value.

Table 5.12 Direct effect

Main constructs				Control variables			
Path	Coef	T-v	P-v	Path	coef	T-v	P-v
GC -> RES	0.205	4.192	0.000	Size -> RES	0.181	7.230	0.000
NC -> RES	0.303	6.811	0.000	Size -> AC	0.176	6.352	0.000
SS -> RES	0.190	5.288	0.000	Size -> Env	0.220	4.014	0.000
GC -> AC	0.216	4.597	0.000	Size -> Eco	0.109	2.528	0.012
NC -> AC	0.184	4.023	0.000	Size -> Soc	0.024	0.502	0.616
SS -> AC	0.230	6.013	0.000	Manuf -> Env	0.554	3.684	0.000
RES -> Env	0.134	2.776	0.006	Manuf -> Eco	0.370	2.241	0.025
AC -> Env	0.336	6.549	0.000	Manuf -> Soc	-0.076	0.451	0.652
RES -> Eco	0.163	3.595	0.000	Transf -> Env	0.164	1.992	0.046
AC -> Eco	0.291	6.099	0.000	Transf -> Eco	0.789	7.562	0.000
RES -> Soc	0.285	6.616	0.000	Transf -> Soc	0.244	1.843	0.065
AC -> Soc	0.436	9.858	0.000	Cons -> Env	0.492	5.973	0.000
Env -> OP	0.089	1.660	0.097	Cons -> Eco	0.752	8.136	0.000
Eco -> OP	0.143	2.636	0.008	Cons -> Soc	0.135	1.734	0.083
Soc -> OP	0.372	6.235	0.000	Trade -> Env	0.562	5.427	0.000
Env -> FP	0.065	1.110	0.267	Trade -> Eco	0.898	8.023	0.000
Eco -> FP	0.197	3.275	0.001	Trade -> Soc	0.024	0.903	0.367
Soc -> FP	0.285	4.902	0.000	Ser -> Env	0.593	5.000	0.000
				Ser -> Eco	1.075	8.794	0.000
				Ser -> Soc	0.108	0.952	0.341
				Phar -> Env	0.210	2.762	0.006
				Phar -> Eco	0.821	8.404	0.000
				Phar -> Soc	0.294	2.378	0.017

According to the results in table 5.12, geographical concentration, networked collaboration and supporting services have a significant positive impact on the two dynamic capabilities: resilience and absorptive capacity. In addition, resilience and absorptive capacity can significantly enhance the three dimensions of sustainability: environmental, economic and social sustainability. Furthermore, economic and social sustainability have a significant positive impact on both operational and financial performance. However, environmental sustainability did not have a significant impact on organisational performance (operational and financial performance).

Regarding control variables- organisation size, role and industry type- the results indicated that both organisation size and role have a positive significant impact on environmental and economic sustainability; however, they did not significantly affect social sustainability. Additionally, firm size can significantly enhance organisations' dynamic capabilities (resilience and absorptive capacity). Regarding industry type that was divided into five different types: transformative industry, construction industry, trade, service sector, and pharmaceuticals industry, results revealed that all industry types have a positive impact on environmental and economic sustainability, but not on social sustainability, except for pharmaceuticals industry, which positively affects the three dimensions of sustainability.

Since PLS-SEM relies on coefficient of determination (R^2) to evaluate the fitting of the model (Hair et al., 2014c; Sarstedt et al., 2014), table 5.13 shows the value of R^2 for each construct. R^2 measures the percentage by which the construct varies as a result of being affected by other constructs in the model (Hair et al., 2014b; Hair et al., 2016; Hair et al., 2011). According to the value of R^2, it can be concluded that 50% and 37% of changes that occur in resilience and absorptive capacity can be explained by the model. Additionally, the model can explain 44%, 49% and 56% of variation in environmental, economic and social sustainability. Furthermore, 30% of the variation in operational performance and 24% of the variation in financial performance can be explained through the model.

Table 5.13 R-Square of the research constructs

Construct	R^2
Resilience	0.449
Absorptive capacity	0.366
Environmental sustainability	0.437
Economic sustainability	0.487
Social sustainability	0.561

Operational performance	0.301
Financial performance	0.249

5.7.2 Mediation analysis

Based on the joint significance method, it can be concluded that resilience and absorptive capacity mediate the relationship between the three design characteristics and the three sustainability dimensions as all direct relations are significant. Based on the results from table 5.12, all direct effects from the three supply chain cluster characteristics to resilience and absorptive capacity and from dynamic capabilities to the three sustainability dimensions are significant (MacKinnon et al., 2002; Taylor et al., 2008). However, in order to calculate the coefficient for the indirect effect, bootstrapping will be carried out using PLS-SEM (Carrión et al., 2017; Nitzl et al., 2016), and to reinforce the results, macro process devised by (Preacher & Hayes, 2008) will be used. The results illustrated in table 5.14 show the results of PLS-SEM and macro process bootstrapping. PLS-SEM has a P value of less than 5% for all indirect effects, which indicates a significant mediation effect. Regarding macro process, results also indicate a significant mediation effect as zero does not fall between the lower (BootLLCI) and upper (BootULCI) boundaries (Preacher & Hayes, 2008). This indicates that both tests generated the same results, which means that both resilience and absorptive capacity mediate the relationship between design characteristics (geographical concentration, networked collaboration and supporting services) and sustainability (environmental, economic and social sustainability).

When investigating the direct effect between design characteristics and sustainability, it appears that all direct effects are significant. This means that resilience and absorptive capacity have a complementary partial mediation between supply chain cluster design characteristics and the three dimensions of sustainability. In other words, there is a complementary partial mediation between

the design characteristics (geographical concentration, networked collaboration and supporting services) and the three sustainability dimensions. This means that a part of the variation in the sustainability dimensions is caused by supply chain cluster design characteristics and the other part is mediated through dynamic capabilities (Carrión et al., 2017; Taylor et al., 2008).

Table 5.14 Results of PLS-SEM bootstrapping and process macro

	PLS-SEM	Macro-process		PLS-SEM	Macro-process		
Direct	P-v	P-v	Indirect paths	P-v	BootLLCI	BootULCI	Sig
GC -> Env	0.002	0.000	GC -> AC -> Env	0.000	0.040	0.160	Sig
			GC -> RES -> Env	0.002	0.117	0.249	Sig
GC -> Eco	0.001	0.000	GC -> AC -> Eco	0.000	0.044	0.147	Sig
			GC -> RES -> Eco	0.000	0.081	0.189	Sig
GC -> Soc	0.002	0.000	GC -> AC -> Soc	0.000	0.244	0.184	Sig
			GC -> RES -> Soc	0.000	0.087	0.242	Sig
NC -> Env	0.004	0.000	NC -> AC -> Env	0.000	0.030	0.153	Sig
			NC -> RES -> Env	0.005	0.117	0.230	Sig
NC -> Eco	0.000	0.000	NC -> AC -> Eco	0.000	0.025	0.133	Sig
			NC -> RES -> Eco	0.005	0.082	0.172	Sig
NC -> Soc	0.003	0.000	NC -> AC -> Soc	0.000	0.082	0.179	Sig
			NC -> RES -> Soc	0.000	0.130	0.227	Sig
SS -> Env	0.000	0.000	SS -> AC -> Env	0.000	0.026	0.121	Sig
			SS -> RES -> Env	0.003	0.093	0.187	Sig
SS -> Eco	0.000	0.000	SS -> AC -> Eco	0.000	0.032	0.119	Sig
			SS -> RES -> Eco	0.001	0.065	0.143	Sig
SS -> Soc	0.026	0.002	SS -> AC -> Soc	0.000	0.071	0.148	Sig
			SS -> RES -> Soc	0.000	0.109	0.195	Sig

5.7.3 Indirect effects

As mentioned earlier, the mediation role is not affected by the significance of the direct effect of the independent variable on the dependent variable (Collins et al., 1998; Shrout & Bolger, 2002; Zhao et al., 2010). In fact, the only prerequisite for a mediator role is the significance of its indirect effect (Carrión et al., 2017; Nitzl et al., 2016; Zhao et al., 2010). In this study, the indirect

coefficient of PLS-SEM running the whole model (including all constructs and control variables) will be used as it presents the whole model output and not nine separate models (Carrión et al., 2017; Nitzl et al., 2016); in addition, it calculates the specific indirect paths (Hair et al., 2016). Other indirect effects will be also illustrated as most of them are considered to be significant based on joint significance (MacKinnon et al., 2002; Taylor et al., 2008) and PLS-SME bootstrapping (Carrión et al., 2017; Nitzl et al., 2016), which will enhance the applicability of the developed framework in the business environment. Joint significance and bootstrapping are considered superior when calculating the mediation effect, especially with more than two path mediations, such as GC -> RES -> Env -> OP (the impact of geographical concentration on operating performance through resilience and environmental sustainability) (Taylor et al., 2008). Table 5.14 illustrates the indirect relationships between the research constructs, the impact of the three supply chain cluster characteristics on the three sustainability dimensions and organisational performance, in addition to the relationship between the two dynamic capabilities and organisational performance. It can be concluded from the P-value and the coefficients in table 5.15 that geographical concentration, networked collaboration and supporting services have a positive significant indirect relationship on environmental, economic and social sustainability through dynamic capabilities. In addition, the three supply chain cluster characteristics can significantly enhance operational and financial performance through dynamic capabilities and sustainability. Furthermore, resilience and dynamic capabilities have a significant positive indirect effect on operational and financial performance through sustainability.

Through examining the specific indirect paths, it can be concluded that the three supply chain cluster characteristics can positively influence the three sustainability dimensions through

resilience and/or absorptive capacity. Regarding operational performance, geographical concentration, networked collaboration and supporting services did not significantly affect it through the paths, resilience – environmental sustainability (RES -> Env), absorptive capacity - environmental sustainability (AC -> Env) and resilience – economic sustainability (RES -> Eco). On the other hand, the three paths between the three supply chain cluster characteristics and operational performance through absorptive capacity – economic sustainability (AC -> Eco), resilience and social sustainability (RES -> Soc) and absorptive capacity – social sustainability (AC -> Soc) were significant. As for financial performance, geographical concentration did not have a significant impact on it through the paths, resilience – environmental sustainability (RES -> Env), absorptive capacity - environmental sustainability (AC -> Env) and resilience – economic sustainability (RES -> Eco). On the other hand, the three paths between the geographical concentration and operational performance through, absorptive capacity – economic sustainability (AC -> Eco), resilience and social sustainability (RES -> Soc) and absorptive capacity – social sustainability (AC -> Soc) were significant. However, networked collaboration and supporting services can significantly influence financial performance through the paths resilience – economic sustainability (RES -> Eco), absorptive capacity – economic sustainability (AC -> Eco), resilience and social sustainability (RES -> Soc) and absorptive capacity – social sustainability (AC -> Soc), but they did not significantly influence financial performance through resilience – environmental sustainability (RES -> Env), absorptive capacity - environmental sustainability (AC -> Env). The two dynamic capabilities had a significant indirect effect on operational and financial performance through economic and social sustainability; however, they had no significant impact through environmental sustainability.

Table 5.15 Indirect effect

Path	Coef	T-v	P-v	Path	Coef	T-v	P-v
GC -> Env	0.100	0.101	0.024	GC -> RES -> Env	0.027	2.258	0.024
				GC -> AC -> Env	0.073	3.671	0.000
GC -> Eco	0.096	0.097	0.024	GC -> RES -> Eco	0.033	2.630	0.009
				GC -> AC -> Eco	0.063	3.538	0.000
GC -> Soc	0.153	0.153	0.034	GC -> RES -> Soc	0.058	3.392	0.001
				GC -> AC -> Soc	0.094	3.941	0.000
GC -> OP	0.079	0.08	0.02	GC -> RES -> Env -> OP	0.003	1.217	0.224
				GC -> AC -> Env -> OP	0.007	1.500	0.134
				GC -> RES -> Eco -> OP	0.005	1.770	0.077
				GC -> AC -> Eco -> OP	0.009	2.076	0.038
				GC -> RES -> Soc -> OP	0.021	2.945	0.003
				GC -> AC -> Soc -> OP	0.035	3.274	0.001
GC -> FP	0.07	0.071	0.018	GC -> RES -> Env -> FP	0.002	0.874	0.382
				GC -> AC -> Env -> FP	0.005	0.990	0.322
				GC -> RES -> Eco -> FP	0.006	1.857	0.063
				GC -> AC -> Eco -> FP	0.012	2.300	0.021
				GC -> RES -> Soc -> FP	0.018	2.786	0.005
				GC -> AC -> Soc -> FP	0.028	3.051	0.002
NC -> Env	0.103	0.104	0.000	NC -> RES -> Env	0.041	2.511	0.012
				NC -> AC -> Env	0.062	3.278	0.001
NC -> Eco	0.103	0.104	0.021	NC -> RES -> Eco	0.049	2.986	0.003
				NC -> AC -> Eco	0.054	3.141	0.002
NC -> Soc	0.167	0.167	0.03	NC -> RES -> Soc	0.086	4.775	0.000
				NC -> AC -> Soc	0.080	3.677	0.000
NC -> OP	0.086	0.086	0.018	NC -> RES -> Env -> OP	0.004	1.312	0.190
				NC -> AC -> Env -> OP	0.006	1.481	0.139
				NC -> RES -> Eco -> OP	0.007	1.875	0.061
				NC -> AC -> Eco -> OP	0.008	2.061	0.039
				NC -> RES -> Soc -> OP	0.032	3.742	0.000
				NC -> AC -> Soc -> OP	0.030	3.059	0.002
NC -> FP	0.076	0.077	0.016	NC -> RES -> Env -> FP	0.003	0.952	0.341
				NC -> AC -> Env -> FP	0.004	0.988	0.323
				NC -> RES -> Eco -> FP	0.009	2.000	0.046
				NC -> AC -> Eco -> FP	0.010	2.222	0.026
				NC -> RES -> Soc -> FP	0.026	3.329	0.001
				NC -> AC -> Soc -> FP	0.024	2.861	0.004
SS -> Env	0.103	0.102	0.019	SS -> RES -> Env	0.026	2.442	0.015

				SS -> AC -> Env	0.077	4.559	0.000
SS -> Eco	0.098	0.097	0.000	SS -> RES -> Eco	0.031	3.042	0.002
				SS -> AC -> Eco	0.067	4.411	0.000
SS -> Soc	0.154	0.153	0.026	SS -> RES -> Soc	0.054	4.255	0.000
				SS -> AC -> Soc	0.100	5.133	0.000
SS -> OP	0.081	0.08	0.016	SS -> RES -> Env -> OP	0.002	1.347	0.178
				SS -> AC -> Env -> OP	0.007	1.706	0.088
				SS -> RES -> Eco -> OP	0.004	1.931	0.054
				SS -> AC -> Eco -> OP	0.010	2.221	0.026
				SS -> RES -> Soc -> OP	0.020	3.422	0.001
				SS -> AC -> Soc -> OP	0.037	3.836	0.000
SS -> FP	0.071	0.071	0.014	SS -> RES -> Env -> FP	0.002	0.942	0.346
				SS -> AC -> Env -> FP	0.005	1.042	0.297
				SS -> RES -> Eco -> FP	0.006	2.073	0.038
				SS -> AC -> Eco -> FP	0.013	2.621	0.009
				SS -> RES -> Soc -> FP	0.016	3.156	0.002
				SS -> AC -> Soc -> FP	0.030	3.589	0.000
RES -> OP	0.141	0.141	0.028	RES -> Env -> OP	0.013	1.363	0.173
				RES -> Eco -> OP	0.024	2.033	0.042
				RES -> Soc -> OP	0.105	4.527	0.000
RES -> FP	0.125	0.125	0.026	RES -> Env -> FP	0.009	0.965	0.335
				RES -> Eco -> FP	0.031	2.167	0.030
				RES -> Soc -> FP	0.086	3.948	0.000
AC -> OP	0.234	0.234	0.033	AC -> Env -> OP	0.032	1.703	0.089
				AC -> Soc -> OP	0.160	5.216	0.000
				AC -> Eco -> OP	0.042	2.454	0.014
AC -> FP	0.208	0.208	0.029	AC -> Env -> FP	0.021	1.066	0.286
				AC -> Eco -> FP	0.055	2.823	0.005
				AC -> Soc -> FP	0.131	4.536	0.000

5.8 Hypotheses testing

This section will illustrate the acceptance and rejection of the hypotheses developed based on the results of PLS-SEM illustrated in the previous section.

5.8.1 The impact of supply chain cluster design characteristics on dynamic capabilities

- H1a: Geographical concentration positively impacts organisational resilience (supported).

The P-value (0.000) of GC -> RES indicates a significant relationship at 99 percent confidence level between geographical concentration and resilience. The hypothesis is accepted because the relationship is significant and positive with a coefficient of ($\beta = 0.205$), which means that for every 100 points change in the geographical concentration, there is a 20.5 points change in organisational resilience in the same direction.

- H1b: Geographical concentration positively impacts organisational absorptive capacity (supported).

This hypothesis is supported because the relationship between geographical concentration and absorptive capacity (GC -> AC) is significant at 99 percent confidence level with a P-value of (0.000). In addition, its coefficient ($\beta = 0.216$) indicates a positive relationship in which 100 points change in the geographical concentration will lead to a 21.6 points change in organisational absorptive capacity in the same direction.

- H2a: Networked collaboration positively impacts organisational resilience (supported).

The results of the PLS-SEM indicate that the hypothesis H1c is supported as it indicates a positive significant relationship between networked collaboration and resilience (NC -> RES) at a 99

percent confidence level with a P-value of (0.000) and coefficient of (β = 0.303). This means that for every 100 points change in networked collaboration, organisational resilience will change by 30.3 points in the same direction.

- H2b: Networked collaboration positively impacts organisational absorptive capacity (supported).

The P-value (0.000) of NC -> AC indicates a significant relationship at 99 percent confidence level between networked collaboration and absorptive capacity. The hypothesis is accepted because the relation is significant and positive with a coefficient of (β = 0.184), which means that for every 100 points change in the geographical concentration, there is a 18.4 points change in organisational absorptive capacity in the same direction.

- H3a: Supporting services positively impact organisational resilience (supported).

This hypothesis is supported because the relationship between supporting services and resilience (SS -> RES) is significant at 99 percent confidence level with a P-value of (0.000). In addition, its coefficient (β = 0.190) indicates a positive relationship in which 100 points change in the geographical concentration will lead to a 19 points change in organisational resilience in the same direction.

- H3b: Supporting services positively impact organisational absorptive capacity (supported).

The results of the PLS-SEM indicate that the hypothesis H1f is supported as they indicate a positive significant relationship between supporting services and absorptive capacity (SS -> AC) at a 99 percent confidence level with a P-value of (0.000) and coefficient of (β = 0.230). This means that

for every 100 points change in networked collaboration, organisational absorptive capacity will change by 23 points in the same direction (supported).

5.8.2 The impact of dynamic capabilities on sustainability

- H4a: Resilience positively impacts environmental sustainability (supported).

The P-value (0.006) of RES -> Env indicates a significant relationship at 99 percent confidence level between resilience and environmental sustainability. The hypothesis is accepted because the relation is significant and positive with a coefficient of (β = 0.134), which means that for every 100 points change in organisational resilience, there is a 13.4 points change in environmental sustainability in the same direction.

- H4b: Resilience positively impacts economic sustainability (supported).

This hypothesis is supported because the relationship between resilience and economic sustainability is (RES -> Eco) significant at 99 percent confidence level with a P-value of (0.000). In addition, its coefficient (β = 0.163) indicates a positive relationship in which 100 points change in organisational resilience will lead to a 16.3 points change in economic sustainability in the same direction.

- H4c: Resilience positively impacts social sustainability (supported).

The results of the PLS-SEM indicate that the hypothesis H2c is supported as they indicate a positive significant relationship between resilience and social sustainability (RES -> Soc) at a 99 percent confidence level with a P-value of (0.000) and coefficient of (β = 0.285). This means that

for every 100 points change in organisational resilience, social sustainability will change by 28.5 points in the same direction.

- H5a: Absorptive capacity positively impacts environmental sustainability (supported).

The P-value (0.000) of AC -> Env indicates a significant relationship at 99 percent confidence level between absorptive capacity and environmental sustainability. The hypothesis is accepted because the relationship is significant and positive with a coefficient of (β = 0.336), which means that for every 100 points change in organisational absorptive capacity, there is a 33.6 points change in environmental sustainability in the same direction.

- H5b: Absorptive capacity positively impacts economic sustainability (supported).

This hypothesis is supported because the relationship between absorptive capacity and economic sustainability (AC -> Eco) is significant at 99 percent confidence level with a P-value of (0.000). In addition, its coefficient (β = 0.291) indicates a positive relationship in which 100 points change in the geographical concentration will lead to a 29.1 points change in organisational absorptive capacity in the same direction.

- H5c: Absorptive capacity positively impacts social sustainability (supported).

The results of the PLS-SEM indicate that the hypothesis H2f is supported as they indicate a positive significant relationship between absorptive capacity and social sustainability (AC -> Soc) at a 99 percent confidence level with a P-value of (0.000) and coefficient of (β = 0.436). This means that for every 100 points change in organisational absorptive capacity, social sustainability will change by 43.6 points in the same direction.

5.8.3 The mediating role of dynamic capabilities between design characteristics and sustainability

- H6a: Geographical concentration affects environmental sustainability through resilience. (supported).

The P-value (0.024) of GC -> RES -> Env supports the hypothesis as it indicates a significant relationship at 95 percent confidence level between geographical concentration and environmental sustainability through resilience. Additionally, results indicate a positive relationship with a coefficient of (β = 0.027, which means that for every 100 points change in the geographical concentration, there is a 2.7 points change in environmental sustainability through resilience in the same direction.

- H6b: Geographical concentration affects economic sustainability through resilience. (supported).

This hypothesis is supported because the relationship between geographical concentration and economic sustainability through resilience (GC -> RES -> Eco) is significant at 99 percent confidence level with a P-value of (0.009). In addition, its coefficient (β = 0.033) indicates a positive relationship in which 100 points change in the geographical concentration will lead to a 3.3 points change in economic sustainability through resilience in the same direction.

- H6c: Geographical concentration affects social sustainability through resilience. (supported).

The results of the PLS-SEM indicate that the hypothesis H3c is supported as they indicate a significant relationship between geographical concentration and social sustainability through resilience (GC -> RES -> Soc) at a 99 percent confidence level with a P-value of (0.001) and coefficient of (β = 0.085). This means that for every 100 points change in geographical

concentration, social sustainability will change by 8.5 points through resilience in the same direction.

- H7a: Networked collaboration affects environmental sustainability through resilience. (supported).

The P-value (0.012) of NC -> RES -> Env supports the hypothesis as it indicates a significant relationship at 95 percent confidence level between networked collaboration and environmental sustainability through resilience. Additionally, the results indicate a positive relationship with a coefficient of (β = 0.041), which means that for every 100 points change in the networked collaboration, there is a 4.1 points change in environmental sustainability through resilience in the same direction.

- H7b: Networked collaboration affects economic sustainability through resilience. (supported).

This hypothesis is supported because the relationship between networked collaboration and economic sustainability through resilience (NC -> RES -> Eco) is significant at 99 percent confidence level with a P-value of (0.003). In addition, its coefficient (β = 0.049) indicates a positive relationship in which 100 points change in the networked collaboration will lead to a 4.9 points change in economic sustainability through resilience in the same direction.

- H7c: Networked collaboration affects social sustainability through resilience. (supported).

The results of the PLS-SEM indicate that the hypothesis H3f is supported as they indicate a significant relationship between networked collaboration and social sustainability through resilience (NC -> RES -> Soc) at a 99 percent confidence level with a P-value of (0.000) and

coefficient of (β = 0.086). This means that for every 100 points change in networked collaboration, social sustainability will change by 8.6 points through resilience in the same direction.

- H8a: Supporting services affect environmental sustainability through resilience. (supported).

The P-value (0.015) of SS -> RES -> Env supports the hypothesis as it indicates a significant relationship at 95 percent confidence level between supporting services and environmental sustainability through resilience. Additionally, the results indicate a positive relationship with a coefficient of (β = 0.026), which means that for every 100 points change in the supporting services, there is a 2.6 points change in environmental sustainability through resilience in the same direction.

- H8b: Supporting services affect economic sustainability through resilience. (supported).

This hypothesis is supported because the relationship between supporting services and economic sustainability through resilience (SS -> RES -> Eco) is significant at 99 percent confidence level with a P-value of (0.002). In addition, its coefficient (β = 0.031) indicates a positive relationship in which 100 points change in the supporting service will lead to a 3.1 points change in economic sustainability through resilience in the same direction.

- H8c: Supporting services affect social sustainability through resilience. (supported).

The results of the PLS-SEM indicate that the hypothesis H3i is supported as they indicate a significant relationship between supporting services and social sustainability through resilience (SS -> RES -> Soc) at a 99 percent confidence level with a P-value of (0.000) and coefficient of (β = 0.054). This means that for every 100 points change in supporting service, social sustainability will change by 5.4 points through resilience in the same direction.

- H9a: Geographical concentration affects environmental sustainability through absorptive capacity. (supported).

The P-value (0.000) of GC -> AC -> Env supports the hypothesis as it indicates a significant relationship at 99 percent confidence level between geographical concentration and environmental sustainability through absorptive capacity. Additionally, the results indicate a positive relation with a coefficient of ($\beta = 0.073$), which means that for every 100 points change in the geographical concentration, there is a 2.8 points change in environmental sustainability through absorptive capacity in the same direction.

- H9b: Geographical concentration affects economic sustainability through absorptive capacity. (supported).

This hypothesis is supported because the relationship between geographical concentration and economic sustainability through absorptive capacity (GC -> AC -> Eco) is significant at 99 percent confidence level with a P-value of (0.000). In addition, its coefficient ($\beta = 0.063$) indicates a positive relationship in which 100 points change in the geographical concentration will lead to a 6.3 points change in economic sustainability through absorptive capacity in the same direction.

- H9c: Geographical concentration affects social sustainability through absorptive capacity. (supported).

The results of the PLS-SEM indicate that the hypothesis H31 is supported as they indicate a significant relationship between geographical concentration and social sustainability through absorptive capacity (GC -> AC -> Soc) at a 99 percent confidence level with a P-value of (0.000) and coefficient of ($\beta = 0.094$). This means that for every 100 points change in geographical

concentration, social sustainability will change by 9.7 points through absorptive capacity in the same direction.

- H10a: Networked collaboration affects environmental sustainability through absorptive capacity. (supported).

The P-value (0.001) of NC -> AC -> Env supports the hypothesis as it indicates a significant relationship at 99 percent confidence level between networked collaboration and environmental sustainability through absorptive capacity. Additionally, the results indicate a positive relationship with a coefficient of ($\beta = 0.062$), which means that for every 100 points change in the networked collaboration, there is a 6.2 points change in environmental sustainability through absorptive capacity in the same direction.

- H10b: Networked collaboration affects economic sustainability through absorptive capacity. (supported).

This hypothesis is supported because the relationship between networked collaboration and economic sustainability through absorptive capacity (NC -> AC -> Eco) is significant at 99 percent confidence level with a P-value of (0.002). In addition, its coefficient ($\beta = 0.054$) indicates a positive relationship in which 100 points change in the networked collaboration will lead to a 5.4 points change in economic sustainability through absorptive capacity in the same direction.

- H10c: Networked collaboration affects social sustainability through absorptive capacity. (supported).

The results of the PLS-SEM indicate that the hypothesis H3o is supported as they indicate a significant relationship between networked collaboration and social sustainability through absorptive capacity (NC -> AC -> Soc) at a 99 percent confidence level with a P-value of (0.000) and coefficient of (β = 0.080). This means that for every 100 points change in networked collaboration, social sustainability will change by 8.2 points through absorptive capacity in the same direction.

- H11a: Supporting services affect environmental sustainability through absorptive capacity. (supported).

The P-value (0.000) of SS -> AC -> Env supports the hypothesis as it indicates a significant relationship at 99 percent confidence level between supporting services and environmental sustainability through absorptive capacity. Additionally, the results indicate a positive relationship with a coefficient of (β = 0.077), which means that for every 100 points change in the supporting services, there is a 7.7 points change in environmental sustainability through absorptive capacity in the same direction.

- H11b: Supporting services affect economic sustainability through absorptive capacity. (supported).

This hypothesis is supported because the relationship between supporting services and economic sustainability through absorptive capacity (SS -> AC -> Eco) is significant at 99 percent confidence level with a P-value of (0.000). In addition, its coefficient (β = 0.067) indicates a

positive relationship in which 100 points change in the supporting services will lead to a 6.7 points change in economic sustainability through absorptive capacity in the same direction.

- H11c: Supporting services affect social sustainability through absorptive capacity. (supported).

The results of the PLS-SEM indicate that the hypothesis H3r is supported as they indicate a significant relationship between supporting services and social sustainability through absorptive capacity (SS -> AC -> Soc) at a 99 percent confidence level with a P-value of (0.000) and coefficient of ($\beta = 0.100$). This means that for every 100 points change in supporting service, social sustainability will change by 10 points through absorptive capacity in the same direction.

5.8.4 The impact of sustainability on organisational performance

- H12a: Environmental sustainability positively impacts operational performance (rejected).

The coefficient of ($\beta = 0.080$) and P-value (0.095) of Env -> OP indicates an insignificant relationship at 95 percent confidence level between environmental sustainability and operational performance.

- H12b: Environmental sustainability positively impacts financial performance (rejected).

The coefficient of ($\beta = 0.064$) and P-value (0.270) of Env -> FP indicates an insignificant relationship at 95 percent confidence level between environmental sustainability and financial performance.

- H13a: Economic sustainability positively impacts operational performance (supported).

The results of the PLS-SEM indicate that the hypothesis H4c is supported as they indicate a positive significant relationship between economic sustainability and operational performance (Eco -> OP) at a 99 percent confidence level with a P-value of (0.009) and coefficient of (β = 0.145). This means that for every 100 points change in economic sustainability, operational performance will change by 14.5 points in the same direction.

- H13b: Economic sustainability positively impacts financial performance (supported).

The P-value (0.002) of Eco -> FP indicates a significant relationship at 99 percent confidence level between economic sustainability and financial performance. The hypothesis is accepted because the relationship is significant and positive with a coefficient of (β = 0.189), which means that for every 100 points change in the economic sustainability, there is a 18.9 points change in financial performance in the same direction.

- H14a: Social sustainability positively impacts operational performance (supported).

This hypothesis is supported because the relation between Soc -> OP social sustainability and operational performance is significant at 99 percent confidence level with a P-value of (0.000). In addition, its coefficient (β = 0.367) indicates a positive relationship in which 100 points change in the social sustainability will lead to a 36.7 points change in operational performance in the same direction.

- H14b: Social sustainability positively impacts financial performance (supported).

The results of the PLS-SEM indicate that the hypothesis H4f is supported as they indicate a positive significant relationship between social sustainability and financial performance (Soc -> FP) at a 99 percent confidence level with a P-value of (0.000) and coefficient of ($\beta = 0.300$). This means that for every 100 points change in social sustainability, financial performance will change by 30 points in the same direction.

5.9 Summary

This chapter presented the results of the pre-test and pilot study to ensure the validity and reliability of the questionnaire. Then the statistical results of the was presented, the developed hypotheses were tested using PLS-SEM, and it indicated that supply chain cluster design characteristics, namely geographical concentration, networked collaboration and supporting services can be used as tools to enhance sustainability and maintain an acceptable level of organisational performance through building dynamic capabilities. Table 5.16 shows the summary of hypotheses testing.

Table 5.16 Summary of hypothesis testing

Hypothesis	Description	Results
H1a	Geographical concentration positively impacts organisational resilience.	Supported
H1b	Geographical concentration positively impacts organisational absorptive capacity.	Supported
H2a	Networked collaboration positively impacts organisational resilience.	Supported
H2b	Networked collaboration positively impacts organisational absorptive capacity.	Supported
H3a	Supporting service positively impacts organisational resilience.	Supported
H3b	Supporting service positively impacts organisational absorptive capacity.	Supported
H4a	Resilience positively impacts environmental sustainability.	Supported
H4b	Resilience positively impacts economic sustainability..	Supported
H4c	Resilience positively impacts social sustainability.	Supported

H5a	Absorptive capacity positively impacts environmental sustainability.	Supported
H5b	Absorptive capacity positively impacts economic sustainability..	Supported
H5c	Absorptive capacity positively impacts social sustainability.	Supported
H6a	Geographical concentration affects environmental sustainability through resilience.	Supported
H6b	Geographical concentration affects economic sustainability through resilience.	Supported
H6c	Geographical concentration affects social sustainability through resilience.	Supported
H7a	Networked collaboration affects environmental sustainability through resilience.	Supported
H7b	Networked collaboration affects economic sustainability through resilience.	Supported
H7c	Networked collaboration affects social sustainability through resilience.	Supported
H8a	Supporting services affects environmental sustainability through resilience.	Supported
H8b	Supporting services affects economic sustainability through resilience.	Supported
H8c	Supporting services affects social sustainability through resilience.	Supported
H9a	Geographical concentration affects environmental sustainability through absorptive capacity.	Supported
H9b	Geographical concentration affects economic sustainability through absorptive capacity.	Supported
H9c	Geographical concentration affects social sustainability through absorptive capacity.	Supported
H10a	Networked collaboration affects environmental sustainability through absorptive capacity.	Supported
H10b	Networked collaboration affects economic sustainability through absorptive capacity.	Supported
H10c	Networked collaboration affects social sustainability through absorptive capacity.	Supported
H11a	Supporting services affects environmental sustainability through absorptive capacity.	Supported
H11b	Supporting services affects economic sustainability through absorptive capacity.	Supported
H11c	Supporting services affects social sustainability through absorptive capacity.	Supported
H12a	Environmental sustainability positively impacts operational performance.	Rejected
H12b	Environmental sustainability positively impacts financial performance.	Rejected

H13a	Economic sustainability positively impacts operational performance.	Supported
H13b	Economic sustainability positively impacts financial performance.	Supported
H14a	Social sustainability positively impacts operational performance.	Supported
H13b	Social sustainability positively impacts financial performance.	Supported

CHAPTER SIX – RESEARCH DISCUSSION

6.1 Introduction

This chapter provides a discussion on the output of structural equation modelling illustrated in the previous chapter. First, a summary of key findings is illustrated followed by a discussion of how the research questions and objectives were highlighted. Then, a discussion of key findings will be illustrated and, finally, a summary of the chapter will be provided. Key findings' discussion will be organised as follows: first, the direct relationship between supply chain cluster design characteristics and dynamic capabilities, then, the direct relationship between dynamic capabilities and sustainability, followed by the mediating role of dynamic capabilities between supply chain cluster design characteristics and sustainability. After that, the direct relationship between sustainability and organisational performance will be illustrated.

6.2 Summary of the key findings

Based on the combination of the three theoretical lenses used to develop the conceptual framework, it can be argued that collaboration and sharing of information and resources can enhance sustainability through dynamic capabilities and eventually increase organisational performance. In addition, collaboration and sharing of information and resources can be operationalised through the three supply chain design characteristics. This argument was also supported through empirical evidence from this study through proving a positive relationship between design characteristics and sustainability, in addition to a positive relationship between dynamic capabilities and sustainability. Furthermore, dynamic capabilities can significantly mediate the relationship between supply chain cluster design characteristics and sustainability. Moreover, the statistical

results proved that social and economic sustainability could significantly enhance operational and financial performance.

These relationships were tested while controlling organisation size, type and role, which contribute to the conceptualisation of the theories and generalisation of the output of the study. Firm size was significantly affecting dynamic capabilities and sustainability except for social sustainably. This means that the larger the organisation is, the greater its ability is to acquire, assimilate, transform and exploit knowledge; in addition, size of the organisation is positively related to the organisations' ability to absorb market shocks and cope with the dynamic business environment. Furthermore, it is related to enhancing environmental and economic sustainability as large organisations have more resources and knowledge to control their costs and participate in environmentally- friendly initiatives. Regarding social sustainability, organisation's size was not significant, which means that focusing on social sustainability aspects is not related to its size.

The other two control variables, organisation role and industry type, were significantly affecting economic and environmental sustainability but not social sustainability, except for pharmaceutical industry that is significantly affected by the three sustainability dimensions. This means that focusing on social sustainability is not related to organisations' role and industry type. However, because of the sensitive role of organisations working in pharmaceutical industry, they focus on all three aspects of sustainability. Since social sustainability is strongly related to religion in Egypt (Ghonimi & Awaad, 2018), it is not affected by organisation size, role or industry type.

6.3 Addressing the research questions and objectives

The first objective of this study is constructing a conceptual framework to explore the nature of the relationship between supply chain cluster design characteristics, dynamic capabilities, sustainability and organisational performance. This objective was achieved through developing the conceptual framework based on the three theoretical lenses (systems theory, extended resources based-view and dynamic capabilities theory) and a review of literature. The theoretical idea of connectedness and resource sharing introduced in the theories was conceptualised by the three design characteristics. Sustainability and performance outcomes were conceptualised by the three dimensions of sustainability (environmental, social and economic) and organisational performance (operational and financial). Finally, dynamic capabilities were conceptualised by resilience and absorptive capacity. The framework was developed to introduce supply chain clusters as a system in which its subsystems create a pool of resources that can be used to build dynamic capabilities to enhance sustainability and eventually performance. This conceptual framework helped in developing 39 hypotheses that were tested using SEM. The results echo the abstract ideas illustrated in systems theory, extended resources-based view and dynamic capabilities theory and confirm that the conceptual framework illustrated in chapter 3 is built on solid theoretical grounds.

The second objective is examining the relationship between supply chain cluster design characteristics, dynamic capabilities and sustainability to evaluate the mediating role of dynamic capabilities (resilience and absorptive capacity). This objective along with the first objective was formulated to help answering the first and second research questions *"What is the strength of the relationship between supply chain cluster design characteristics and dynamic capabilities, and*

between dynamic capabilities and sustainability?" and *"How do supply chain cluster design characteristics affect sustainability through dynamic capabilities?"* As the three theoretical lenses and empirical studies presented in the literature review, along with the research results, concluded that supply chain cluster design characteristics (geographical concentration, networked collaboration and supporting services) can be used to achieve sustainability through dynamic capabilities (resilience and absorptive capacity) and eventually enhance organisational operational and financial performance. This helped in investigating the relationship among eight constructs: the three supply chain cluster design characteristics (geographical concentration, networked collaboration and supporting services), dynamic capabilities (resilience and absorptive capacity) and the three dimensions of sustainability (environmental, social and economic) in order to illustrate the strength of the relationship and provide an in-depth understanding of the nature of the relationship among these constructs. First, the direct relationship between supply chain cluster design characteristics and dynamic capabilities was tested through the hypotheses H1a, H1b, H2a, H2b, H3a and H3b. Results illustrated that supply chain cluster design characteristics can positively impact both dynamic capabilities. Second, the relationship between dynamic capabilities and sustainability was tested in hypotheses H4a, H4b, H3c, H5a, H5b and H5c. Results confirm that resilience and absorptive capacity can enhance the three dimensions of sustainability. Third, the mediating role of dynamic capabilities was tested through the hypotheses H6a, H6b, H6c, H7a, H7b, H7c, H8a, H8b, H8c, H9a, H9b, H9c, H10a, H10b, H10c, H11a, H11band H11c. Results verify that resilience and absorptive capacity mediate the relationship between supply chain cluster design characteristics and sustainability. The results clearly indicate how supply chain cluster design characteristics affect sustainability through dynamic capabilities.

The third and final objective focusing on illustrating the impact of the three dimensions of sustainability on organisational operational and financial performance was achieved through testing the impact of environmental sustainability on operational and financial performance in H12a and H12b, in addition to the impact of economic sustainability on operational and financial performance in H13a and H13b and the impact of social sustainability on operational and financial performance in H14a and H14b. These hypotheses concluded that social sustainability and economic sustainability have a significant positive relationship with operational and financial performance. However, environmental sustainability was not significantly affecting operational and financial performance. This helped in answering the third question "*What is the nature of the relationship between sustainability and organisational performance in a supply chain cluster context?"* Table 6.1 illustrates how the findings discussed in this chapter answered the research questions through achieving the research objectives.

Table 6.1 Summary of research questions and objectives

Research questions	Research objectives	Achieved through	Findings
What is the strength of the relationship between supply chain cluster design characteristics and dynamic capabilities, and between dynamic capabilities and sustainability? How do supply chain cluster design characteristics affect sustainability through dynamic capabilities?	- Constructing a conceptual framework to explore the nature of the relationship between supply chain cluster design characteristics, dynamic capabilities, sustainability and organisational performance. - Examining the relationship between supply chain cluster design characteristics, dynamic capabilities and sustainability to	- Developing and testing the conceptual framework - Testing the developed hypotheses H1a, H1b, H2a, H2b, H3a, H3b, H4a, H4b, H3c, H5a, H5b, H5c, H6a, H6b, H6c, H7a, H7b, H7c, H8a, H8b, H8c, H9a, H9b, H9c, H10a, H10b, H10c, H11a, H11b and H11c	- The framework was built on solid theoretical foundation and can be generalised to help organisations take advantage of cluster design characteristics to enhance their sustainability and performance through building dynamic capabilities

	evaluate the mediating role of dynamic capabilities (resilience and absorptive capacity).		- Dynamic capabilities can significantly mediate the relationship between cluster design characteristics and sustainability. In addition there is a positive direct link between (cluster design characteristics and dynamic capabilities) and (dynamic capabilities and sustainability).
What is the nature of the relationship between sustainability and organisational performance in a supply chain cluster context?	Illustrating the impact of sustainability on organisational, operational and financial performance.	Testing the developed hypotheses H12a, H12b, H13a, H13b, H14a and H14b.	Social sustainability and economic sustainability were found to be significantly affecting organisational performance; however, environmental sustainability was not significant.

6.4 Discussions of the research findings

6.4.1 Supply chain cluster design characteristics and dynamic capabilities

This study focused on the three design characteristics of supply chain clusters, which provide a holistic approach of how organisations can take advantage of being in a cluster to build dynamic capabilities. Previous studies focused on specific aspects of supply chain cluster design characteristic and one dynamic capability. For example, Belso-Martínez et al. (2016) examined

the relationship between network density, reciprocity and transitivity and absorptive capacity. D'Angelo et al. (2013) investigated the impact of networking on research and development aspects of absorptive capacity. Lis and Rozkwitalska (2020) investigated how being in a cluster can affect organisational technological capability through accumulation of knowledge, which is facilitated by absorptive capacity. Lei and Huang (2014) focused on geographical concentration and knowledge sharing, while Presutti et al. (2017) focused on close proximity to customer and its impact on absorptive capacity. Wang et al. (2018) investigated the impact of local networking on absorptive capacity. Taslimi et al. (2020) illustrated how organisations operating in a specific cluster can build resilience; however, cluster characteristics were not included in the analysis.

Other research studies focused on specific clusters to investigate how organisations' resilience or absorptive capacity can be affected when they are operating inside a cluster. In addition, organisations in these clusters were mostly operating in high-tech industries located in developed countries. For example Belso-Martínez et al. (2016) and Martinez-Sanchez et al. (2019) conducted the research on high-tech industrial cluster and absorptive capacity in Spain. Chandrashekar and Mungila Hillemane (2018) focused on high-tech industrial clusters and absorptive capacity in Bengaluru. Conz et al. (2017) investigated how organisations can enhance their resilience in wine clusters located in Europe. Golicic et al. (2017) also focused on wine clusters and resilience; however, the research scope was USA, Australia, Italy and New Zealand. Wang et al. (2018) investigated absorptive capacity in high-tech industrial clusters in China. Zapata-Cantu et al. (2020) focused on high-tech industrial clusters and absorptive capacity in Mexico.

The focus of previous research led to a lack of generalisability (Golicic et al., 2017; Lis & Rozkwitalska, 2020). The empirical evidence of this research contributes to the research gap

through answering the call of Lis and Rozkwitalska (2020) and Golicic et al. (2017) to quantitatively investigate the impact of clustering on absorptive capability and resilience, in addition to the call of Taslimi et al. (2020) who specifically focused on the role of public institutions' support in enhancing resilience in a supply chain cluster context. Finally, through using firm size and industry types as control variables, the empirical evidence can be generalised and the understanding of the nature of the relationship between supply chain cluster design characteristics and dynamic capabilities can be enhanced, especially that dynamic capabilities vary among different organisations' sizes and roles (Wall & Bellamy, 2019).

Based on the above discussion, this research has a different focus and its findings clearly fill the literature gap. Generally speaking, the empirical evidence of this study is consistent with other studies, such as (Belso-Martínez et al., 2016; Golicic et al., 2017; Lei & Huang, 2014; Sami Sultan, 2014; Wang et al., 2018), where it was proven that clustering can enhance organisational competitiveness through increasing their performance and their ability to cope with the dynamic business environment. However, other studies e.g. (Bathelt et al., 2004; Dyer & Hatch, 2006; Gilbert et al., 2008; Presutti et al., 2017; Romanelli & Khessina, 2005) argued that geographical concentration and networked collaboration can affect organisations' adaptability and performance negatively. Geographically concentrated organisations in a cluster tend to form closed networks (Boschma, 2005), which can affect their performance negatively (Presutti et al., 2017) as it decreases the international interactions with other entities; in other words, organisations tend to rely heavily on their local network and are not keen to build alliances and collaborate with entities outside their geographical location (Bathelt et al., 2004; Gilbert et al., 2008; Romanelli & Khessina, 2005). In addition, when organisations perceive that their comparative advantage is

threatened (Dyer & Hatch, 2006) when they share knowledge, they might decide not to share valuable information (Lei & Huang, 2014). This affects the diversity of knowledge (Presutti et al., 2017) and leads to a decline in organisations' performance (Bathelt et al., 2004; Gilbert et al., 2008; Romanelli & Khessina, 2005). Furthermore, connectedness through clustering (Carpenter et al., 2001; Craighead et al., 2007; Geng et al., 2013a) can lead to disruption in the whole network because of cascading failure when disturbance occurs (Geng et al., 2013a; Simmie & Martin, 2010).

However, based on the statistical results, connectedness in a supply chain cluster context can give organisations access to resources that can help them seize the opportunity of being connected to enhance sustainability through dynamic capabilities. These findings are supported by the theoretical lenses extended resource-based view (Mishra et al., 2019; Popli et al., 2017) and dynamic capabilities theory (Eisenhardt & Martin, 2000; Mandal, 2017; Ponomarov, 2012) as organisations need to acquire resources from the external environment to achieve higher sustainability levels and enhance performance, and these resources can only be acquired through forming alliances (Mishra et al., 2019). In addition, cluster members can make an impact on the cluster's external environment (Lis & Rozkwitalska, 2020) through establishing alliances among them in order to create a pool of shared resources (Lis & Rozkwitalska, 2020; Tolossa et al., 2013; Xue et al., 2012b). In return, these resources can help organisations create value (Lis & Rozkwitalska, 2020), establish links with entities outside their geographical location (Hendry et al., 2000; Huang & Xue, 2012) and participate smoothly in the global market (Huang & Xue, 2012). Furthermore, through building dynamic capabilities, organisations can enhance their

adaptability to market changes and sustain their competitive advantage (Eisenhardt & Martin, 2000; Mandal, 2017; Ponomarov, 2012).

6.4.1.1 The nature of the relationship between geographical concentration and dynamic capabilities

The statistical results contribute to the geographical concentration literature, especially that there is a debate around the nature of the relationship between geographical concentration and organisational performance (Presutti et al., 2017). Based on the statistical results, it can be confirmed that the access that geographical concentration provides to the pool of resources can in fact increase organisational ability to cope with the dynamic environment (Porter, 1998), which will eventually enhance performance (Bag, 2019; Xi et al., 2014). In addition, the accumulation of knowledge creates knowledge infrastructure (Knudsen et al., 2008). The shared infrastructure provided through clustering (Lei & Huang, 2014; Lis & Rozkwitalska, 2020; Tolossa et al., 2013; Xue et al., 2012b) allows organisations to conveniently have access to important resources when unexpected shocks hit the market and give them the ability to adapt quickly to these shocks (Lei & Huang, 2014). Furthermore, it helps organisatons to reduce the negative impact of market disruptions (Sheffi & Rice, 2005). These benefits of geographical concentration enhance organisational competitive advantage (Porter, 1998) and can eventually help in enhancing the global competitive position (Porter, 1998; Villa et al., 2009). The pool of skilled workers that organisations can use to hire allows them to expliot external knowlegde. This can enhance organisational absorptive capacity as experienced employees are able to effeciently use newly-acquired knowledge towards organisational benefit (Cordero P. & Ferreira, 2019). In return, absorptive capacity helps organisations utilise this knowledge efficiently and effectively (Flatten et al., 2011; Lane et al., 2006). The connectedness established through geographical concentration

(Porter, 1998) can be used as a bridge to span the enhanced dynamic capabilities across organisations' boundaries (Huo et al., 2014; Yu & Huo, 2019). Organisations inside a cluster can also use their enhanced capabilities (Yu & Huo, 2019) to diversify their knowledge through actively pursuing relationships with other entities that are located outside their geographical location and not solely rely on collaborating with local entities (Hendry et al., 2000).

6.4.1.2 The nature of the relationship between networked collaboration and dynamic capabilities

Geographical concentration is not the only source of competitive advantage (Sorenson et al., 2006) because forming networks can give organisations access to useful knowledge (Tether & Tajar, 2008). When organisations form networks, they tend to exchange knowledge, which leads to an increase in their performance (Wu, 2008) and can be a source of competitive advantage (Cordero P. & Ferreira, 2019; John & Pouder, 2006). The results contribute to the debate of how information sharing through networked collaboration can affect organisational competitive advantage, as some organisations tend not to share valuable information in order to protect their comparative advantage (Dyer & Hatch, 2006; Lei & Huang, 2014). However, the statistical results provide evidence that connectedness in a supply chain cluster context can give organisations access to resources that can help them seize the opportunity of being connected to enhance sustainability through dynamic capabilities. In addition, it proves that knowledge sharing through collaboration is an antecedent for organisational absorptive capacity (Cordero P. & Ferreira, 2019). In return, absorptive capacity will enhance organisations' ability to transform, acquire and exploit knowledge (Carter & Rogers, 2008). Additionally, networked collaboration enhances trust among organisations in the network (Lei & Huang, 2014), which triggers knowledge sharing (John & Pouder, 2006; Lei & Huang, 2014) and collective learning (Lei & Huang, 2014). This also allows organisations to share risk information and build knowledge about potential risks (Jüttner, 2005;

Min & Mentzer, 2004), which enhances organisational resilience (Chowdhury & Quaddus, 2016). This will help all organisations within the system as the developed dynamic capabilities can be spanned across organisations through the established links and collaborative efforts (Huo et al., 2014; Yu & Huo, 2019).

6.4.1.3 The nature of the relationship between supporting services and dynamic capabilities

Any support, such as government funding and infrastructure delivery, will help organisations as it improves business environment and organisations' competitiveness (Worldbank, 2017b). When the level of support increases (Foghani et al., 2017), such as technical support, education, information and specialised training (Porter, 1998), organisations will be able to increase their competitiveness (Foghani et al., 2017). The empirical evidence of this study contributes to the litrature gap through illustrating the impact of supporitng entities on dynamic capabilities in a supply chain cluster context as it proves that supporting service entities facilitate access to information (He, 2016; Huang & Xue, 2012; Tolossa et al., 2013), which can be used as an antecedent for organisational absorptive capacity (Alonso & Austin, 2017; Cordero P. & Ferreira, 2019). In addition, supporting service entities help in building knowledge of potential risks (Jüttner, 2005; Min & Mentzer, 2004), which enhances organisational resilience (Østergaard & Park, 2013). In general, supporting services provide training and new technological information, which allow employees and organisations to cope with dynamic business environment. In addition, government support, such as infrastructure to supply power, roads, customs and ports, can allow organisations to tackle their vulnerabilities efficiently (Chowdhury & Quaddus, 2016). Supporting services also facilitate financial support, technology (Gunasekaran et al., 2011), information regarding new technology, training (Chowdhury & Quaddus, 2016) and other services essential for business enhancement (Gunasekaran et al., 2011).

6.4.2 Dynamic capabilities and sustainability

The conceptual model developed in this study helps in investigating the nature of the relationship between dynamic capabilities (resilience and absorptive capacity) and sustainability (environmental, social and economic). As mentioned earlier, this relationship was investigated while controlling organisation size, type and role. The empirical results of this research will fill the gap highlighted by Golicic et al. (2017), who asserted that it is important to shed light on the relationship between resilience and sustainability while taking into consideration different organisations' sizes and roles. Similar points were highlighted by Aboelmaged and Hashem (2019) and Albort-Morant et al. (2018) regarding absorptive capacity as the authors argued that the relationship between absorptive capacity and sustainability needs to be investigated while controlling for firm size and role. In addition, studies investigating the relationship between absorptive capacity and sustainability mainly focused on environmental sustainability; there was no focus on how dynamic capabilities affect the three dimensions of sustainability (Ruiz-Benitez et al., 2019; Touboulic & Walker, 2015). In addition, there was a lack of studies investigating this relationship in a supply chain cluster context. For example, Aboelmaged and Hashem (2019) and Albort-Morant et al. (2018) focused on green innovation and absorptive capacity. Walton et al. (2020) focused on learning and knowledge sharing and green practices, while Riikkinen et al. (2017) focused on absorptive capacity and green purchasing practices. However, studies such as (Aboelmaged & Hashem, 2019; Golicic et al., 2017) did not fully focus on sustainability as Albort-Morant et al. (2018) only focused on green innovation and Golicic et al. (2017) only focused on financial sustainability. The positive link between dynamic capabilities and sustainability proven in this study is generally supported by their findings and dynamic capability theory, which argues

that dynamic capabilities will allow organisations to enhance sustainability through protecting and developing their resources to cope with the dynamic environment (Teece, 2007; Teece et al., 1997).

6.4.2.1 The nature of the relationship between resilience and sustainability

Sustainability's main objectives are to maintain desirable conditions for current generations and to secure high welfare for future generations (Meacham, 2016). Resilience is needed to achieve the desired level of sustainability (Anderies et al., 2013) because without resilience, any system will be vulnerable and will not be able to maintain high sustainability levels (Ben-Menahem et al., 2013; Blackmore & Plant, 2008). The statistical results illustrated that if organisations build the ability to adapt and absorb market shocks, they will be able to enhance sustainability. In this sense, resilience is needed to maintain sustainability of organisations and their supply chains before (Loh Hui et al., 2017), during and after disruptions (Park et al., 2013). It also proves that resilience can positively impact sustainability (Carpenter et al., 2001) as market disruption can lead to a dramatic decline in organisational functionality, and resilience can help in maintaining its function (Cox Rimante, 2015) during and after disruption (Chang et al., 2010a; Chang et al., 2010b), in addition to protecting organisations from potential future risks through decreasing organisational vulnerability (Ismail Farrah, 2017).

In a dynamic business environment, organisations are unable to sustain their operations; resilience allows organisation to adapt to the constantly changing environment (Flint et al., 2011; Golicic et al., 2017). For example, labour strikes lead to an inability to fulfill delivery commitments, and organisations become unable to meet their contractual agreements (Blackhurst et al., 2005). Resilience allows organisations to keep original production schedules with the lowest cost possible (Tang, 2006) while reducing waste and emissions through establishing strategies, such as a

recovery plan and sharing of information and resources (Eshetu et al., 2017). Resilience also helps in building a decision support system to reach recovery solutions (Tang, 2006). This enables organisations to leap back to original operation after shocks (Yu et al., 2003), which increases customer satisfaction (Tang, 2006).

Resilience focuses on flexibility as well as speed of adaptation, because when organisations adapt more quickly than their competitors, they will be able to sustain their performance through exploiting market opportunities before competitors (Ponomarov & Holcomb, 2009). The flexibility that resilience offers to organisations, such as flexible transportation (Golicic et al., 2010) and flexible sourcing (Stevenson & Spring, 2007), enhances the quality of transportation networks, which decreases costs and enhances economic sustainability (Golicic et al., 2010). In addition, it reduces CO2 emissions, which increases environmental sustainability (Christopher et al., 2011). Furthermore, it eliminates wastes (Govindan et al., 2014), which decreases the negative impact on society (Ruiz-Benitez et al., 2019) and the environment (Turrisi et al., 2013) and leads to improvements in the social conditions (Govindan et al., 2014). All these benefits of building resilience help organisations achieve their main goal of enhancing sustainable performance (economic, environmental and social) (Anderies et al., 2013; Golicic et al., 2017).

6.4.2.2 The nature of the relationship between absorptive capacity and sustainability

The high level of absorption capacity is an antecedent for enhancing sustainability (Riikkinen et al., 2017) in order to exploit sustainability-related knowledge and information (Abareshi & Molla, 2013; Haugh & Talwar, 2010), which means that absorptive capacity facilitates the implementation of sustainability dimensions (Delmas et al., 2011; Kauppi et al., 2013; Schiele, 2007). Statistical results show that resilience is not the only dynamic capability that can be used to

enhance sustainability as absorptive capacity can also positively affect sustainability through absorbing and exploiting knowledge from its external environment.

Organisations can understand stakeholders' demands and the expectations of any future changes needed in their service and/or product through acquiring knowledge (Riikkinen et al., 2017). Since sustainability-related knowledge is not necessarily owned by organisations, they need to enhance their absorptive capacity in order to acquire important knowledge for implementing sustainability practices (Pace, 2016). Sustainability-related information, such as new standards, certificates (Riikkinen et al., 2017) and new requirements regarding corporate social responsibility (Boyd et al., 2007), can help organisations enhance their sustainability levels (Boyd et al., 2007; Riikkinen et al., 2017). In order to facilitate the implementation of sustainable practices, sustainability-related knowledge requires absorptive capacity to be spread within and across organisations (Lee et al., 2014; Pagell et al., 2010).

6.4.3 Supply chain cluster design characteristics, sustainability and dynamic capabilities

This research uniquely identifies the role of resilience and absorptive capacity in mediating the relationship between the three cluster design characteristics and the three dimensions of sustainability. This will contribute in filling the literature gap through covering the call of Sirilertsuwan et al. (2018) regarding how clustering can affect the three dimensions of sustainability, in addition to the call of Golicic et al. (2017) who asserted that the relationship between resilience and sustainability needs to be investigated quantitatively in a supply chain cluster context. Furthermore, as illustrated in section 6.4.1 research on absorptive capacity in a supply chain cluster context e.g. (Chandrashekar & Mungila Hillemane, 2018; Lis &

Rozkwitalska, 2020; Martinez-Sanchez et al., 2019; Zapata-Cantu et al., 2020) did not include sustainability aspects.

Based on the statistical results, this study introduced dynamic capabilities as a tool for organisations operating inside a cluster to achieve and maintain high sustainability levels in a dynamic business environment. In other words, it can be concluded that dynamic capabilities (resilience and absorptive capacity) can be developed through design characteristics since absorptive capacity is used to help organisations exploit external knowledge to maintain their normal levels of operations during and after crises. In addition, resilience can help organisations face disruption and thrive quickly after it through adaptation, readiness and the ability to absorb market shocks. It can be argued that dynamic capabilities (resilience and absorptive capacity) can enhance sustainability. This means that dynamic capabilities (resilience and absorptive capacity) mediate the relationship between design characteristics and sustainability.

Even though this research has more holistic approach, its results can be supported through previous research e.g. (Flint et al., 2011; Golicic et al., 2017; Kassai et al., 2018), in addition to the positive link established in previous empirical work between dynamic capabilities and sustainability e.g. (Riikkinen et al., 2017; Teece, 2007; Zahra & George, 2002). Furthermore, the results were supported through the positive impact of clustering on dynamic capabilities established in previous research e.g. (Martinez-Sanchez et al., 2019; Taslimi et al., 2020). The results are also supported by the theoretical lenses of systems theory, where organisations inside a cluster form alliances in order to create a pool of resources, in addition to extended resources-based view (Mathews, 2003) and dynamic capabilities theory (Teece et al., 1997), as these resources are used by organisations to enhance sustainability through building dynamic capabilities.

In general, statistical results prove that absorptive capacity can be used to achieve a certain level of sustainability-related knowledge (Haugh & Talwar, 2010; Riikkinen et al., 2017), which can be used for adaptation of sustainability practices (Delmas et al., 2011). In addition, results illustrate the important role of resilience (Park et al., 2013) because risk will lead to fragile sustainability (Ahern, 2013; Blackmore & Plant, 2008), and resilience can help organisations overcome risk and decrease vulnerability (Cao, 2011; Christopher, 2016). This contributes to the relationship between dynamic capabilities and sustainability, as previous studies mainly focused on environmental sustainability (Ruiz-Benitez et al., 2019; Touboulic & Walker, 2015). Previous studies also established that clusters can enhance dynamic capabilities (Golicic et al., 2017). This study contributes to this link as it provides an in-depth investigation regarding how supply chain cluster design characteristics affect both resilience and absorptive capacity. Previous studies focused only on resilience and did not explain how different design characteristics affect both dynamic capabilities e.g. (Flint et al., 2011; Golicic et al., 2017).

Based on the above argument, it can be concluded that sustainability is considered to be the main goal that sets organisations' objectives (Anderies et al., 2013); dynamic capabilities can be used to facilitate the sustainability practices (Riikkinen et al., 2017; Teece, 2007; Zahra & George, 2002). Organisations inside a cluster develop their sustainability through building dynamic capabilities (Flint et al., 2011; Golicic et al., 2017) as supply chain cluster characteristics allow for an easier access to resources, information (Grimstad & Burgess, 2014; Tolossa et al., 2013) and knowledge generation (Lei & Huang, 2014; Mitchell et al., 2010); they also allow organisations to cope with the constantly changing market (Huang & Xue, 2012; Villa et al., 2009).

6.4.4 Sustainability and organisational performance

This study fills the literature gap through illustrating the impact of sustainability on organisational performance in a supply chain cluster context, as the adopted SEM technique allowed for simultaneous illustration of the impact of sustainability (environmental, social, economic) on organisational operational and financial performance, while taking into consideration the effect of dynamic capabilities and organisations' size, role and type. Previous research focused on comparing organisations' performance operating inside and outside clusters with no focus on any aspects of sustainability. For example Abushaikha (2018) investigated how clustering can enhance distribution performance of fast-moving consumer good. While, Sami Sultan (2014) investigating the impact of clustering on organisational innovation, customer satisfaction, business performance and profitability. In addition, it answers the call of Croom et al. (2018), Das et al. (2019) and Ni and Sun (2019) to investigate the impact of sustainability on organisational performance (financial and non-financial). Das et al. (2019) added that this relationship needs to be investigated in a supply chain cluster context. On the other hand, Croom et al. (2018) and Nath and Agrawal (2020) asserted that research is needed regarding the impact of sustainability on operational performance in different countries, while Younis and Sundarakani (2019) argued that the nature of the relationship between sustainability and organisational performance needs to be investigated in the MENA region.

The importance of sustainability comes from the fact that pursuing only financial gains can initiate a rapid economic growth (Feizpour & Mehrjardi, 2014; Geng et al., 2013b), but it will raise a lot of environmental issues and public unrest (Esfahbodi et al., 2016). However, pursuing sustainability will enhance organisational performance (Zhu et al., 2013), as well as social and

environmental aspects (Beske, 2012). Additionally, enhancing sustainability for organisations can positively affect economic growth (Hsu et al., 2013; Moldan et al., 2012). The statistical results contribute to sustainability literature as the relationship between sustainability and performance has been a topic of debate (Ni & Sun, 2019). Previous research e.g. (Curkovic & Sroufe, 2007; Golicic & Smith, 2013; Orsato, 2006; Pagell et al., 2004; Paulraj et al., 2017) debated that sustainability can negatively affect organisational performance because of the uncertainty and high capital needed. However, it can be argued, based on the statistical results of this study, that sustainability can still be a source of competitive advantage (Krause et al., 2009) as it enhances customers' as well as investors' trust (Aguinis & Glavas, 2012; Albuquerque et al., 2019; Albuquerque et al., 2020) through enhancing the overall quality (Pullman et al., 2009), reducing waste and increasing efficiency of resources' uses (Kleindorfer et al., 2005; Tachizawa & Wong, 2015).

Even though there was a lack of studies investigating the impact of the three dimensions of sustainability on organisational performance in a supply chain cluster context, the results of this study can be supported by previous literature e.g. (Aguinis & Glavas, 2012; Albuquerque et al., 2020; Song & Choi, 2018) as the empirical evidence indicated a positive and significant impact from corporate social responsibility, economic sustainability and green practices towards organisational performance in general and financial performance. In addition, the results are supported through the theoretical lenses- systems theory (Rigby et al., 2000) and extended resource based view (Mathews, 2003)- as the collaboration and availability of resources achieved through clustering can help in increasing organisational performance through enhancing sustainability. The lack of significant impact of environmental sustainability on performance contradicts with the

findings of previous studies as sustainability enhances the organisational image (Kusi-Sarpong et al., 2016; Reuter et al., 2010), through allowing it to focus on environmental and social aspects and not just economic aspects (Mzembe & Meaton, 2014). This focus will remove social and community pressure as it gives organisations a good reputation (Kusi-Sarpong et al., 2016), increases investors' trust and attracts more investments, which will eventually enhance organisational financial performance (Aguinis & Glavas, 2012). In addition, it also enhances operational performance (Carter & Liane Easton, 2011; Reuter et al., 2010) through focusing on increasing productivity with lower cost, energy, resources and a higher product lifespan (Hollos et al., 2012). However, the insignificant relationship between environmental sustainability and performance was not because of uncertainty and high capital needed as mentioned above. It can be related to the lack of customer awareness regarding environmental sustainability (Chen et al., 2006; Orsato, 2006). More specifically, in the case of Egypt, the most important factors that affect awareness for environmental sustainability are the education system (Elbarky & Elzarka, 2015; Faragallah, 2016) and the lack of resources such as clean fuel; additionally, rules and regulations regarding environmental sustainability in Egypt are far less strict than international laws (Elbarky & Elzarka, 2015). If these regulations and policies are not modified, environmental sustainability will not be developed in Egypt, even with an enhanced education system focusing on environmental sustainability education (Faragallah, 2016). Since individuals' awareness is low regarding environmental sustainability, it can be argued that customers will not regard environmental-friendly products as better than other products. Additionally, the lack of resources, such as clean fuel and weekly-enforced laws and regulations, makes environmental sustainability practices inefficient. Based on the above argument, it can be concluded that environmental sustainability is insignificant when it comes to enhancing operational and financial performance.

6.5 Summary

This chapter analyses the findings of this study and illustrates interpretations regarding tested hypotheses. The chapter discussion is divided into four sections to cover all hypotheses developed in this study. At the beginning of each section, the research gap is identified through illustrating the difference between the focus of this study and that of previous empirical studies, in addition to recommendation of future research from previous studies and how this study covered this call. Furthermore, the contribution of this study results to contradictions of findings in previous research is presented. Finally, a discussion explaining the results of the study is illustrated.

CHAPTER SEVEN – CONCLUSION AND RECOMMENDATIONS

7.1 Introduction

This chapter provides an overview of the study aim, findings and the significance of the study in terms of theoretical and practical contributions. First, an overview of the study will be illustrated, followed by theoretical and practical implications. Finally, the research limitations and recommendations for future research will be illustrated.

7.2 Overview of the study

Since the uprising in the Middle East against corrupted leaders, economic instability increased dramatically (Abdelbary, 2018; Elzarka, 2013), which led to an increase in organisations' vulnerability and risk (Elzarka, 2013). However, the Egyptian government focused on stabilising the economic situation through some economic reforms (Youssef et al., 2019). These reforms are embedded in the sustainability development strategy 2030 carried out by the Egyptian government (Worldbank, 2017b). These reforms focus on environmental, economic and social dimensions of sustainability (MTI, 2019; Worldbank, 2017b), in addition to sustaining and developing clusters in order to enhance economic growth (MTI, 2019). Because of the unexpected shocks that occur in the global market in general (Conz et al., 2017) and Middle East region in particular (Abdelbary, 2018; Elzarka, 2013), organisations need to build dynamic capabilities (Brusset & Teller, 2017; Gligor & Holcomb, 2012; Riikkinen et al., 2017; Santanu, 2017; Shubham et al., 2018; Zahra & George, 2002) in order to gain the full benefits of sustainability (Flint et al., 2011; Golicic et al., 2017; Helfat et al., 2007; Ketchen & Hult, 2007).

Based on the above discussion, this research aims to investigate the link between supply chain cluster design characteristics and dynamic capabilities (resilience and absorptive capacity) in an effort to develop organisational sustainability and eventually enhance organisational performance. This overall aim will be achieved through three main objectives "constructing a conceptual framework to explore the nature of the relationship between supply chain cluster design characteristics, dynamic capabilities, sustainability and organisational performance", "examining the relationship between supply chain cluster design characteristics, dynamic capabilities and sustainability to evaluate the mediating role of dynamic capabilities (resilience and absorptive capacity)" and "illustrating the impact of sustainability on organisational, operational and financial performance".

In general, in order to achieve the above objectives, a process was followed throughout the thesis. First, in chapter two, the three theoretical lenses, namely systems theory, extended resource based view and dynamic capabilities theory were combined in order to develop a theoretical framework. This framework worked as a guide to review previous studies in order to conceptualise the theoretical concepts and discover the research gap. Then in chapter three, these theories were linked to the empirical work from previous studies to develop the conceptual framework that links supply chain cluster design characteristics, namely geographical concentration, networked collaboration and supporting services to sustainability dimensions: environmental, economic and social sustainability through the dynamic capabilities (resilience and absorptive capacity) to enhance organisational, operational and financial performance. This helped in achieving the first objective.

Based on the conceptual framework, 36 hypotheses were developed in chapter three to achieve objectives 2 and 3. In chapter four, first, the research philosophy, approach and strategy were determined. Since the focus of this study is to statistically prove the significance of the relationships among the research constructs, the positivist paradigm was followed, where quantitative strategies under the deductive research approach were adapted. Second, research construct measurements were adapted from previous studies, and the first draft of the questionnaire that will be used to collect standardised data was developed. Third, data analysis techniques were illustrated including validity and reliability assessment. Finally, a pretest was carried out through interviewing practitioners and academics about the clarity, appropriateness and relevance of the questionnaire. In addition, they were given the authority to add or remove any of the items in the questionnaire. This step was followed by a pre-test including 254 completed questionnaires to further ensure the validity and reliability of the questionnaire. After the pretest and the pilot study, the final draft of the questionnaire was developed for the main study. Chapter five carried out the testing of the collected data for the main study in order to test the developed hypotheses and achieve objectives 2 and 3.

Finally, chapter six discussed the nature of the relationship between the research constructs and linked the output with previous studies. In general, the results indicated that the framework was based on solid theoretical and empirical foundations, and the empirical evidence proves that the constructs in this study are significantly related. However, environmental sustainability had no significant effect on organisational performance because of the lack of Egyptian citizens' awareness regarding aspects of environmental sustainability. In addition, control variables were

not significantly related to social sustainability because social sustainability issues in Egypt are strongly related to religion.

7.3 Theoretical contribution

The results of this study have a number of theoretical contributions. First, this research fills the gap regarding the relationship between dynamic capabilities and sustainability (Aboelmaged & Hashem, 2019; Albort-Morant et al., 2018; Golicic et al., 2017) and between sustainability and organisational performance (financial and non-financial) (Croom et al., 2018; Das et al., 2019; Ni & Sun, 2019), especially in a supply chain cluster context (Das et al., 2019; Golicic et al., 2017) as research in the field of supply chain management mainly focused on green practices and innovation (Aboelmaged & Hashem, 2019; Riikkinen et al., 2017; Song & Choi, 2018; Walton et al., 2020) when trying to investigate its link to performance (mainly financial performance) (Albuquerque et al., 2020; Song & Choi, 2018) or dynamic capabilities (Song & Choi, 2018; Walton et al., 2020)

Second, SEM technique adopted to analyse the quantitative data collected will allow for a simultaneous illustration on how dynamic capabilities (resilience and absorptive capacity) affect sustainability (environmental, social, economic) and eventually impact organisational, operational and financial performance, while taking into consideration the effect of the three supply chain cluster design characteristics (geographical concentration, networked collaboration and supporting services) and organisations' size, role and type. This will help in filling the research gap mentioned above in supply chain management literature, as it will provide a holistic picture of how organisations can enhance the three dimensions of sustainability and not just specific environmental sustainability aspects. In addition, it will help organisations increase their financial

and operational performance through building resilience and absorptive capacity using supply chain cluster design characteristics. In addition, it will also fill the gap regarding the impact of clustering on sustainability through dynamic capabilities (Golicic et al., 2017), especially that there is a need to quantitatively investigate the impact of clustering on sustainability (Sirilertsuwan et al., 2018) as previous research used case studies and focused on resilience and financial sustainability without including supply chain cluster design characteristics in the investigation (Golicic et al., 2017).

Third, the use of standardised data and control variables in this study will also help in extending systems theory, dynamic capabilities theory and extended resources based-view by promoting supply chain clusters as a system in which its sub elements (clusters members) can form links and depend on each other to create a pool of resources (systems theory).

Fourth, this study will also help in the generalisability of the abstract ideas in the theoretical lenses conceptualised in the framework, which will help in the developing of the three theoretical lenses, as previous research e.g. (Capone & Zampi, 2019; Chandrashekar & Mungila Hillemane, 2018; Patti, 2006) focused only on high-technology sectors in developed countries. In addition, this research fills the research gap through testing the proposed relationships in the conceptual framework in a developing county (Egypt) while controlling for different business sectors.

Finally, the empirical results will also contribute to supply chain management literature as they fill the gap regarding the impact of clustering on dynamic capabilities (Golicic et al., 2017; Lis & Rozkwitalska, 2020; Taslimi et al., 2020). In addition, the results of previous research on clusters and dynamic capabilities lack generalisability (Golicic et al., 2017; Lis & Rozkwitalska, 2020) as they mainly used case studies e.g. (Belso-Martínez et al., 2016; Chandrashekar & Mungila

Hillemane, 2018; Conz et al., 2017; Golicic et al., 2017; Martinez-Sanchez et al., 2019; Wang et al., 2018; Zapata-Cantu et al., 2020). Furthermore, previous studies e.g. (Belso-Martínez et al., 2016; D'Angelo et al., 2013; Lei & Huang, 2014; Presutti et al., 2017; Taslimi et al., 2020; Wang et al., 2018) focused on how organisations operating inside a cluster can enhance their resilience and absorptive capacity but did not include supply chain cluster design characteristics in the investigation (Martinez-Sanchez et al., 2019; Taslimi et al., 2020). Moreover, there is a lack of evidence on how supply chain design characteristics can be linked to performance through dynamic capabilities and sustainability e.g. (Capone & Zampi, 2019; Chandrashekar & Mungila Hillemane, 2018; Golicic et al., 2017; Liao, 2015). This conceptual framework gives organisations a way to maintain their performance and focus on sustainability through building dynamic capabilities using supply chain cluster design characteristics.

7.4 Practical contribution

The results of this study also have a number of practical contributions. First, they emphasize the importance of clusters to organisations' performance. Since clusters are also important to regional and local economic activities (Branco & Lopes, 2013), the results of this study will draw the attention to the use of cluster characteristics to enhance local organisations' competitiveness and increase economic growth through developing sustainability by building dynamic capabilities and linking it to organisational performance. In addition, it will help in development an environmental-friendly supply chain cluster as the results illustrated the importance of government support along with collaboration among organisations inside the cluster to build high levels of sustainability. This will also help the Egyptian government support local business activities and enhance economic growth through increasing exports using clusters, while taking into consideration all

aspects of sustainability as the plan to develop environmental-friendly supply chain cluster includes maximizing value added while decreasing waste and energy consumption, creating job opportunities and enhancing the well-being of the community in order to reach high income levels (MTI, 2019; Worldbank, 2017b).

Second, even though there are some limitations regarding the generalisability, empirical results can help other countries similar to Egyptian economy, such as Tunisia, as it falls under the category of lower income countries (Worldbank, 2020). In addition, these countries are focusing on developing environmental-friendly supply chain clusters (UNIDO, 2016). The empirical findings will guide organisations as well as policy makers in these countries to develop sustainability.

Third, the empirical results of this study will enhance the importance of geographically concentrated local networks established through supply chain clusters; in addition, they will give organisations a tool to use this local network to sustain their sustainability through dynamic capabilities and eventually increase their performance in a dynamic business environment.

Fourth, since resilience can help organisations overcome the trade-off between connectedness and adaptability (Geng et al., 2013a; Simmie & Martin, 2010), the positive link established between design characteristics and dynamic capabilities will allow organisations to actively build dynamic capabilities in order to gain the advantage of being in a cluster.

Fifth, as sustainability focuses on efficient use of resources and reducing cost (Duflou et al., 2012; Tam, 2018; Zhu et al., 2008a), and dynamic capabilities enhance organisations' responsiveness (Di Stefano et al., 2014; Ponomarov, 2012; Teece, 2016; Teece, 2007), it can be argued that the

significant relationship between dynamic capabilities and sustainability will allow organisations to enhance their responsiveness while reducing costs.

Sixth, during market shocks, organisations do not focus on achieving sustainability (Mari et al., 2016); the framework in this study will help organisations focus on sustainability even during market shocks.

Seventh, proving a positive impact of sustainability on organisational performance will give organisations incentives to invest in sustainability (Esfahbodi et al., 2016); in addition, it sheds the light on the relationship between sustainability and performance in a supply chain cluster context.

Eighth, this study examined the impact of the three dimensions on sustainability while taking into account the indirect impact of the three design characteristics of supply chain clusters, but previous studies focused only on comparing organisations' performance inside and outside clusters.

Finally, decision makers and governmental officials should facilitate the creation of clusters and support them through infrastructure and necessary knowledge and resources to seize the full benefits of clusters.

7.5 Research limitations

Even though this study has theoretical and practical contributions, it still has some limitations. First, the sample was collected from organisations operating in Egypt; generalizability might be limited to developing countries similar to the Egyptian economy. Factors such as religion, market mechanisms and economic situation might affect the results. Investigating the relationships

between the research constructs in developed countries while taking into consideration market features is needed.

Second, this research focused on providing a bird's eye view of how the research constructs affect each other. Subdimensions of resilience and absorptive capacity were not included; in addition, environmental uncertainty constructs were not included as a moderator between dynamic capability and sustainability.

Third, as this research focused on the relationships among the research constructs, there was no in-depth investigation on specific supply chain cluster and industry and specific business activities that needs to be carried out in order to implement resilience, absorptive capacity or the three dimensions of sustainability.

Fourth, the results provide a snapshot regarding the relationship between supply chain cluster design characteristics, dynamic capabilities, sustainability and organisational performance as the research used cross-sectional design to investigate the relationship among these constructs. This means it does not provide a dynamic interrelation between the research constructs over a long period of time.

Fifth, this research captured how supply chain cluster design characteristics affect organisational sustainability through dynamic capabilities and eventually organisational performance. However, it did not take into consideration the technological aspects that can enhance information and knowledge sharing such as industry 4.0.

Sixth, this study employed self-selecting and snowball sampling techniques that are criticised as being biased and subjective (Saunders et al., 2016). Additionally, snowball sampling technique is

criticised for being homogeneous as participants identify respondents who have similar characteristics (Sekaran & Bougie, 2016). This criticism for both self-selecting and snowball sampling techniques affects the generalisability of the results as they do not ensure that the sample will be representative (Saunders et al., 2016).

7.6 Recommendations for future research

The conceptual framework developed in this research and the findings of the empirical research can further expand knowledge. First, environmental uncertainty construct and its dimensions can be added as moderators between dynamic capabilities and sustainability, which sheds the light on the nature of the relationship between resilience and absorptive capacity and the three dimensions of sustainability under environmental uncertainty.

Second, dimensions of resilience and absorptive capacity can be further investigated and developed in a supply chain cluster context, in addition to investigating the relationships between these different dimensions and design characteristics and sustainability.

Third, this conceptual framework can still be tested in a developed country in order to further extend the theories used to construct it and improve its generalisability. In addition, longitudinal research should be carried out to capture the dynamic relationship among the research construct. Furthermore, since supply chain cluster can help in enhancing regional economic growth (Branco & Lopes, 2013), cross country analysis can be carried out especially with countries in the same region such as Egypt and Tunisia. This will provide a more universal framework of how to create and develop environmental-friendly supply chain cluster.

Fourth, an in-depth investigation is needed to practically illustrate different practices applied to implement dynamic capabilities in order to enhance sustainability in a supply chain cluster context, especially in developing countries and different industries.

Fifth, a study focusing on how research and educational institutions and governmental agencies can practically enhance sustainability through dynamic capabilities is needed.

Sixth, future studies should investigate how collaboration practices between entities in the same geographical concentration can enhance organisations' international competitiveness in a developing county.

Seventh, further investigation is needed to explore the reason behind the lack of insignificance between environmental sustainability and organisational performance.

Eighth, supply chains' internationalisation through the development of international trade allowed domestic organisations to decrease their cost through being a part of the global supply chain (Jenny, 2020). However, since COVID-19 crisis became a global pandemic (Baker et al., 2020), this global network broke down (Jenny, 2020) as it became harder and more expensive to move products and materials globally (Baldwin & Tomiura, 2020). If organisations are not able to acquire needed resources from local suppliers, their performance will decline dramatically (Cappelli & Cini, 2020; Inoue & Todo, 2020). Since securing a steady flow of resources can be achieved through forming supply chain clusters as they promote local network collaboration among geographically concentrated organisations (Geng et al., 2013a; Porter, 1998; Tolossa et al., 2013), it can be argued that supply chain clusters can be a tool to overcome international disruptive events such as COVID-19. Future research can focus on testing the framework in COVID-19

context to test whether local networks established through supply chain clusters can help organisations overcome such events, especially that short supply chains and local production are not affected by international restrictions enforced because of the crisis, and they can reach customers easily (Cappelli & Cini, 2020).

Finally, since geographical concentration as part of supply chain clusters increases organisations' innovativeness (Geng et al., 2013a) and technological advancement (Elola et al., 2012), it can be argued that it can facilitate the implementation of industry 4.0 as it promotes the required technological achievement (Ghobakhloo, 2020), resources and information sharing (Ivanov et al., 2016) and connectedness (Kamble et al., 2020). Future research can further develop the conceptual framework through adding the concepts of industry 4.0 (degitisation and smartisation) that enhance connectedness, speed of information sharing and production (Qu et al., 2019), especially that the nature of the relationship between sustainability and industry 4.0 needs further investigation (Ghobakhloo, 2020).

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Appendix A

Appendix A.1

عزيزي السيد/السيدة:
أنت مدعو للمشاركة في دراسة عن دور خصائص تصميم سلاسل امداد المجمعات الصناعية في تعزيز الأداء المؤسسي من خلال الامكانيات الديناميكية. قبل أن تقرر المشاركة، من الضروري ان تعرف الهدف من البحث وما سوف يتضمنه. تهدف هذه الدراسة لتوفير الفهم والمساعدة للمؤسسات لكي تستخدم خصائص تصميم سلاسل امداد المجمعات الصناعية للتأقلم مع البيئة التجارية النشطة وتعزيز أداء المؤسسات من خلال بناء الامكانيات الديناميكية (المرونة والقدرة الاستيعابية للسوق).
إن لإسهامك قيمة كبيرة في هذه المرحلة المهمة من البحث. لقد تم إختيارك لتشارك في هذه الدراسة لما تتمتع به من خبرة في إدارة مؤسستك ومعرفة بكيفية تحقيق مؤسستك لأهدافها الإستراتيجية. إنه قرارك إمّا إن تشارك في هذه الدراسة أو لا، وسيكون لك مطلق الحرية للإنسحاب من الدراسة في أي وقت وبدون إبداء أي أسباب. إن قرارك بالإنسحاب أو عدم المشاركة لن يؤثر علي منصبك، مسماك الوظيفي، أو أي ترقيات مستقبلية قد تحصل عليها في مؤسستك.
إذا وافقت أن تشارك فبرجاء الإجابة علي كل الأسئلة لأن البحث لن ينجح بدون إجاباتك. لن يكون هناك إمكانية للوصول للمعلومات التي ستقدمها أثناء البحث إلا للباحث والمشرفين ولن تستخدم إلا للأغراض الأكاديمية فقط. سوف يتم الاحتفاظ بها آمنة لمدة عشرة أعوام في جامعة هدرسفيلد. كما أنه لن يتم تحصيل أي معلومات تعريفية عنك كإسمك و إسم مؤسستك لضمان السرية وإخفاء الهوية. سيسرني أن أشارككم نتائج البحث النهائية مجهولة الهوية إذا رغبتم في الحصول عليها. الرجاء التواصل معي بلا تردد للمزيد من المعلومات. أشكركم مسبقا علي وقتكم ومساهمتكم و صبركم.

المخلص لكم،
محمود بركات
البريد الإلكتروني:mahmoud.barakat@hud.ac.uk

لقد قرأت المعلومات أعلاه و قررت بكامل حريتي وإرادتي أن أشارك في هذه الدراسة.

نعم، أوافق	
لا، لا أوافق	

الجزء الأول: معلومات عامة

1. برجاء ذكر منصبك في مؤسستك:

2. عدد سنوات الخبرة:

3. ما هو حجم مؤسستك (عدد الموظفين)؟
   - أقل من 10
   - 50-10
   - 250-51
   - أكثر من 250
4. موقع الشركة

إذا كانت مؤسستك تقع في منطقه صناعيه، برجاء تحديد إسم المنطقه و المدينة التي تدير المنطقة الصناعيه
إذا كانت مؤسستك لا تقع في منطقة صناعيه، فبرجاء تحديد إسم المدينة فقط

5. برجاء تحديد

دور مؤسستك

تصنيع	
تجارة تجزئة/ جملة	
تقديم خدمات	
أخرى، من فضلك وضح	

نوع الصناعة

بتروكيماويات	
القطاع الخدمي	
الترفية و السياحة	
أخرى، من فضلك وضح	

الجزء الثاني: خصائص تصميم سلاسل إمداد المجمعات الصناعية

تقع مؤسستي على مسافة قريبة من الكيانات التاليه المتواجدة فى نفس المنطقة (المدينة أو المناطق/الأحياء الصناعية التابعة لها):

	أوافق بشدة	أوافق	أوافق إلى حد ما	لا أوافق ولا أرفض	لا أوافق إلى حد ما	لا أوافق	لا أوافق بشدة
شركاء سلاسل الإمداد							
معاهد بحثية/ تعليمية محلية و/أو جامعات							
المنافسين							
الغرف التجارية و/أو إتحادات الصناعة/ التجارة المحلية							

تتعاون مؤسستك (على سبيل المثال دمج الطاقات الإنتاجية، مشاركة الموارد، المعلومات، والخدمات لكسب المال، الوقت، والميزة التنافسية) مع كيانات في نفس المنطقة (المدينة أو المناطق/الأحياء الصناعية التابعة لها)

	أوافق بشدة	أوافق	أوافق إلى حد ما	لا أوافق ولا أرفض	لا أوافق إلى حد ما	لا أوافق	لا أوافق بشدة
شركاء سلاسل الإمداد							
معاهد بحثية/ تعليمية محلية و/أو جامعات							
المنافسين							
الغرف التجارية و/أو إتحادات الصناعة/ التجارة المحلية							

تتلقى مؤسستك الدعم الفني، التعليمي، المالي أو التدريب المتخصص والمعلومات من كيانات في نفس المنطقة (المدينة أو المناطق/الأحياء الصناعية التابعة لها)

	أوافق بشدة	أوافق	أوافق إلى حد ما	لا أوافق ولا أرفض	لا أوافق إلى حد ما	لا أوافق	لا أوافق بشدة
هيئات حكومية							
الغرف التجارية و/أو إتحادات الصناعة/ التجارة المحلية							
معاهد بحثية/ تعليمية محلية و/أو جامعات							

الجزء الثالث: الإمكانيات الديناميكية، الإستدامة، و الأداء المؤسسي

القدرة على التكيف مع متغيرات السوق

برجاء تحديد إلى أىّ مدى توافق أو لا توافق مع الآتى فيما يخص مواجهة أية عراقيل مثل الخطأ البشري، الركود الإقتصادي، الكوارث طبيعية، أو تأرجح السوق
مؤسستي:

	أوافق بشدة	أوافق	أوافق إلى حد ما	لا أوافق ولا أرفض	لا أوافق إلى حد ما	لا أوافق	لا أوافق بشدة
تحتفظ بمستوى طبيعي للتشغيل خلال العراقيل							
تستجيب بشكل ملائم لأي خلل غير متوقع عن طريق الرجوع بسرعة إلى مستوى الأداء المطلوب							
لديها مستوى منخفض من الإستعداد للتعامل مع النتائج المالية السلبية للعراقيل							
تحتفظ بمستوى مرغوب فيه من الإتصال بين شركاء العمل (مثل موردين، موزعين و تجار جملة) في وقت العراقيل							
تستخدم خطط بديلة مرتبطة بالمخاطر التى تم تحديدها							
تقيم بإستمرار مستوى المخاطر التي تواجه المؤسسة							

القدرة الإستيعابية للسوق

برجاء تحديد إلي أىّ مدى توافق أو لا توافق مع الآتي مؤسستي:

	أوافق بشدة	أوافق	أوافق إلى حد ما	لا أوافق ولا أرفض	لا أوافق إلى حد ما	لا أوافق	لا أوافق بشدة
تشارك المعرفة والخبرة العملية عبر أقسامها							
تجتمع بإنتظام مع العملاء،الإستشاريين،معاهد البحث والتطوير/الجامعات أو جهات اخرى لإكتساب معارف جديدة							
تدرك التغيرات في السوق (كالمنافسة، القواعد و اللوائح الجديدة و إحصاءات السكان)							
تتعرف بسرعة على الفرص الجديدة في السوق							
تسجل وتحفظ المعارف المكتسبة حديثا للرجوع اليها مستقبلا							
يجتمع موظفوها بصورة دورية لمناقشة تبعات إتجاهات السوق الحديثة وتطور المنتجات/الخدمات الحديثة							
تدرك فائدة إضافة المعرفة الخارجية الى المعرفة الحالية							

الإستدامة البيئية

برجاء تحديد إلى أىّ مدى توافق أو لا توافق مع الآتي مؤسستي:

	أوافق بشدة	أوافق	أوافق إلى حد ما	لا أوافق ولا أرفض	لا أوافق إلى حد ما	لا أوافق	لا أوافق بشدة
تقلل من المخلفات							
تستخدم الطاقة المتجددة							
تقلل من إستهلاك الطاقة/الوقود							
تركز على الإستخدام الأمثل للخامات							
تلتزم بالمعايير البيئية							

الإستدامة الإقتصادية

برجاء تحديد إلى أىّ مدى توافق أو لا توافق مع الآتي مؤسستي تركز علي:

	أوافق بشدة	أوافق	أوافق إلى حد ما	لا أوافق ولا أرفض	لا أوافق إلى حد ما	لا أوافق	لا أوافق بشدة
تقليل تكلفة إستهلاك الطاقة							
تقليل تكلفة التشغيل (توفير الموارد في عمليات التجارة قصيرة المدى)							
خفض التكلفة اللوجستية الإجمالية كالتكلفة المتعلقة بالتخلص من النفايات والحصول على							

المواد/المنتجات بالإضافة الى جمعها، فحصها، ونقلها							

الإستدامة الإجتماعية

برجاء تحديد إلى أىّ مدى توافق أو لا توافق مع الآتي مؤسستي:

	أوافق بشدة	أوافق	أوافق إلى حد ما	لا أوافق ولا أرفض	لا أوافق إلى حد ما	لا أوافق	لا أوافق بشدة
تأخذ شكاوي المجتمع بعين الإعتبار							
تركز على صحة وسلامة العميل							
تركز على الإستقرار الوظيفى							
تقدم تبرعات بطريقة منتظمة للمجتمع							
لديها مستوى عالي من حوافز العاملين							

الأداء التشغيلي

برجاء تحديد إلى أىّ مدى توافق أو لا توافق مع الآتي مؤسستي:

	أوافق بشدة	أوافق	أوافق إلى حد ما	لا أوافق ولا أرفض	لا أوافق إلى حد ما	لا أوافق	لا أوافق بشدة
تحسن المنتجات/الخدمات لتحقق متطلبات العميل							
تقدم منتجات/خدمات جديدة سريعا الى السوق							
لديها مستوى عالي من تحسين جودة المنتجات/الخدمات							
لديها مستوى متدني من خدمة العملاء							
لديها وقت إتمام قصير (lead-time) لتلبية طلبات العملاء							
تقوم بتوصيل و تسليم الطلبات للعملاء بحسب الوقت المتفق عليه							

الأداء المالي

برجاء تحديد إلى أىّ مدى توافق أو لا توافق مع الآتي فى الثلاث سنوات الماضية حققت مؤسستي:

	أوافق بشدة	أوافق	أوافق إلى حد ما	لا أوافق ولا أرفض	لا أوافق إلى حد ما	لا أوافق	لا أوافق بشدة
مستوى عالى من النمو فى المبيعات							
مستوى عالى من النمو فى الحصة السوقية							
مستوى عالى من النمو فى العائد على الإستثمار							

Appendix A.2

Dear Sir/Madam:

You are being invited to take part in a study about the role of supply chain cluster design characteristics in sustaining organisational performance through dynamic capabilities. Before you decide to take part, it is important that you understand why the research is being done and what it will involve. The purpose of this study is to provide understanding and help organisations use supply chain cluster characteristics to cope with the dynamic business environment and sustain the organisations' performance through building dynamic capabilities (resilience and absorptive captivity).

Your contribution is really valuable at this crucial stage of the research. You have been asked to participate in this study as you have experience in running an organisation and knowledge regarding how your organisation is achieving its strategic goals. It is your decision whether or not to take part, you will be free to withdraw at any time and without giving a reasons. A decision to withdraw or a decision not to take part will not affect your position, title or any future promotions that you might take within your organisation. A decision to withdraw or a decision not to take part will not affect your position, title or any future promotions that you might take within your organisation.

If you agree to participate, please provide answers to all the questions as this research will not be successful without your responses. The data collected from this questionnaire will be accessed by the researcher and supervisors and used for academic purposes only. It will be kept secure for a period of 10 years at the University of Huddersfield, and any identifying material such as names, and your oganisation's name will not be collected to insure confidentially and anonymity. I will gladly share my final anonymous results with you if you wish to receive them. Please feel free to contact me for any further information. Thank you in advance for your time, contribution and patience.

Yours sincerely,

Mahmoud Barakat

Email: mahmoud.barakat@hud.ac.uk

I have read the above information and I freely and voluntarily choose to participate in this study.

	Yes, I consent
	No, I do not consent

Section 1 General information

1. Please mention your position in your organisation:

2. Years of experience:

3. What is the size (number of employees) of your organisation?
- Below 10
- 10-50
- 51-250
- Above 250

4. Location of your organisation:
-If your organisation is located in an industrial zone/ district, please specify the name of the city governing the zone.
-If not, please just specify the city.

5. Please, indicate:

Organisation role

Manufacturing	
Retailer/ wholesaler	
Service provider	
Other, please specify	

Industry type:

Petrochemicals	
Service sector	
Tourism and entertainment	
Other, please specify	

Section 2 Supply chain cluster design characteristics

Your organisation is in close distance proximity with the following entities located inside the same city or any industrial zones/ districts under its governance:

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
Supply chain partners							
Universities and/or local educational/ research institutions							
Competitors							
Chamber of commerce and/or local trade/ industrial associations							

Your organisation collaborates (for example through pooling production capacities, share resources, information and services to gain cost, time and competitive advantage) with entities in the same area (city or any industrial zones/ districts under its governance):

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
Supply chain partners							
Universities and/or local educational/ research institutions							
Competitors							
Chamber of commerce and/or local trade/ industrial associations							

Your organisation receives support such as technical, educational, financial or specialized training and information from entities located in the same area (city or any industrial zones/ districts under its governance):

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
Governmental bodies							
Chamber of commerce and/or local trade/ industrial associations							
Universities and/or local educational/ research institutions							

Section 3: Dynamic capabilities, sustainability and organisational performance

Resilience

Please determine to what extent you agree or disagree with the following regarding facing any disruptions, such as human error, economic recession, natural disasters or market fluctuations:
Your organisation:

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
Maintains normal level of operation during disruption							
Adequately responds to unexpected disruptions by quickly restoring normal operation							
Has a low level of preparation to deal with negative financial outcomes of disruptions							
Maintains a desired level of connectedness							

among business partners (such as suppliers, distributors and retailers) at the time of disruption							
Deploys alternative plans associated with identified risks							
Constantly evaluates the level of risk facing the organisation							

Absorptive capacity

Please determine to what extent you agree or disagree with the following
Your organisation:

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
Shares knowledge and practical experience across its units							
Regularly meets with customers, consultants, R&D institutions/ universities or third parties to acquire new knowledge							
Recognises shifts in the market (such as competition, regulation, demography)							

Identifies new opportunities in the market							
Records and stores newly-acquired knowledge for future reference							
Has its employees periodically meet to discuss consequences of new market trends and new product/service development							
Recognises the usefulness of external knowledge to existing knowledge							

Environmental sustainability

Please determine to what extent you agree or disagree with the following
Your organisation:

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
Focuses on waste reduction							
Uses renewable energy							
Reduces energy/ fuel consumption							
Optimises the use of materials							
Focuses on compliance with environmental standards							

Economic sustainability

Please determine to what extent you agree or disagree with the following - Your organisation focuses on:

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
Decrease cost of energy consumption							
Decrease operational cost (saving recourses in short-term business operations)							
Reduction of total logistics cost such as cost related to waste disposal and product/materials acquisition, collection, inspection and transportation							

Social sustainability

Please determine to what extent you agree or disagree with the following - Your organisation:

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
Takes community complaints into consideration							
Focuses on customer health and safety							
Focuses on employment stability							

Regularly donates to community							
Has a high level of employee benefits							

Operational performance

Please determine to what extent you agree or disagree with the following - Your organisation

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
Modifies products/services to meet customer requirements							
Quickly introduces new products/services into the market							
Has a high level of products/services quality enhancement							
Has a low level of customer service							
Has a short lead time for fulfilling customers' orders							
Fulfills delivery commitments							

Financial performance

Please determine to what extent you agree or disagree with the following - In the last 3 years, your organisation achieved

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
High level of growth in sales							

High level of growth in market share							
High level of growth in return on investment							

Appendix B

Appendix B.1

University of Huddersfield
Business School Research Ethics Committee
Sample organisational participation consent form (E5)
(Required for submission with application for ethical approval)

This form is to be used when consent is sought from those responsible for an organisation or institution for research to be carried out with participants within that organisation or institution. This may include schools, colleges or youth work facilities.

Title of Research Study: Developing sustainability performance through dynamic capabilities in a supply chain cluster context

Name of Researcher: Mahmoud Ramadan Mahmoud Barakat

School/College/organisation: Huddersfield Business School

- This research aims to investigate the link between supply chain cluster design characteristics and dynamic capabilities in an effort to develop organisational sustainability and eventually enhance organisational performance.
- The collection of data will be carried out using questionnaire through electronic (qualtrics) and hard copies.
- Any organisation with any size (number of employees) working in different industries, such as pharmaceuticals, petrochemicals and agriculture.

☐ I confirm that I give permission for this research to be carried out and that permission from all participants will be gained in line within my organisation's policy.

Name and position of senior manager:
……

Signature of senior manager:…..……
Date: ……

Name of Researcher: Mahmoud Ramadan Mahmoud Barakat

Signature of Researcher:
Date:

Researcher name: Mahmoud Ramadan Mahmoud Barakat
E-mail: Mahmoud.barakat@hud.ac.uk
Telephone: +201119933344
Supervisor Name: Nicoleta Tipi
Email: N.tipi@hud.ac.uk

Appendix B.2

University of HUDDERSFIELD
Inspiring tomorrow's professionals

CONSENT FORM

Title of Research Project: Developing sustainability performance through dynamic capabilities in a supply chain cluster context

It is important that you read, understand and sign the consent form. Your contribution to this research is entirely voluntary, and you are not obliged in any way to participate. If you require any further details, please contact your researcher.

I have been fully informed of the nature and aims of this study as outlined in the information sheet version 01, dated 26:07:19	□
I consent to taking part in this study	□
I understand that taking part in this study is voluntary; I have the right to withdraw at any time and without giving any reasons. A decision to withdraw, or a decision not to take part, will not affect my position or tilte.	□
I understand that the information collected will be kept in secure conditions for a period of 10 years at the University of Huddersfield.	□
I understand that no person other than the researcher/s and supervisors will have access to the information provided; however, I fully understand that the data provided may appear in journal publications, reports and theses in an anonymised, collective form.	□

If you are satisfied that you understand the information and are happy to take part in this project, please put a tick in the box aligned to each sentence and print and sign below.

Signature of Participant:	Signature of Researcher:
Print:	Print:
Date:	Date:

(One copy to be retained by Participant / one copy to be retained by Researcher)

Researcher name: Mahmoud Ramadan Mahmoud Barakat
E-mail: Mahmoud.barakat@hud.ac.uk
Telephone: +201119933344
Supervisor Name: Nicoleta Tipi
Email: N.tipi@hud.ac.uk

Appendix B.3

Developing sustainability performance through dynamic capabilities in a supply chain cluster context

INFORMATION SHEET

You are being invited to take part in a study about the role of supply chain cluster design characteristics in sustaining organisational performance through dynamic capabilities. Before you decide to take part, it is important that you understand why the research is being done and what it will involve. Please, take time to carefully read the following information and discuss it with me if you wish. Please, do not hesitate to ask if there is anything that is not clear or if you would like more information.

What is the study about?

The purpose of this study is to provide understanding and help organisations use supply chain cluster characteristics to cope with the dynamic business environment and sustain the organisations' performance through building dynamic capabilities (resilience and absorptive capacity).

Why have I been approached?

You have been asked to participate in this study as you have been identified as an expert in your field with knowledge and understanding of how your organisation is achieving its strategic goals.

Do I have to take part?

It is your decision whether or not to take part. If you decide to take part, you will be asked to sign a consent form, and you will be free to withdraw at any time and without giving any reasons. A decision to withdraw or a decision not to take part will not affect your position, title or any future promotions that you might take within your organisation.

What will I need to do?

If you agree to take part in the research, you will be asked to answer a questionnaire.

Will my identity be disclosed?

All information will be kept confidential, identifying material such as names will be removed in order to ensure anonymity.

What will happen to the information?

All information collected from you during this research will be kept secure for a period of 10 years at the Univerity of Huddersfield, and any identifying material, such as names and your oganisation's name, will not be collected. It is anticipated that the research will be published in journal papers, conference papers and thesis, in which the research data will appear in an anonimised and a collective format.

Who can I contact for further information?

If you require any further information about the research, please contact:

Researcher name : Mahmoud Ramadan Mahmoud Barakat
E-mail: Mahmoud.barakat@hud.ac.uk
Telephone: +201119933344
Supervisor Name: Nicoleta Tipi, Jialin (Snow) Wu
Email: N.tipi@hud.ac.uk; j.wu@hud.ac.uk