ATTENTION-BASED DRIVERS, OPERATIONAL RESILIENCE, AND OPERATIONAL EFFICIENCY: MODEL DEVELOPMENT AND EMPIRICAL ANALYSIS

By

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DECLARATION

I hereby declare that this submission is my own work towards the award of Doctor of Philosophy in Logistics and Supply Chain Management and that to the best of my knowledge, it contains no material previously published by another person, nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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ABSTRACT

Developing knowledge of drivers and outcomes of operational resilience is important for building resilient societies as societal welfare depends on the sustenance of business operations. However, such knowledge will not only be incomplete but also misleading if the operational resilience construct remains ambiguous. This study first develops the conceptual domain of operational resilience, and second combines insights from the attention-based view of the firm, the contingency theory, and the resource-based view to propose a model to investigate how attention to threats, uniquely, and in interaction with strategic mission rigidity and disruption orientation, affect operational resilience and how operational resilience affects operational efficiency. The proposed conceptual model is tested on survey data from 259 firms in a major Sub-Sahara African economy - Ghana. The measurement and the structural parts of the model are analysed using confirmatory factor analysis and three-stage least squares estimator respectively. Results support the arguments that operational resilience consists of two distinct theoretical components: disruption absorption and recoverability; and that attention to threats positively relates to operational resilience. Additional analysis, however, shows that there is a limit to the operational resilience benefit of attention to threats: extreme levels of attention to threats are associated with low levels of operational resilience. Further results support the arguments that strategic mission rigidity and disruption orientation negatively and positively moderate the attention to threats-operational resilience relationship respectively and that operational resilience is positively related to operational efficiency. The study demonstrates that contingency-based models can be useful for investigating the drivers and outcomes of operational resilience. A key practical implication from the study is that managers' ability to match emphasis on attention to threats with relevant attention structures may boost operational resilience, and accordingly operational efficiency.

Keywords

Attention to threats; Operational resilience; Strategic mission rigidity; Disruption orientation; Operational efficiency; Attention-based view of the firm; Contingency theory; Resource-based view; Ghana

DEDICATION

This work is dedicated, with deep love and appreciation, to my family.

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Like some, I am convinced effort matters. Yet, I don't believe it singularly explains success. Many have contributed in diverse ways to the completion of this work, and I see it as a privilege to have received their love and support. I thank God and my Saviour Jesus Christ for always looking for me, keeping me safe and strong, and giving me all that it takes for one to be successful in this life. I'm indebted to my able and wonderful supervisors (Prof Nathaniel Boso and Prof Jonathan Annan) for giving me the opportunity to do this research and also helping me to complete on time. It was evident that the support you were offering me was beyond the limits of your responsibilities but you never hesitated to do so. I know I did nothing to deserve all that. When I knew all hope was lost, the two of you found me another. I appreciate and value your guidance, kindness, patience, encouragement, and friendship, and also, the scholarly skills and virtues you've freely given me. Can't thank you enough.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

In today's business environment characterised by high levels of disruptions[1] (Business Continuity Institute, 2018; Kwak *et al.*, 2018), attaining operational efficiency goals, and for that matter competitive advantage, is more challenging (Revilla and Saenz, 2017). Disruptions pose significant negative effects on operational, market, and financial performance (Ambulkar *et al.*, 2015), corporate reputation (Revilla and Saenz, 2017), and business survival (Bode *et al.*, 2011). For example, a study of 885 supply chain glitches by Hendricks and Singhal (2005) reports that firms that experienced such disruptions comparatively recorded 10.66% higher increases in cost and 13.88% inventory growth. Also, it is reported that Ericsson lost $400 million due to failure to receive on-time delivery of chips when its supplier's (i.e., Philips) plant caught fire (Latour, 2001).

Recent theoretical developments and empirical research suggest that resilience is an important organisational capability for firms to operate successfully in disruption situations (Kwak *et al.*, 2018; Buyl *et al.*, 2017; DesJardine *et al.*, 2017; Ambulkar *et al.*, 2015; Brandon-Jones *et al.*, 2014), achieve competitive advantage (Kwak et al., 2018), and enhance societal welfare (Buyl

[1] Disruptions are unplanned and unintended events that interrupt the normal flow of business operations (Craighead *et al.*, 2007). Examples include disturbances in the conditions in the supply market and supplier failure, transportation failure, technology/communication failure, disturbances in the demand market, product liability/failure and recalls, political turmoil and regulatory changes, strike/sabotage, changes in macro-economic indicators, cyber-attacks, terrorism, and natural disasters (Business Continuity Institute, 2018; Revilla and Saenz, 2017; Ambulkar *et al.* 2015; Pettit *et al.*, 2010). Other terms that the resilience literature uses interchangeably with "disruptions" include disruptive events, threats, catastrophes, crises, disturbances, perturbations, jolts, and changes.

et al., 2017; van der Vegt *et al.*, 2015). Accordingly, discussions on what resilience is, its drivers, and benefits have taken centre stage in policy and academic settings lately (Linnenluecke, 2015). Despite the valuable scholarly contributions made so far, the concept remains vague (DesJardine *et al.*, 2017), inhibiting its practical relevance and application (Davidson *et al.*, 2016). Besides, there is little scholarly effort to understand *operational resilience*, an operations level of the firm perspective of resilience. This study defines operational resilience as the ability of a firm's operations to absorb and recover from disruptions (cf. Buyl *et al.*, 2017, van der Vegt *et al.*, 2015; Meyer, 1982).

Prior research (Kwak *et al.*, 2018; Li *et al.*, 2017; Liu *et al.*, 2017; McCann *et al.*, 2009) has examined a few performance outcomes of different conceptual elements of resilience. Missing in this body of work is how resilience relates to operational efficiency. van der Vegt *et al.* (2015, p.975) argue that limited knowledge of the resilience-operational efficiency relationship is "unbalanced, to say the least, because resilience is often described in terms of redundancy and slack, which indicates inefficiency and comes at a cost". Meanwhile, driven by efficiency motive, business executives have long expressed doubts about resilience as a driver of operational efficiency (World Economic Forum Report, 2013). In fact, without empirical analysis, one cannot reach any meaningful conclusion on the relationship between resilience and efficiency as disruptions or lack of resilience can equally result in inefficiency.

Moreover, while literature on drivers of resilience is extensive (see e.g., Kwak *et al.*, 2018; Buyl *et al.*, 2017; DesJardine *et al.*, 2017; Tukamuhabwa *et al.*, 2016; Ambulkar *et al.*, 2015; Hohenstein *et al.*, 2015; Pettit *et al.*, 2013; Blackhurst *et al.*, 2011), there is a dearth of understanding of how and when organisational attention affects resilience. Organisational attention, the distinct focus of time and effort by a firm on specific issues and particular repertoire of answers (Ocasio, 1997), is the most essential, scarce, and sought-after resource in firms (Ambos and Birkinshaw, 2010; Yadav *et al.*, 2007). The attention-based view of the firm (ABV) stresses that the focusing of attention by firms "...allows for enhanced accuracy, speed, and maintenance of information-processing activities, facilitating perception and action for those activities attended to" (Ocasio, 1997, p. 204). Consistent with this logic, this study proposes the notion of attention to threats (cf. McMullen *et al.*, 2009) as an important driver of operational resilience. Attention to threats refers to the extent to which a firm focuses resources (including time, effort, and money) on information search and processing aimed at enhancing its understanding of, and responses to, disruptions (cf. Bouquet *et al.*, 2009; Durand and Jacqueminet, 2015; Durand, 2003). Attention to threats can improve visibility (Rerup, 2009; Bouquet *et al.*, 2009), minimise forecast error (Durand, 2003), and help in detecting weak cues that signal potential disruptions (Rerup, 2009), enabling the firm to be swifter and more effective in weathering and recovering from disruption impacts (Brandon-Jones *et al.*, 2014; Lam and Bai, 2016).

Though attentional focus is of strategic essence, it does not equate success (Titus and Anderson, 2016). The ABV argues that organisational outcomes are a function of what top executives focus attention on and the circumstances that shape their attentional focus (i.e., attention structures). Indeed, prior research (Titus and Anderson, 2016; Ambos and Birkinshaw, 2010) shows that the effects of attentional focus constructs are moderated by relevant attention structures. Therefore, and per the information search and processing nature of the attention to threats construct, the study extends the ABV to the contingency theory (Donaldson, 2006) to argue that attention structures that restrict or boost information search and processing capacity may moderate the relationship between attention to threats and operational resilience. The moderating roles of two such attention structures: *strategic mission rigidity* and *disruption orientation*; that are equally central to theorising resilient systems are investigated in this study.

The resilience literature recognises that change, learning, and innovative behaviours are key inherent characteristics of resilient systems (Chowdhury and Quaddus, 2016; Tukamuhabwa *et al.,* 2015; Folke *et al.,* 2010; Reinmoeleer and van Baardwijk, 2005; Meyer, 1982). Meanwhile, strategic management literature indicates that such behaviours can be suppressed when strategic mission rigidity is high (Atuahene-Gima *et al.*, 2005; Mone *et al.*, 1998). Strategic mission rigidity refers to the extent to which a firm's "mission is defined narrowly, is inflexible, discourages activities outside its scope, and difficult to change" (Atuahene-Gima *et al.,* 2005, p. 468). Due to their efficiency motive, strategic mission rigid firms are more likely to show little commitment to attention to threats. Besides, their inward focus inhibits external information search and learning, narrowing their information search and processing capacity. Thus, within such firms, emphasis on attention to threats may become counter-productive.

Again, prior research shows that resilience-building effort thrives among disruption-oriented firms (Bode et *al.,* 2011) and that such firms are more resilient (Ambulkar *et al.,* 2015). Disruption orientation refers to a firm's "general awareness and consciousness of, concerns about, seriousness toward, and recognition of opportunity to learn from disruptions" (Bode *et al.,* 2011, p. 873). Disruption-oriented firms can disruption-specific knowledge capacity to foster attention to threats as they recognise the opportunity to learn from disruptions. Moreover, heightened concern about disruptions and seriousness toward preparing for disruptions in such firms will not only stimulate attention to threats but also sustain it, making it more effective.

From the foregoing discussions, this study focuses on developing knowledge about resilience at the operations level of the firm. Specifically, it develops the conceptual domain of operational resilience and proposes a model to investigate how attention to threats, uniquely and in interaction with strategic mission rigidity and disruption orientation, influence operational resilience, and how operational resilience influences operational efficiency. The proposed research model is analysed in the context of firms in a major sub-Saharan African economy – Ghana. The following section discusses gaps in the resilience literature that motivates the study.

1.2 DISCUSSION OF GAPS IN THE RESILIENCE LITERATURE

1.2.1 Resilience: Conceptualisation and Measurement Concerns

The resilience concept is vague in many fields of research (DesJardine *et al.*, 2017; Davidson *et al.*, 2016). Based on interrogation and synthesis of definitions of resilience in major streams of studies that represent the forefront of researching disruptions and developing traditions for resilience theorising, Davidson *et al.* (2016) find that the core meaning of resilience is about persistence/ resistance/ system identity retention/ disruption absorption, recovery to previous state, and renewal/adaptability/ transformability. In the field of business and management, two seminal papers: Meyer (1982) and Christopher and Peck (2004); reinforce Davidson *et al.*'s (2016) position on the core meaning of resilience. Meyer's (1982) study on hospitals' responses to environmental jolt views resilience as an organisation's ability to absorb disruption impacts and operationalises it in terms of recovery rate. On the other hand, in their analysis of supply chain resilience, Christopher and Peck (2004) viewed resilience as the ability of a system (e.g., supply chain) to return to its original state or move to a new, more desirable state after being disturbed. To Christopher and Peck (2004), supply chain (re)engineering, collaboration/integration, risk management culture, and agility are crucial drivers of supply chain resilience. Recent empirical studies, however, conceptualise resilience as comprising these factors (see e.g., Brusset and Teller, 2017; Li *et al.*, 2017; Liu *et al.*, 2017; Wieland and Wallenburg, 2013; Chowdhury and Quaddus, 2017).

Moreover, while some argue that resilience is a system's response capability to disruptions and which cannot be predetermined (Sutcliffe and Vogus, 2007; Weick *et al.*, 1999), others suggest that disruption-preparedness/readiness (including anticipation) constitutes a conceptual dimension of resilience (Ponomarov and Holcomb, 2009; Kamalahmadi and Parast, 2016; Chowdhury and Quaddus, 2016). Still, other scholars suggest that since resilience is a latent concept, it can be measured indirectly by inferring its impacts on other organisational performance outcomes such as stock price (DesJardine *et al.*, 2017), return on asset (Buyl *et al.*, 2017), financial volatility, growth, and survival rate (Ortiz-de-Mandojana and Bansal, 2016).

Indeed, the ambiguous nature of the resilience concept poses a significant challenge for policy and practice (Davidson *et al*., 2016). For example, mixing the core nature of the concept with its antecedents or inferring the performance consequences of the concept from its antecedents can be misleading. Given this concern, and in response to Davidson *et al.*'s (2016) call for alternative traditions and interpretations of the term, this study focuses on developing a conceptual understanding of resilience at the operations level of the firm. The term "operational resilience" has appeared in prior research (e.g., Birkie *et al.*, 2017). However, it suffers from the same definitional and conceptualisation challenges highlighted above. Concepts that are non-core to the meaning of resilience as pointed out in Davidson et al. (2016) and other streams of research (Christopher and Peck, 2004; Brandon-Jones *et al*., 2014), but are its antecedents, have been used to conceive and measure it. For instance, Birkie *et al.* (2017) conceptualise and measure operational resilience as comprising proactive and reactive resilience-building strategies (cf. Tukamuhabwa *et al.*, 2015). The present study takes the position that operational resilience can be developed as a construct distinct from its underlying drivers or antecedents.

Coupling the interdependence among firms for resources with the observation that disruptions cause rippling adverse effects along the supply chain (Mohan and Bakshi, 2017; Kim *et al.*, 2015) appears to make resilience research at the supply chain-level more appealing, resulting in a dearth of literature on the firm-level perspective of resilience. A study of resilience at the focal firm-level is not only relevant but also appropriate. Firms make up supply chains. Thus, only if firms are resilient will supply chains be resilient. Individual firms have greater control over their internal task environment and can be swifter in strategising and responding to disruptions (McManus *et al.*, 2008). In part, it is the accumulation of individual firms' resilience-building efforts that contributes to resilient supply chains. For instance, although Nokia and Ericsson encountered the same supplier-related disruption (i.e., the fire outbreak at Philips' semiconductor plant in Albuquerque), Nokia, unlike Ericsson, effectively absorbed and recovered from the disruption (Latour, 2001), enabling the continuity of operations of its downstream supply chain. Besides, unlike the supply chain-level, an empirical analysis of resilience at the focal firm-level is more likely to be associated with fewer measurement challenges and increase validity of conclusions as in the case of the former, it becomes difficult determining which independent 'supply chains' to sample or the boundaries of each focal firm's supply chain to allow for sound measurement. It is perceived in this study that managers can provide more accurate responses when asked to indicate the level of resilience of their firms' operations than that of their supply chains/logistics networks.

1.2.2 Performance Consequences of Resilience

Several scholars (e.g., Kwak *et al.*, 2018; Ambulkar *et al.*, 2015; Brandon-Jones *et al.*, 2014) and think tanks (e.g., FM Global, The World Economic Forum, and The Business Continuity Institute) assert that the strategic value of resilience cannot be overemphasised. In line with this assertion, prior studies have associated resilience with different performance outcomes:

competitiveness/competitive advantage (McCann *et al.*, 2009; Kwak *et al.*, 2018), profitability/financial performance (Li *et al.*, 2017; McCann et al., 2009), supply chain value/performance (Chowdhury and Quaddus, 2016; Wieland and Wallenburg, 2013), operational performance (in terms of delivery performance) (Mandal, 2017), operational vulnerability (Chowdhury and Quaddus, 2017), and risk management performance (Liu *et al.*, 2017). However, beyond the concern that most of these studies (e.g., Birkie *et al.*, 2017; Mandal, 2017; Li *et al.*, 2017; Liu *et al.*, 2017; McCann *et al.*, 2009; Wieland and Wallenburg, 2013) combine the core conceptual elements of the concept with its antecedents or operationalise the concept in terms of its antecedents, there is a limited empirical understanding of the implication of resilience on operational efficiency.

In van der Vegt *et al.'s* (2015) view, the value of resilience is over-projected. To these authors, operational inefficiency, a dark-side of resilience, is often ignored in scholarly discussion on the value of resilience. Indeed, operational (in)efficiency cannot be overlooked in the analysis of resilience as resilience-building involves resource investment (Li *et al.*, 2017; van der Vegt *et al.*, 2015; Sheffi and Rice, 2005) and sometimes results in redundancies/inefficiencies (van der Vegt *et al.*, 2015; Sheffi and Rice, 2005). Nonetheless, prior research (Hendricks and Singhal, 2005) indicates that disruptions cause operational inefficiency, suggesting that firms that lack operational resilience can be operationally inefficient. This thus raises an intriguing question: *how does operational resilience affect operational efficiency, after controlling for operational disruption and investment in resilience-building (e.g., attention to threats)?* This study attempts to answer this question by examining the relationship between operational resilience and operational efficiency while controlling for operational disruption and attention to threats. The study contends that not only is operational efficiency of strategic importance (Gligor *et al.*, 2015; Boyer and Lewis, 2002), but also a logical outcome of operational resilience to investigate (van der Vegt *et al.*, 2015; World Economic Forum Report, 2013).

1.2.3 Antecedents of Resilience: Prior Theoretical Perspectives

One of the significant streams of resilience research focuses on developing knowledge of antecedents of firm/supply chain resilience. To this end, prior studies have predominantly drawn on the resource-based view/dynamic capabilities theory/relational view (Blackhurst *et al.*, 2011; Brandon-Jones *et al.*, 2014; Chowdhury and Quaddus, 2017; Kwak *et al.*, 2018; Ambulkar *et al.*, 2015; Dubey *et al.*, 2017; Wieland and Wallenburg, 2013). Other theories that have been utilised in this stream of research include systems theory (DesJardine *et al.*, 2017; Tukamuhabwa *et al.*, 2016; Blackhurst *et al.*, 2011), natural accident theory (Chowdhury and Quaddus, 2016; Linnenluecke, 2015), disaster/crisis management perspective (Chowdhury and Quaddus, 2016; Ponomarov and Holcomb, 2009), competing values framework (Mandal, 2016), contingency theory (Brandon-Jones *et al.*, 2014), and agency theory (Buyl *et al.*, 2017). Drawing on these theoretical perspectives, prior studies have investigated three broad categories of antecedents of resilience: inter-/firm resources, capabilities, and practices; firm culture, structure, orientations, and practices; and top management and leadership characteristics (see Section 2.5.1 for discussion).

Despite the valuable insights that these theoretical perspectives offer, they appear less suitable for aiding a discussion on the role of organisational attention in driving resilience. While the literature recognises that resilience-building requires resource investment (Li *et al.*, 2017; van der Vegt *et al.* 2015; Sheffi and Rice, 2005), knowledge of how firms invest time, effort, and money in resilience-building strategies remains sparse. Specifically, the extant literature scarcely discusses how and when organisational/managerial attention may affect supply chain/firm/operational resilience. In addressing this knowledge gap, the present study draws on the ABV to propose the notion of attention to threats (cf. McMullen *et al.*, 2009) as an important antecedent of operational resilience.

Some scholars (e.g., Chowdhury and Quaddus, 2016; Ponomarov and Holcomb, 2009) assert that a firm's resilience level can be invoked from its score on disruption-preparedness, an argument that is yet to receive empirical consideration. As proposed in this study, attention to threats constitutes disruption-preparedness (see Section 3.2.2.1.2) and thus allows for examining the assertion that disruption-prepared firms are resilient to disruptions. Consistent with Levinthal and Rerup's (2006) point that associating any particular attentional focus variable "with particular outcomes, particularly more-or-less favorable performance outcomes, cannot be presupposed but must be derived through analysis and empirical observation" (p. 510) and the view that a system's resilience cannot be predetermined (Sutcliffe and Vogus, 2007; Weick *et al.*, 1999), the study maintains that although attention to threats can drive operational resilience, firms that place high emphasis on attention to threats cannot be presumed to be more operationally-resilient.

1.2.4 Contingencies in Models of Antecedents of Resilience

Evidence from prior research suggests that it is appropriate for models of antecedents of resilience to be contingency-based. For example, Ambulkar *et al.* (2015) find that the effect of supply chain orientation on firm resilience is moderated by risk management infrastructure and disruption impact. Further, Brandon-Jones *et al.* (2014) find that supply complexity moderates the relationship between visibility and supply chain resilience. Moreover, Dubey *et al.* (2017) show that the effects of inter-firm trust and cooperation on supply chain resilience are moderated by behavioural uncertainty. Beyond its theoretical relevance, contingency-based models of antecedents of resilience offer practical guidelines for management on when the resilience benefit of specific resilience-building strategies will be amplified or eroded.

Nonetheless, such models are rare. Particularly, little is known about how the overall strategic direction of the firm interacts with resilience-building strategies to affect resilience. Strategic mission rigidity is an important corporate strategy-level variable that matters in the analysis of whether certain resilience-building strategies will be successful or not as it does not only point to the firm's overall proclivity for change, information search, innovation, and learning but also shapes its resource allocation decisions. Other body of research (Atuahene-Gima *et al.*, 2005; Li *et al.*, 2008) find that strategic mission rigidity undermines the benefits of proactive market orientation (which involves significant new and diverse information search). Considering this, and in answering the question of whether corporate strategy-level dispositions/behaviours of the firm matter in building resilience capability, the present study investigates the moderating role of strategic mission rigidity in the relationship between attention to threats and operational resilience.

The study also contends that not only may corporate strategy-level dispositions/behaviours of the firm matter in the successes of resilience-building strategies, but also resilience-building specific dispositions/behaviours of the firm. Bode *et al.* (2011) find that disruption orientation, uniquely and in interaction with prior experience, affect buffering and bridging strategies. Ambulkar *et al.* (2015) additionally find that disruption orientation interacts with risk management infrastructure and disruption impact to affect firm resilience. The present study examines how disruption orientation moderates the relationship between attention to threats and operational resilience.

1.2.5 Contextual Analysis of Resilience

While empirical research on firm/supply chain resilience is generally limited, an analysis of the literature reveals that knowledge of drivers and outcomes of resilience among firms in developing economies, particularly in Africa, is very underdeveloped (see Table 2.7 and Table 2.9 in Chapter Two). The bulk of the emerged studies rely on data from Asia and the U.S. Yet, firms in the sub-Saharan Africa region have in recent times been noted to be susceptible to diverse forms of disruptions, including transport network failure, technology and communication failure, energy shortage, outsourcer failure, loss of talent/skills, and currency/exchange rate volatility (Business Continuity Institute 2018:2017). Besides, firms in Africa are more sensitive to disruption impacts as the continent generally lacks the requisite economic, risk management, and supply chain infrastructure (FM Global Resilience Index Report, 2019).

Given this contextual knowledge gap, the present study draws on data from Ghana, an important economic context within the West African region (World Bank, 2017) to test its proposed research model. It is possible for firms operating within any given socio-economic context to score differently on operational resilience, and accordingly operational efficiency, due to differences in firm-level variables. In that regard, firm-level specific variables can prove useful in developing generic models of operational resilience. Yet, it is also possible that the predictive power of such models will be contingent upon relevant institutional variables (e.g., uncertainty avoidance/risk-taking culture) impacting firms' strategic responses to disruptions (e.g., investing in resilience-building). Consequently, generating context-specific insights on resilience is theoretically and practically imperative.

1.3 OBJECTIVES OF THE STUDY

In line with the discussion in Section 1.2, the study addresses three specific objectives:

1. To develop and analyse the conceptual domain of operational resilience.
2. To examine the relationship between attention to threats and operational resilience and how strategic mission rigidity and disruption orientation moderate this relationship.
3. To examine the relationship between operational resilience and operational efficiency.

In addressing research objective one, the study seeks to extend theoretical logics underpinning the notion of resilience at the operations level of the firm. Regarding research objective two, the study seeks to advance knowledge of drivers of (operational) resilience from the ABV standpoint. Drawing on the ABV, the study proposes a new construct: attention to threats, as an important driver of operational resilience. Again, the study extends the ABV to the contingency theory to investigate how two firm-level attention structures: strategic mission rigidity and disruption orientation; may moderate the relationship between attention to threats and operational resilience. In relation to the third research objective, the study aims to extend the resource-based view discussion on resilience in terms of the organisational capability nature of operational resilience and why it can be a source of (sustained) competitive advantage and drive operational efficiency. Lastly, in addressing the three research objectives using data from Ghana, the study aims to broaden the limited contextual knowledge of resilience among firms in African (or developing) economies. The following section expounds the contributions from the study.

1.4 CONTRIBUTIONS FROM THE STUDY

The study makes five key contributions:

1.4.1 Conceptual and Empirical Analyses of Operational Resilience

First, the study attempts to develop the operational resilience construct. Specifically, it defines and empirically analyses the conceptual domain of operational resilience. Following Davidson *et al.* (2016), the study argues that it is possible to develop a conceptual domain of operational resilience, devoid of either its drivers or organisational performance outcomes in order to improve its theoretical and practical relevance. Drawing on the systems theory, seminal papers (Holling, 1973; Meyer, 1982), the general idea that firms strive for stability and continuity

(Bode *et al.*, 2011) of operations, and relevant cases, the study defines operational resilience as the ability of a firm's operations to absorb and recover from disruptions (cf. van der Vegt *et al.,* 2015; Buyl *et al.,* 2017). Consistent with this definition, operational resilience is argued to consist of two theoretically distinct components: *disruption absorption* and *recoverability* (cf. DesJardine *et al.*, 2017, Buyl *et al.*, 2017). In the face of disruptions, disruption absorption preserves the structure and normal functioning of operations while recoverability restores operations to a prior normal level (DesJardine *et al.*, 2017; Buyl *et al.*, 2017). It is suggested that neither disruption absorption nor recoverability is utilised to perform or modify primary activities that create economic rent for the firm. Thus, they do not constitute either operational capabilities or dynamic capabilities.

1.4.2 Antecedents of Resilience: An Attention-based View of the Firm

The study introduces the ABV into the resilience literature as an alternative theoretical lens for investigating the question of why resilience differs among firms. This is in accordance with calls for new theories for developing and testing models of antecedents of resilience (van der Vegt *et al.*, 2015; Linnenluecke, 2015). Although the resource-based view has been the dominant and useful theoretical lens for explaining resilience, it largely focuses on stock of resources. The ABV, as utilised in this study, emphasises resource allocation/investment as necessary for creating resilience (cf. Li *et al.,* 2017; van der Vegt *et al.*, 2015; Sheffi and Rice, 2005). Specifically, the attention to threats construct, as proposed in this study, underscores investment in information search and processing as a driver of resilience. The study argues that while it is difficult to accurately predict the occurrence and impact levels of disruptions (Weick and Sutcliffe, 2007; Linnenluecke, 2015), lack of attention to threats will rather increase a firm’s susceptibility to disruptions and slow down its responses, and accordingly operational resilience.

1.4.3 Moderating Effects of Attention Structures

By integrating the ABV with the contingency theory, the research model proposed in this study advances the contingency-based approach to understanding drivers of resilience. Specifically, the study theorises how strategic mission rigidity and disruption orientation may moderate the attention to threats-operational resilience relationship. While the study argues that attention to threats can enhance operational resilience, lack of knowledge of organisational circumstances that may alter the strength and direction of the relationship may put the idea of attention to threats in a dangerous position of being ‘oversold’ or ‘undersold’ and inappropriately exploited in practice. Investigating various organisational circumstances as moderators of attention to threats offers management with a clear direction regarding situations when attention to threats may positively or negatively affect operational resilience.

An analysis of the moderating effect of strategic mission rigidity enriches the emerging view that corporate-level factors matter in resilience-building (Buyl *et al.*, 2017). Bode *et al.* (2011) show that resilience-building strategies strive among disruption-oriented firms while Ambulkar *et al.* (2015) find that disruption orientation indirectly drives firm resilience via resource reconfiguration. The present study extends insights from these studies by analysing how disruption orientation may moderate the attention to threats-operational resilience relationship.

1.4.4 Analysing the Operational Resilience-Operational Efficiency Relationship

The study extends the empirical literature on performance outcomes of resilience by analysing the relationship between operational resilience and operational efficiency. An empirical analysis of the relationship between these variables is important not because prior research has overlooked it; on the contrary, it helps in resolving the debate on resilience-efficiency linkage.

Additionally, the study advances knowledge of why superior performance outcomes may accrue from resilience. Kwak *et al.* (2018) draw on the logic of competitive heterogeneity to suggest that resilience drives competitive advantage. In linking operational resilience to operational efficiency, this study draws on the RBV to conceptualise operational resilience as a valuable, rare, inimitable, and non-substitutable (VRIN) resource, and thus a critical source of (sustained) competitive advantage and superior performance. Consequently, it is suggested that operational resilience positively relates to operational efficiency, cet par.

1.4.5 Broadening the Contextual Domain of Resilience Research

Whereas the present study addresses some important theoretical issues, it also enriches contextspecific knowledge of resilience from an African (or a developing) economy perspective. Not only are events that disrupt business operations prevalent in Africa (Business Continuity Institute 2018:2017), but also, there is a dearth of resilience-enhancers available to firms operating on the continent (FM Global Resilience Index Report, 2019). In using data from Ghana, the present study offers valuable insight on the potential drivers of operational resilience, and accordingly operational efficiency, among firms operating in similar African settings.

1.5 OUTLINE OF THE THESIS

This thesis is organised into six chapters. Chapter one presents the background of the study, discussion of gaps in the resilience literature, research objectives, and contributions from the study. Chapter two reviews conceptual and empirical bodies of literature on resilience. This chapter additionally develops the notion of operational resilience. Chapter three develops the study's theoretical approach, research model, and hypotheses. Chapter four presents the research methodology. Chapter five focuses on data analysis and presentation of results. Lastly, Chapter six discusses the theoretical and practical implications of the findings alongside limitations of the study and avenues for further research. It also presents the study's conclusion.

CHAPTER TWO

RESILIENCE: REVIEW OF THE LITERATURE

2.1 INTRODUCTION

The focal concept in this study is resilience. Consistent with the research objectives, this chapter first reviews literature on the notion of resilience and then develops a conceptual perspective of it at the operations level of the firm. The chapter again assesses prior empirical research on resilience at the firm-/supply chain-level and highlights gaps that motivate this study. Lastly, justifications for the theoretical and the methodological approaches followed to address the research objectives are discussed. Regarding the conceptual review, the broad resilience literature is considered. On the other hand, the empirical review is limited to business and management studies that examined the concept at the firm-/supply chain-level. The rest of the chapter is organised into five broad sections: brief historical account on resilience, competing conceptual perspectives on resilience, conceptual domain of operational resilience, a review of empirical studies, and chapter summary.

2.2 BRIEF HISTORICAL ACCOUNT ON RESILIENCE

The concept of resilience originated within the ecology field (Scott, 2013; Gallopín, 2006). Holling (1973), whose seminal work is associated with the term (Davidson *et al.*, 2016; Ponomarov and Holcomb, 2009), regards resilience as a property of system that allows it to absorb or accommodate disturbances without experiencing changes to the system. For Holling (1973), persistence in the face of disruption is a defining characteristic or outcome of resilience. Studies that drew on or revisited Holing's (1973) work have in fact attributed varied interpretations to what the concept means (Davidson *et al.*, 2016).

Today, the applicability of the concept extends to several fields of study, including engineering science, material science, sociology, psychology, socioecology, disaster and risk management, urban and community studies, economics, organisational studies, and supply chain management (Scott, 2013; Ponomarov and Holcomb, 2009; Davidson *et al.*, 2016). It is perceived that resilience is becoming a buzzword in academic literature (replacing "sustainability"), given the heightened global sense of disruptions (including economic, ecological, and social) (Scott, 2013). As Linnenluecke (2015) observes, the 9/11 terrorist incidence, coupled with the increasingly complex and interdependent socio-economic, financial, and technology systems and the associated heightened risk of failure over the past two decades, might have contributed to the heightened attention on resilience. Linnenluecke (2015) further notes that it is during this period that the concept first appeared in regulatory settings. Moreover, this period saw a closure on the dominant emphasis on intra-organisational reliability and moved attention to organisational coping mechanisms and response strategies in the face of high environment turbulence (Linnenluecke, 2015).

The major shift of attention on resilience started in the early 2000s where researchers and policymakers focused on evaluating its viability across several contexts (Bhamra *et al.*, 2011). A historical account by Linnenluecke (2015) reveals that Staw *et al.*'s (1981) and Meyer's (1982) studies were key in advancing the applicability of the concept in the field of business and management. While Staw *et al.* (1981) focused on how negatively framed situations lead organisations to develop risk avoidance and maladaptive response (i.e., threat-rigidity), Meyer (1982) focused on how organisations respond to external disruptions, either through (1) absorbing/recovering from impacts (via a first-order change and single-loop learning, termed "resiliency"), or (2) adopting new configurations or practices via a second-order change and double-loop learning, termed "retention").

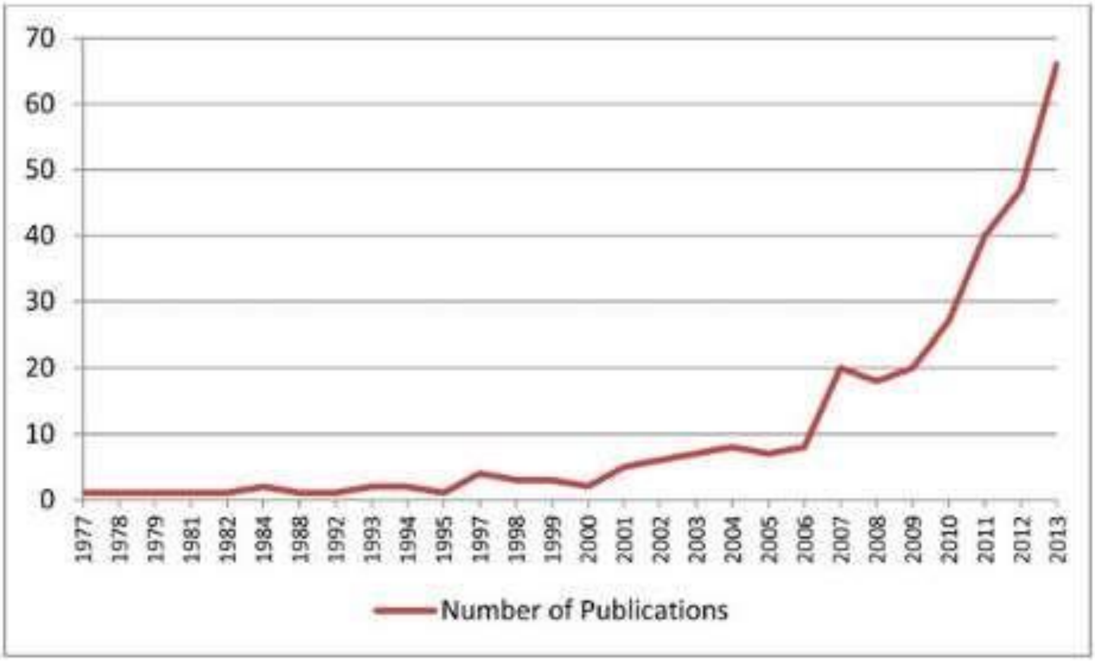

Figure 2.1: Yearly Publications on Resilience in the Business and Management Field
Source: Linnenluecke (2015)

As shown in Figure 2.1, Linnenluecke (2015) finds that the rise in research publications on resilience in the field of business and management since 2000 has been exponential. Despite the huge literature on the concept in the business and management field, empirical research has been lacking (Buyl *et al.,* 2017; Linnenluecke, 2015; van der Vegt *et al.,* 2015). Although a large proportion of the literature focuses on advancing conceptual clarity and measurement issues, the concept remains ambiguous (DesJardine *et al.,* 2017) and most of the emerged empirical studies have been exploratory and case-study based (Tukamuhabwa *et al.,* 2015). Additionally, both conceptual and empirical discussions on the concept have been narrow and scarcely highlight both the dark- and the bright-side of resilience-building (van der Vegt *et al.*, 2015).

2.3 COMPETING CONCEPTUAL PERSPECTIVES ON RESILIENCE

Generally, the resilience literature is voluminous and proposals on what the concept means are not only several but also very opposing. Davidson *et al.* (2016) note that borrowing the concept from ecological context and extending it to social contexts has led to the current confusion and ambiguity in resilience thinking. Nevertheless, there is some level of consensus that resilience represents a system's *capability* to *deal* with events that disrupt its normal functioning. However, as will be discussed in this section, the controversies on the definition, conceptualisation, and operationalisation of the concept appear to arise from:

1) The belief that different systems deal differently with disruptions, and 2) Differences in theoretical lenses utilised to explain the concept.

For example, in developing a conceptual view of resilience at the supply chain-level, Tukamuhabwa *et al.* (2016) distinguished supply chains from other systems in terms of level of complexity and inorganic-organic/dynamic nature. Drawing on the complex adaptive system theory, these scholars argue that supply chains are complex dynamic systems and thus the conceptual nature of supply chain resilience is that of co-evolution, adaptation, emergence, and self-organisation. Also, the system theory has been used to explain firm resilience as implying the ideas of disruption absorption (stability) and the recoverability (flexibility) (DesJardine *et al.* 2017). Again, Chowdhury and Quaddus (2017), Mandal (2016: 2017), and Ponomarov and Holcomb (2009) draw on the dynamic capabilities theory to argue that resilience constitutes dynamic capability that allows a firm/supply chain to prepare for unexpected events and respond to (in terms of adapting to and recovering from) disruptions. Similarly, Li *et al.* (2017) ground their logic in the dynamic capabilities theory to suggest that concepts such as preparedness, alertness, and agility are distinct dynamic capabilities and important conceptual dimensions of supply chain resilience. Moreover, Ponomarov and Holcomb (2009) and

Chowdhury and Quaddus (2016) respectively draw on the disaster management perspective/ emergency management perspective; and the natural accident theory, the high reliability theory, and the crisis management perspective to advance that disruption-preparedness/readiness, response, and recovery constitute conceptual dimensions of supply chain resilience.

Since the idea of systems and systems theory appear central in the discussion of disruptions and resilience, to facilitate discussion on the conceptual perspectives of resilience, the following subsection will highlight the idea of systems/systems theory first.

2.3.1 Systems and Systems Theory: Implications for Resilience Thinking

The idea of systems or systems theory appears to be the most fundamental underpinning of the resilience concept (see e.g., Holling, 1973; Gallopín, 2006; Scott, 2013; Fiksel, 2006; Pike *et al.*, 2010; Bruneau *et al.*, 2003; Folke *et al.*, 2010; Bhamra *et al.*, 2011; Folke *et al.*, 2004; Tukamuhabwa *et al.*, 2015; Davidson *et al.*, 2016; DesJardine *et al.*, 2017). Yet, systems come in variant forms (due to differences in degree of organicity/dynamism and degree of complexity, for example), giving rise to different units of analyses and conceptualisation of resilience.

A system is a "set of objects together with relationships between the objects and between their attributes" (Hall and Fagen, 1956, p. 18). The "objects" are the components of the system, while attributes are the properties (physical or otherwise) of objects. Relationship refers to the linkages between/among the objects or attributes within a system. It is the “relationships” that tie the system together and makes it functional and relevant (Hall and Fagen, 1956). Also, different configurations of components within a system can create multiple subsystems within it. The point is, each subsystem, when its boundaries are properly defined, can be analysed as a system on its own. Put differently, any given system may be a subsystem of another system, a complex one, to be precise. That different systems can be made up of different number of components (e.g., few-to-many) implies that systems can vary in terms of level of complexity. Complexity describes the range of components within a system and the degree of heterogeneity in its environment (Dess and Beard, 1984). It is believed that organisations characterised by high levels of complexity experience greater levels of uncertainty (Dess and Beard, 1984).

Consider a firm as a system. Some of its basic components may include people, machines, materials, and tasks. Different configurations of these create subsystems such as operations or functional units. At the supply chain-level, the firm itself is a subsystem, embedded within the network of autonomous firms that focus on fulfilling a customer's request (Flynn *et al.*, 2016; Blackhurst *et al.*, 2011). In this study, a firm's operations (rather than the 'whole' firm) is the system and the level at which resilience is conceptualised and analysed. Other systems in which the notion of resilience can be applied to include physical objects, individuals, organisations (as a whole), ecological systems, economic systems, communities/societies, and countries (Ponomarov and Holcomb, 2009; Davidson *et al.*, 2016).

The systems theory suggests that firms are open systems since they depend on, exchange materials, energies, and information, and interact with, and are influenced by their external environments (von Bertalanffy, 1950; Hall and Fagen, 1956; Kast and Rosenzweig, 1972). Within their task environments, firms extract and deploy resources (e.g., raw materials, labour, and information) to produce goods and services (Miller and Rice, 1967; Dess and Beard, 1984). Also, firms are organic systems (as opposed to inorganic ones), meaning they adapt or react to their environments in a way that is favourable to ensure stability or continued existence (Hall and Fagen, 1956).

Systems have "environment" (internal or external) and changes in their environments can negatively impact their stability (Hall and Fagen, 1956). Systems are characterised by varying levels of stability (i.e., the degree to which the variables within a system remain within defined limits [Hall and Fagen, 1956]). The occurrence of accidental events (whether from the internal or external environment) disrupts the configurations of components within a system, and consequently cause it to lose its stability. The fit between/among components within a system is crucial for its effective functioning, performance, and longevity.

2.3.2 Frame of Reference

Some studies have attempted to analyse and organise the varied conceptual perspectives on resilience. Thus, it is imperative that the present study consider and build on these studies. Key among them include Ponomarov and Holcomb (2009), Mandal (2014), Linnenluecke (2015), Tukamuhabwa *et al.* (2015), Kamalahmadi and Parast (2016), and Davidson *et al.* (2016). Except for Davidson *et al.* (2016), the other five listed studies are business and management-focused. Nevertheless, Davidson *et al.*'s (2016) study is used as the frame of reference for discussion as it provides a more in-depth and broader analysis of literature from major domains (viz., ecological, social-ecological, urban, disaster, and community) that are the forefront of researching disruptions and developing traditions for resilience theorising. Moreover, Davidson *et al.*'s (2016) study provides a more comprehensive taxonomy for discussing both the common and the opposing perspectives in the broad literature.

Through interrogation, interpretation, and synthesis of resilience definitions, Davidson *et al.* (2016) proposed nine resilience definitions subcategories (RDSs), including engineering resilience, original ecological resilience, extended ecological resilience, basic social-ecological resilience, extended social-ecological resilience, advanced social-ecological resilience, static urban resilience, social-ecological urban, evolutionary urban, basic disaster, integrated disaster resilience, advanced disaster resilience, basic community resilience, extended community resilience, and integrated community resilience. They further identified two groups of conceptual elements (i.e., core versus non-core) that characterise the RDSs and showed how the RDSs may differ within and between the two groups of conceptual elements.

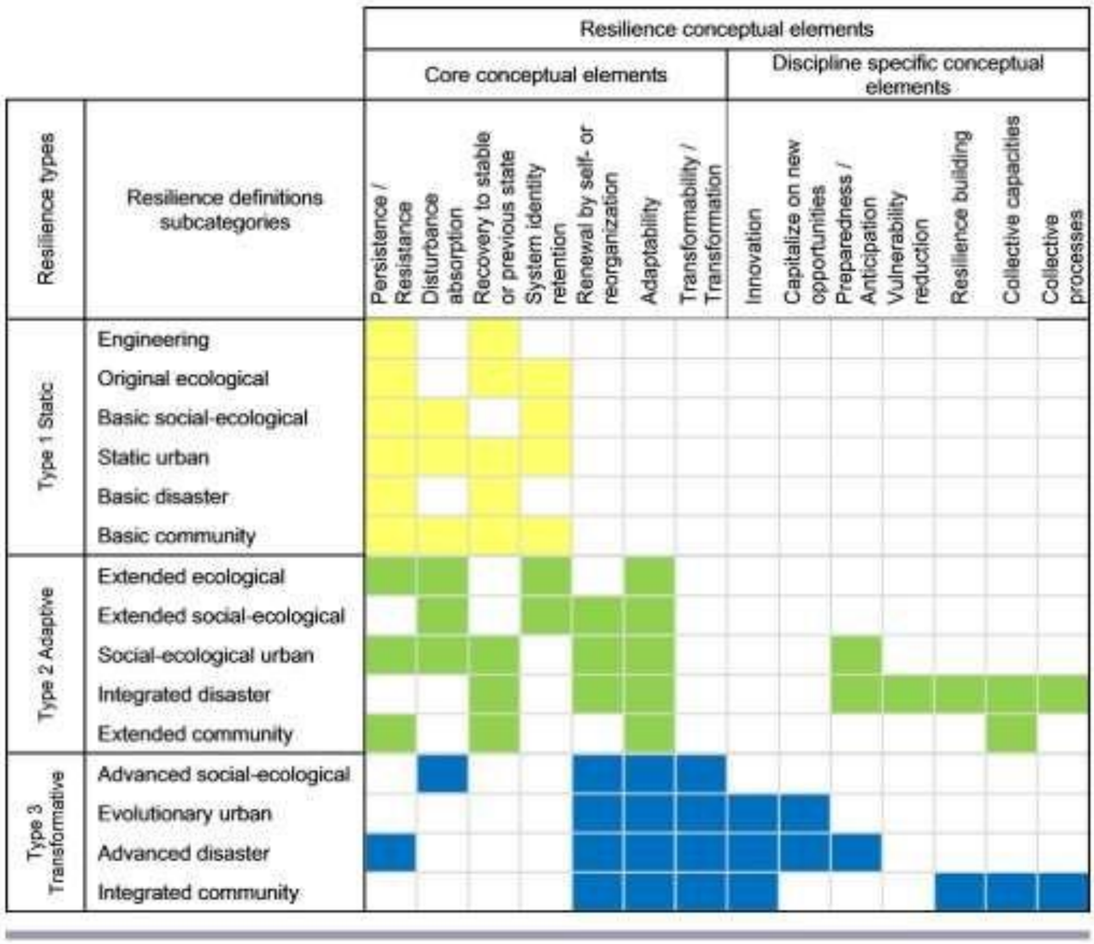

Figure 2.2: Typology of Ideal Resilience Interpretations

Source: Davidson *et al.* (2016)

As they observed, some conceptual elements (i.e., persistence/ resistance, disruption absorption, recovery to previous state, and system identity retention, renewal/self-organisation, adaptability, and transformability/transformation) are *fundamentally* associated with the idea of resilience, while others (i.e., innovation, capitalisation on new opportunities, preparedness, anticipation, vulnerability reduction, resilience building, and collective process/ capabilities) are not. Those proposed not to be essential to the base concept of resilience are believed to have resulted from particular resilience interpretations. Based on these propositions, the authors proposed three ideal resilience types, namely, Type 1 (static) resilience, Type 2 (adaptive) resilience, and Type 3 (transformative) resilience (see Figure 2.2).

Davidson *et al.* (2016) explain that systems with Type 1 resilience are characterised by core conceptual elements such as persistence/ resistance, disruption absorption, recovery to previous state, and system identity retention. Systems with Type 2 or Type 3 resilience, while may possess some of the elements of Type 1 resilience, are largely characterised by renewal/ selforganisation, adaptability, and transformability/ transformation. In addition, Systems with Type 2 and Type 3 resilience exhibit other non-conceptual elements, such as innovation, capitalisation on new opportunities, preparedness, anticipation, vulnerability reduction, resilience building, and collective process/ capabilities. The major difference between systems with Type 2 resilience and Type 3 resilience is that the latter is uniquely characterised by transition from the status quo and replacement of adaptations as the lead change response.

Giving that it is the differences in the conceptual elements that counted in Davidson *et al.*'s (2016) proposal of ideal resilience types, this study focused largely on discussing the competing perspectives on the concept, mainly around the conceptual elements. Combining Davidson *et al.*'s (2016) typology with insights from other streams of literature (including business and management field, particularly, supply chain management), this study proposes and discusses five major competing perspectives of resilience under the following labels[2]:

1. 'Original' dictionary perspective of resilience
2. Holling's (1973) perspective of resilience
3. Dynamic perspective of resilience

[2] The labels were proposed based on the researcher's own interpretation and understanding of the literature.

4. Formative perspective of resilience

5. ‘Process’ perspective of resilience

Consistent with Davidson *et al.* (2016), the first three are discussed under the label “core perspectives” while the last two are discussed under the label “non-core perspectives”.

2.3.3 Core Perspectives of Resilience

2.3.3.1 Original Dictionary Perspective of Resilience

Proponents of the ‘original’ dictionary perspective (ODP) of resilience assume that systems have and operate within their domains of attraction (i.e., a region of the state space where a system would tend to remain in the absence of disruptions [Gallopín, 2006]. According to the ODP, resilience is a property (i.e., capability) of a system that allows it (system) to return to its domain of attraction (or equilibrium state) after being displaced by an unfortunate event. In essence, proponents of the ODP of resilience limit the definition, and accordingly the measurement, of the concept to its original dictionary meaning.

Etymologically, the English word “resilience” is derived from the Latin word “resiliens” which means, the “act of rebounding” (Online Etymology Dictionary), or the Latin word “resilire”, which means to “leap or jump back” (van der Vegt *et al.*, 2015). Per this perspective, resilience implies to recoil, retract, spring back, start back, or return to a prior position (www.merriamwebster.com). The Oxford dictionary likewise defines resilience as the ability of a substance or object to spring back into shape or the capacity to recover quickly from difficulties. Relatedly, the Merriam-Webster Online Dictionary defines resilience as the capability of a strained body to recover its size and shape after deformation caused especially by compressive stress (www.merriam-webster.com). These definitions suggest that (1) resilience is a capability required to execute a specific task, that is, to *restore* the state of a negatively affected system, possibly, in a way that does not modify or change the configuration of the system prior to the disruption, (2) the need for the system to regain "fit", following a disruption, is required within the system's internal environment, and (3) if a system's normal state is not affected or its stability displaced, the extent of its resilience may be difficult to determine.

Consistent with the above explanation, the ODP suggests that, rather than as a 'proactivity' or preparedness/readiness or anticipation concept (or related ones), resilience is an aspect of a system's *response* capability (Sutcliffe and Vogus, 2007; Weick *et al.*, 1999; Gallopín, 2006), activated purposely in response to disruptions (Linnenluecke, 2015) so as to offer immediate or quick restoration (Meyer, 1982; Christopher and Peck, 2004; Sheffi and Rice, 2005; Gallopín, 2006; Bhamra *et al.*, 2011; Brandon-Jones *et al.*, 2014). As would be contrasted in the subsequent discussions, this school of thought largely believes that resilience has a singular meaning, and that is the original dictionary meaning. For Brandon-Jones *et al.* (2014), resilience connotes a system's ability to recover to its original state, after negatively affected by an event.

The ODP of resilience, which is elsewhere referred to as engineering resilience[3] (Davidson *et al.* 2016), has received a number of criticisms. It is asserted that by assuming resilience to mean 'return to previous state…'[4] is not only limiting but has little relevance and applicability to organic and or complex systems such as firms and supply chains. It is argued that organic systems may not have a single equilibrium (in other words, a single stability domain), given

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[3] This study preferred to use the label "'original' dictionary perspective" rather than "engineering perspective" as the term "engineering resilience" is sometimes used to also mean Holling's (1973) perspective of resilience (see e.g. Scott 2013).
[4] Perhaps, 'return to previous state…' is used hypothetically to mean the normal functioning of the system or its performance just before a disruption occurred. This only makes sense in the short-run. Also, practically speaking, apart from 'mechanical systems', it is hard to accept that organic systems such as firms or supply chain could 'return' to same old state when faced with disruptions. It is only about degree of proximity to or deviation from the original state, assuming, an intention was made to restore it after a disruption occurred.

their evolving or dynamic behaviour (Scott, 2013; Tukamuhabwa *et al.*, 2015). Besides, for organic systems, 'bouncing back to a prior disruption state…' should not be a desired option (Scott, 2013).

Nevertheless, the ODP of resilience remains relevant, and also applicable, to organic systems since it represents a short-term[5] response capability in the face of disruption (Scott, 2013; Weick *et al.*, 1999; Gallopín, 2006). Meyer's (1982) study of hospitals' response to environmental jolt operationalised resilience as recovery rate and suggested that it represents a first-order response capability. Gallopín (2006) contends that systems (including complex and organic ones) have multiple response capabilities for dealing with disruptions, and resilience, which he suggests to mean 'return to previous state…', constitutes one of such response capabilities. Davidson *et al.* (2016) find that even system that possess other types of responses capabilities (such as adaptability and transformability) can also possess the ODP type of resilience. Empirical studies (e.g., Meyer, 1982; Brandon-Jones *et al.*, 2014; DesJardine *et al.*, 2017; Buyl *et al.*, 2017; Kwak *et al.*, 2018) that (partly or fully) subscribe to the ODP, measured resilience in terms of recovery level/rate/ time of the system after being hit a disruption.

Table 2.1: Selected Definitions eliciting the ODP of Resilience

Author(s)	*Definition or description*
Brandon-Jones *et al.* (2014)	"The ability of a system to return to its original state, within an acceptable period of time, after being disturbed" (p. 58).
Bhamra *et al.* (2011)	"Capability and ability of an element to return to a stable state after a disruption" (p. 5376)
Sheffi and Rice (2005)	Ability of a company to bounce back from a large disruption—this includes, for instance, speed with which it returns to normal performance levels (production, services, fill rate, etc.) (p. 2)
Sheffi and Rice (2005)	Ability to bounce back from a disruption
Blackhurst *et al.* (2011)	Ability to recover from disruptive events
Henry and RamirezMarquez (2012)	Ability to bounce back, spring back after receiving a hit

Source: Developed by the Researcher (2019)

[5] A period when it is almost impossible to (or there is no need to modify the elements and configurations of) a system

2.3.3.2 Holling's (1973) Perspective of Resilience

Holling's (1973) perspective of resilience represents a major stream of resilience thinking in general, as it is the earliest thought and application of the concept (Scott, 2013; Gallopín, 2006; Davidson *et al.*, 2016; Ponomarov and Holcomb, 2009). Holling (1973) proposed that systems have two core properties, namely, stability and resilience. In Holling's (1973) view, resilience is the ability of a system to absorb changes while stability is about a system's ability to return to an equilibrium state following a temporary disturbance. He contends that persistence and degree of fluctuation of the system are the outcomes of resilience and stability respectively and that a system can be resilient and yet lack stability, and vice versa. Accordingly, other terms that are sometimes used to express the idea of "persistence" which Holling considered as the fundamental attribute of resilient systems have been resistance (Scott, 2013; Vugrin *et al.*, 2011), disruption absorption/ containment/ accommodation (Buyl *et al.*, 2017; DesJardine *et al.*, 2017; Bhamra *et al.*, 2011; Davidson *et al.*, 2016), and robustness (Bruneau *et al.*, 2003; Bhamra *et al.*, 2011).

From the above, it is clear that Holling's description of resilience (vis-à-vis what he means by "stability") runs in sharp contrast with that of the ODP. In fact, what he describes as stability rather reflects the ODP of resilience. According to the advocates of the ODP, Holling's (1973) description of resilience as a system's capability to persist or absorb change while preserving its structure and functioning does not essentially indicate resilience, but rather, a very different response capability, that is, "robustness" (see e.g., Kwak *et al.*, 2018; Christopher and Peck, 2004; Brandon-Jones *et al.*, 2014; Gallopín, 2006). For example, Brandon-Jones *et al.* (2014, p. 58) define supply chain robustness as "the ability of the supply chain to maintain its function despite internal or external disruptions". Robust systems can endure and cope with disruptions

(Klibi *et al.*, 2010; Christopher and Peck, 2004; Wieland and Wallenburg, 2012). Wieland and Wallenburg (2012) view supply chain robustness as the ability of a supply chain to resist change without adapting its initial stable configuration. As Wieland and Wallenburg (2013) explain, a robust system carries out its functions despite some damage done to it. It can retain the same stable situation it had been before being hit by disruptions. It endures and withstands, rather than adjusting to disruptions. And it performs well over a wide variety of possible scenarios. These definitions/descriptions of the term "robustness" largely reflect Holling's (1973) perspective of resilience.

Despite these conceptual overlaps or differences in the labelling of ideas, both Holling's (1973) perspective and ODP of resilience remains important in the business and management field. Some empirical studies that preferred to consider both perspectives as all aspects of "resilience" include Buyl *et al.* (2017) and DesJardine *et al.* (2017) while those that argued against this suggestion and empirically analysed them as distinct response capabilities include Kwak *et al.* (2018) and Brandon-Jones *et al.* (2014).

Table 2.2: Selected Definitions that reflect Holling's (1973) Perspective of Resilience

Author(s)	*Definition or description*
Davidson et al. (2016)	Persistence, resistance, and disruption absorption
Scott (2013)	How systems *cope with* or respond to environmental crisis and risk. It may also imply *resistance* and speed.
van der Vegt et al. (2015)	The ability of systems to *absorb* and recover from shocks,
Buyl et al. (2017)	Ability to *endure a major disruption* and its capacity to bounce back [after being disrupted]
DesJardine et al. (2017)	Ability of a system to *persist despite disruptions* and the ability to regenerate and maintain existing organisation.

Source: Developed by the Researcher (2019)

It should be noted that whether resilience connotes the Holling's (1973) perspective or the ODP assumes that a system has a single equilibrium state (Scott, 2013). However, unlike the former, the latter implicitly assumes that disruptions lead to a system losing its normal functioning, which requires the need for restoration. While an organic system such as a firm can possess both resilience types, both schools of thought appear to be silent on which resilience type is necessary or activated first, given a disruption. This clarification is necessary as disruptions come in varying degrees of impacts and firms have different levels of sensitivity (i.e., the degree to which the system can be affected negatively when a disruption occurs [Bhamra *et al.*, 2011]). Meyer (1982) note that resilience represents a *first-order change response*. However, he used the term "resilience" to mean both Holling's (1973)'s perspective and the ODP (though he operationalised it based on the ODP). The occurrence of disruptions requires immediate, time-bound, and less costly response to restrain the propagation of losses (Tukamuhabwa *et al.,* 2015). Accordingly, it can be reasoned that firms' response options can be ordered. First, accommodating the disruption without structural adjustment to operations (i.e., maintaining structure and function), if possible, is likely to be considered as the first option. Second, should operations breakdown (due to higher impacts), recovery may be considered the next option, prior to any other response options that may require either structural adjustment or transformation. This means, both perspectives of resilience can be applicable and coexist, yet it is highly likely the ODP will be a second-order response mode while Holling's (1973) perspective will be a first-order response mode, *cet. par*.

2.3.3.3 Dynamic Perspective of Resilience

The dynamic perspective focuses mainly on organic systems, and it suggests that organic systems do not have 'static' domains of stability. That is, the variables in organic systems are subject to change in the face of disruptions. Accordingly, resilience as implying 'return to previous stability state…' may not be applicable to organic systems. Some definitions that connote the dynamic perspective of resilience are presented in Table 2.3.

In the field of business and management, researchers such as Ponomarov and Holcomb (2009) and Tukamuhabwa *et al.* (2015) have viewed supply chain resilience as a dynamic/adaptive capability. Ponomarov and Holcomb (2009) suggest that adaptiveness is an inherent characteristic of a dynamic system, such as a supply chain (or an organisation), that allows it to recover from disruptions. Tukamuhabwa *et al.* (2015) extend this proposition by suggesting that for supply chains, resilience is more of a transformation or an evolutionary concept. According to Tukamuhabwa *et al.* (2015), the definitions of supply chain resilience should highlight more on the notions of co-evolutions, adaptations, emergence, self-organisation, and non-linearity. Based on this, they argue that supply chain resilience is more of a dynamic capability rather than a capability for ensuring "stability" of operations in the face of disruptions. This notion, however, contradicts the claim made by Ponomarov and Holcomb (2009) that resilient supply chains are those that maintain continuity and structure of operations. In Ponomarov and Holcomb's (2009, p. 132) view, it is the "dynamic nature of this adaptive capability allows the supply chain to recover after being disrupted, returning to its original state or achieving a more desirable state of supply chain operations".

Table 2.3: Selected Definitions that reflect the Dynamic Perspective of Resilience

Author(s)	*Definition or description*
Reinmoeleer and van Baardwijk (2005)	Capability to *self-renew over time* through innovation It also refers to successful *adaptations* to diverse and turbulent changes over time
Burnard et al. (2012)	It relates to the *adjustment of an element* in a system following the influence of a perturbation or disturbance It can be viewed as the emergent property of organisational systems that relates to the inherent and *adaptive qualities and capabilities* that enable an organisations *adapt* during turbulent periods It also relates to the *adaptive capabilities* that enable an organisation to respond to change effectively while enduring minimal discontinuity
Pettit et al. (2013)	Refers to the ability to survive, *adapt*, and *grow* in the face of turbulent change.
Freshwater (2015)	Refers to the *adaptability* to a new environment after a shock event
Christopher and Peck (2004)	Is the ability of a system to return to its original state or *move to a new, more desirable state* after being disturbed. It implies *flexibility and adaptability*.
Fiksel (2003)	The capacity for an enterprise to survive, adapt, and growth in the face of turbulent change. Resilience means survival, adaptation, and growth in the face of uncertainty and unforeseen disruptions. It is the capacity of social–ecological systems to cope with, adapt to, and shape change.

Tukamuhabwa et al. (2015)	"The adaptive capability of a supply chain to prepare for and/or respond to disruptions, to make a timely and cost-effective recovery, and therefore progress to a post-disruption state of operations - ideally, a better state than prior to the disruption (p. 5599).

Source: Developed by the Researcher (2019)

Consistent with Davidson's *et al.* (2016) typology, this study discusses two main aspects of the dynamic perspective, namely, adaptive resilience and transformative resilience. Davidson *et al.* (2016) suggest that the core elements that distinguish adaptive and transformative resilience types from the ODP and the Holling's perspective of resilience include renewal by selforganisation, adaptability, and transformation/transformability. A system that possesses transformative resilience is able to alter its normal state or constituents (Davidson *et al.*, 2016) as well as its current domain of attraction (Folke *et al.*, 2010). Similarly, a system with adaptive resilience is able to modify its elements (Davidson *et al.*, 2016) within the current domain of attraction (Folke *et al.*, 2010). However, unlike adaptive resilience, transformative resilience results in transition from the status quo (Davidson *et al.*, 2016). The likely challenges with empirically investigating into these resilience types at the firm/supply chain level may include the following:

First, the notion of resilience is linked to the idea of accidental and unplanned unfortunate events (rather than planned ones, e.g., implementing an organisational change). However, transformative resilience (or capability) may be activated *intendedly* or *unintendedly*, or in response to a disruption or no disruption (Folke *et al.*, 2010; Davidson *et al.*, 2016). Firms are organic systems (Hall and Fagen, 1956) and that means they naturally evolve and transform over time (e.g., "shrinking" or "expanding" scope of operations, or re-directing focus or compositions), not necessarily as a response to any specific disruption (Folke *et al.*, 2010). Therefore, extending the meaning of resilience to also mean transformability (or evolutionary capability) could present some measurement challenges (e.g., how does one determine whether a transformation that took place was a response to a given disruption?). Also, adaptability is believed to have multiple meanings and purposes (Gallopín, 2006). For example, if thought of as a capability, it allows an organisation, not only to achieve internal "fit" but also "fit" with its external environment (Folke *et al.*, 2010). To some scholars (Gallopín, 2006), this meaning of adaptive capability goes beyond the meaning and purpose of resilience. The idea of change in a system's constituents (in the face of disruptions) is a defining characteristic of the dynamic perspective of resilience. This, however, may span over time. This study's review of the available literature indicates that these resilience types lack empirical investigation in the business and management field. Nonetheless, it should be mentioned that, already, the business and management literature discuss the concepts of transformation and adaptive capability, although they might have not been linked to the ideas of disruptions and resilience.

2.3.4 Non-core Perspectives of Resilience

Davidson *et al.* (2016) propose that the non-core elements of resilience (e.g., innovation, capitalisation on new opportunities, preparedness, anticipation, vulnerability reduction, resilience building, and collective process/ capabilities) are not essential characteristics of the basic idea of resilience[6]. Some authors (e.g., Ponomarov and Holcomb, 2009), however, think otherwise. Two related (but different) schools of thought advance the non-core perspectives of resilience. This study discusses them under the labels 'formative' and 'process' perspectives.

2.3.4.1 Formative Perspective of Resilience

The formative perspective of resilience raises, and attempts to answer, the question of "why do some systems better *deal* with disruptions, in terms of absorbing impacts, or recovering from

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[6] In essence, the non-core elements are factors that can facilitate either the ODP type of resilience, or Holling's (1973) perspective type of resilience, or the dynamic perspective type of resilience. For example, Kwak et al. (2018) and Brandon-Jones et al. (2014) respectively investigated the effects of innovation, and visibility on both the ODP and Holling's (1973) types of resilience.

impacts, or adapting to, or transforming (themselves) in the face of disruptions"? This school of thought believes that certain factors allow some systems to better deal with disruptions and that systems that possess high levels of such factors are more 'resilient'. Christopher and Peck's (2004) thought on "creating the resilient supply chain" clearly advances this perspective. To these authors, "resilience should be designed in"[to a system]. Or "there are certain features that, if engineered into a supply chain, can improve its resilience" (p. 6). Christopher and Peck's four-factor drivers of supply chain resilience include: (1) collaboration between/among actors (collaborative planning and intelligence), (2) agility (visibility, and velocity and acceleration), and risk management culture (continuity teams, board-level responsibility and leadership, need to factor risk consideration into decision making), and (4) design principles (real options thinking, and efficiency versus redundancy) and understanding of the system (mapping and critical path analysis, and risk register).

Table 2.4: Studies that have Operationalised Resilience based on the Formative Perspective

Author(s)	*Construct label*	*Formative variables/indicators of resilience studied*
Chowdhury and Quaddus (2017)[1]	Supply chain resilience	*Proactive*: disaster readiness, flexibility, redundancy/reserve capacity, integration, efficiency, market strength, financial strength; and *Supply chain design*: density, complexity, criticality
Akgün and Keskin (2014)	Organisational resilience capacity	Behavioural preparedness, Competence orientation, Deep social capital, Original/unscripted agility, Practical habits, and Broad resource networks
McCann *et al.* (2009)	Organisational resiliency	Sense of identity and purse to survive, Support network of, and expanding external alliance, Access to capital and resources weather anything, and Defined widely held values and beliefs
Liu *et al.* (2017)	Supply chain resilience	Risk management culture, Agility, Integration, Supply chain (re)engineering
Li *et al.* (2017)	Supply chain resilience	Preparedness, Alertness, and Agility
Jain *et al.* (2017)	Supply chain resilience	Adaptive capability, Sustainability, Supply chain agility, Risk management culture, Market sensitiveness, Technological capability, Collaboration, Risk and revenue sharing, Supply chain structure, Trust, Supply chain visibility, Minimising uncertainty, Information sharing
Brusset and Teller (2017)	Supply chain resilience	Visibility, Ability to evaluate process vulnerabilities, Ability to evaluate risks, Deploy alternative plans associated with risks
Birkie *et al.* (2017)	Operational resilience	Proactive and reactive resilience-building strategies

Notes: [1]While the "proactive" and "supply chain design" dimensions are consistent with the formative perspective, Chowdhury and Quaddus (2017), including "reactive (response and recovery)" dimension, analysed the construct as a third-order reflective construct.

Source: Developed by the Researcher (2019)

Some empirical studies that drew on the formative view of resilience include Li *et al.* (2017), Birkie *et al.* (2017), Liu *et al.* (2017), Jain *et al.* (2017), Chowdhury and Quaddus (2017), Akgün and Keskin (2014), and McCann *et al.* (2009). A point worth noting here is, usually, these studies, although their definitions of resilience are consistent with either the ODP, Holling's (1973) perspective or the dynamic perspective, do not measure resilience *per se*; they infer it from the variables studied as "causes" of resilience (see Table 2.4). For example, Li *et al.*'s (2017) analysis of effect of supply chain resilience on financial performance captured the latter in terms of preparedness, alertness, and agility. Similarly, Liu *et al.*'s (2017) study on the links between supply chain resilience and risk management performance and financial performance captured supply chain resilience in terms of risk management culture, agility, integration, and supply chain re-engineering. Moreover, McCann *et al.* (2009) study on the link between organisational resiliency and firm competitiveness and profitability captured organisational resiliency in terms of sense of identity and purse to survive; support network of, and expanding external alliance; access to capital and resources weather anything; and defined widely held values and beliefs. Furthermore, Birkie *et al.* (2017) analysed the operational performance consequence of operational resilience by operationalising the latter in terms of proactive and reactive resilience-building strategies.

The formative perspective tends to present at least three theoretical and empirical concerns. The first is, factors that may drive a system's resilience to disruptions can be many. Thus, it will be difficult (if not impossible) to identify and model all in any single study as formative indicators of resilience. Second, consistent with formative measurement theory, eliminating an important indicator (for whatever reason) may alter the conceptual domain the construct (Jarvis *et al.*, 2003). Third, consistent with the core perspective of resilience, that these formative indicators are present in a system may not necessarily mean that the system is resilient. The core perspectives of resilience acknowledge that the resilience of a system can only be determined when it is exposed to a disruption. In other words, one cannot say a system is resilient when it is not hit by a disruption. Accordingly, examining the consequences of resilience based on its formative indicators may lead to wrong conclusions.

2.3.4.2 Process Perspective of Resilience

As shown in Figure 2.3, the process perspective considers resilience as a multidimensional concept, which can be understood in terms of a sequence of actions that cumulatively determine a system's resilience. In other words, the process perspective proposes that an organisation's ability to maintain its normal level of performance in the face of disruption (or regain it after being displaced) depends on how it effectively performs some series of actions, comprising input (preparing/readiness for disruptions), process (responding to disruptions), and output (e.g., absorbing and recovering from disruptions).

While there are variant propositions regarding the "sequence of actions", almost all fall into two broad groups, viz., (1) disruption-preparedness/readiness, and (2) disruption management (cf. Macdonald and Corsi, 2013; Ponomarov and Holcomb, 2009; Kamalahmadi and Parast, 2016). Some studies that better articulate and promote the process view of resilience include Ponomarov and Holcomb (2009) and Kamalahmadi and Parast (2016). Ponomarov and Holcomb (2009) draw on the four stages of emergency management (i.e., hazard mitigation, disaster preparedness (readiness), emergency response, and disaster recovery) to propose that supply chain resilience comprises readiness, response, and recovery. They further suggest that these dimensions of resilience collectively determine the system's ability to maintain structure and functioning even in the face of disruptions. Kamalahmadi and Parast (2016) build on Ponomarov and Holcomb's (2007) propositions to suggest that supply chain resilience comprises (1) anticipation (proactive thought and plans), (2) resistance (maintain control over structure and functions), and (3) recover & response (rapid and effective reaction actions).

Figure 2.3a

Figure 2.3b

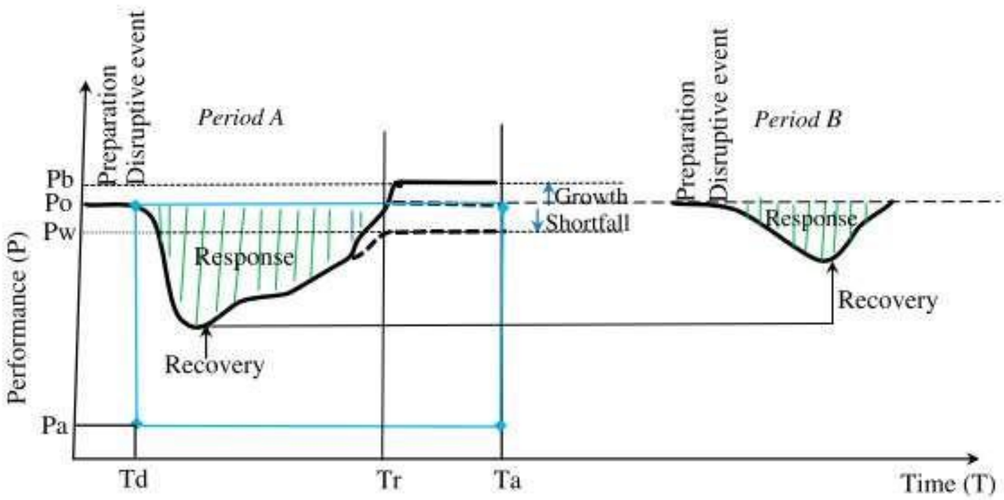

Figure 2.3c

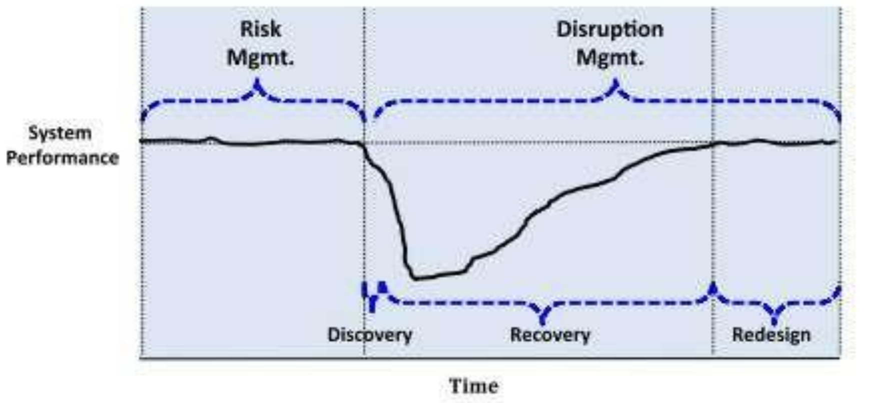

Figure 2.3: Frameworks Shaping the Process Perspective of Resilience

Source: Sheffi and Rice (2005) (Figure 2.3a), Tukamuhabwa *et al.* (2015) (Figure 2.3b), Macdonald and Corsi (2013) (Figure 2.3c)

The concerns with the process perspective could be many. This study points out three obvious ones. The first is similar to the third concern in the case of the formative perspective. The core perspectives of resilience suggest that in the absence of disruption, the resilience of a system cannot be determined. Thus, firms' readiness or preparedness for disruptions may not necessarily mean that they are 'resilient'. This is not to discount the fact that readiness can contribute to the ability to absorb and recover from disruptions. However, in as much as readiness can contribute to the ability of the firm to deal with disruptions (in terms of absorbing impacts, or recovering from impacts, or adapting to or transforming in the face of disruptions) as and when they occur, so is fighter-fighting or ad hoc problem-solving approach (cf. Winter, 2003).

The second concern is the process perspective apparently suggests a recursive causal flow from readiness to the other proposed dimensions of resilience (e.g., response and recovery [Ponomarov and Holcomb, 2009] or resistance and recover & response [Kamalahmadi and Parast, 2016]. However, empirical studies (e.g., Chowdhury and Quaddus, 2016:2017) drawing on the process perspective have not considered this. The implication of this concern is, analysing resilience a second or third order reflective or formative construct (see Chowdhury and Quaddus, 2017) can be quite problematic as there appears to be logical causal linkages from readiness to the other dimensions. Also, combining readiness with response and recovery (for example) to obtain a composite variable and examining its link with organisational performance outcomes can produce confounding results and conclusions.

The justification for regarding disruption preparedness (sometimes, referred to as 'proactive resilience' [approach/strategy] (see e.g. Li *et al.*, 2017; Chowdhury and Quaddus, 2017;

Wieland and Marcus, 2013) as a component of resilience is grounded in the disaster/risk/emergency management literature (Ponomarov and Holcomb, 2009), the crisis management literature, the normal accident theory, and the high reliability theory (Chowdhury and Quaddus, 2017; Linnenluecke, 2015).

Table 2.5: Definitions/Conceptualisations eliciting the Process Perspective of Resilience

Author(s)	Unit of analysis	Definition or description	Process dimensions
Tukamuhabwa *et al*. (2015)	Supply chain	"The adaptive capability of a supply chain to prepare for and/or respond to disruptions, to make a timely and cost-effective recovery, and therefore progress to a post-disruption state of operations - ideally, a better state than prior to the disruption (p. 5599).	• Preparation for a disruptive event • Response capabilities, recovery of the event, • Growth (or competitive advantage) after the event
Ponomarov and Holcomb's (2009)	Supply chain	"The adaptive capability of the supply chain to prepare for unexpected events, respond to disruptions, and recover from them by maintaining continuity of operations at the desired level of connectedness and control over structure and function" (p. 131)	• Event readiness • Efficient response • Recovery
Kamalahmadi and Parast (2016)	Supply chain	"The adaptive capability of a supply chain to reduce the probability of facing sudden disturbances, resist the spread of disturbances by maintaining control over structures and functions, and recover and respond by immediate and effective reactive plans to transcend the disturbance and restore the supply chain to a robust state of operations" (p. 121)	• Anticipation • Resistance • Response & and Recover
Macdonald and Corsi 2013	Supply chain		• Risk management • Disruption management: — discovery — recovery — redesign

Source: Developed by the Researcher (2019)

It is suggested that since disruptions are unavoidable and are unpredictable in nature (Linnenluecke, 2015; Blackhurst *et al.*, 2011; Jüttner and Maklan, 2011), there is the need for organisations to be in a state of preparedness (Kamalahmadi and Parast, 2016; Ponomarov and Holcomb, 2009; Chowdhury and Quaddus, 2016). Preparedness here involves mindfulness of disruptions (or disruption orientation), vigilance (monitoring and scanning), anticipation, risk identification and assessment, and putting in place contingency plans and measures (e.g., buffering) (Bode *et al.,* 2011; Chowdhury and Quaddus, 2016; Kamalahmadi and Parast, 2016). This way, preparedness helps (1) reduce exposure to disruptions and (2) minimise impact of disruptions (i.e., preparedness facilitates responses to disruptions, in terms of discovering disruptions, avoiding or absorbing impacts, and or recovering from impacts (Chowdhury and Quaddus, 2016; Ambulkar *et al.,* 2015; Macdonald and Corsi, 2013; Tukamuhabwa *et al.*, 2015).

The disruption management component of resilience is about capabilities that allow for quick *discovery* of, and *responses*[7] to disruptions (Macdonald and Corsi, 2013). Discovery is the point in time that the organisation becomes aware of the disruption (Macdonald and Corsi, 2013, p. 9) and the ability to do so represents is its disruption discovery capability. *Responses* to disruptions involve a first-order response action which attempts to accommodate the impact of disruption, after being discovered, and a second-order response action which focuses on recovering from the impact or restoring the system back to normalcy (DesJardine *et al.,* 2017; Buyl *et al.,* 2017). The ability to execute these actions are referred to as disruption absorption (robust) or recoverability (see Brandon-Jones *et al.,* 2014; Brandon-Jones *et al.,* 2014; DesJardine *et al.,* 2017; Buyl *et al.,* 2017; Kwak *et al.,* 2018). Still, some literature (e.g., Macdonald and Corsi, 2013; Meyer, 1982) proposes further response actions, which involve learning from the disruption and redesigning the system.

Like the ODP perspective, the process perspective assumes that systems operate within a given stability domain (or normal level of performance), and in the absence of disruption, they will

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[7] The word "responses" is not same as the word "response" as appear in Ponomarov and Holcomb (2009), Chowdhury and Quaddus (2017), and Chowdhury and Quaddus (2016) for example. It is used to mean the response options/ actions available that can be activated depending on the magnitude of disruption.

continue to remain in their stability domain or perform normally, *cet. par*. Disruptions, however, displace a system's stability which undermines its normal functioning or lowers its performance level. Based on this assumption, the process perspective suggests that a system's resilience can be determined by quantifying the amount of loss of functionality (i.e., drop in normal performance level), given a disruption, and the amount of time it takes to return to its normal functioning (see DesJardine *et al.,* 2017; Buyl *et al.,* 2017). It proposes that more resilient systems will experience a smaller drop in normal performance level, and or recover quicker in the face of disruptions. In addition, the process perspective particularly suggests that the size of drop in normal performance level depends on the amount of resilience *built* into the system (i.e., preparedness).

The main similarity between the process perspective and the formative perspective is preparedness (or proactiveness or readiness against disruptions), i.e., resilience can be designed into a system. However, unlike the latter, the former considers preparedness as an integral dimension of resilience. From Christopher and Peck's (2004) original conceptualisation, resilience is a distinct concept that can be "formed" by certain variables. Another difference between the two perspectives is that, while the formative perspective considers preparedness as key, it is less specific on what constitutes preparedness. As discussed in the previous paragraphs, several practices/capabilities (e.g., collaboration, information sharing) can contribute to the core elements of resilience but their intended purposes and value are pluralistic. For instance, collaboration and information sharing with supply chain actors are done for several reasons (e.g., minimise opportunism and improve innovation), not just to make organisations get prepared for disruptions. In the case of the process perspective, however, practices (e.g. developing contingency plan) discussed as preparedness largely have a singular intended purpose: facilitating disruption management in terms of accommodation of, and recovery from, disruption impacts.

2.4 OPERATIONAL RESILIENCE: CONCEPTUAL DEVELOPMENT

> …resilience thinking must be open to alternative traditions and interpretations if it is to become a theoretically and operationally powerfully paradigm" (Davidson et al. 2016, p.1)

In relation to research objective one, this section attempts to develop the conceptual domain of operational resilience. This involved defining and conceptualising operational resilience and explaining its nature as an organisational capability.

The term operational resilience has appeared in the literature (e.g. Munoz and Dunbar, 2015; Ganin *et al.*, 2016; Birkie *et al.*, 2017; Birkie, 2016). However, it suffers the same definitional and conceptualisation challenges discussed in the preceding section. Concepts that are not core to the meaning of resilience, but are its potential drivers, as pointed out by Davidson *et al*. (2016), have been used to define, conceive, and measure it. For example, Birkie *et al.*, (2017) conceptualised and measured operational resilience as comprising proactive and reactive resilience building strategies (i.e., strategies that may contribute to resilience, see e.g., Tukamuhabwa *et al.* [2015] and Hohenstein *et al.* [2015]).

In view of these concerns, this study develops a conceptual perspective of resilience at the operations level of the firm by drawing on the original dictionary perspective (ODP) and Holling's (1973) perspective with complementary insights from Brandon-Jones *et al.* (2014), DesJardine *et al.* (2017), Buyl *et al.* (2017), and Meyer (1982). Brandon-Jones *et al*. (2014) captured 'resilience' (in terms of recoverability) and 'robustness' (in terms of disruption absorption) at the 'supply chain' level. Although the labelling of their construct is "supply chain resilience", their items chiefly focused on supply chain operations. DesJardine *et al.* (2017) and Buyl *et al.* (2017) analysed resilience at the firm level, but both captured it using less proximal firm performance indicators, including stock prices and return on asset respectively. Both studies operationalised firm resilience as di-dimensional construct comprising recovery time and drop in size of performance. Meyer (1982) defined resiliency in terms of a firm's ability to absorb disruptions but operationalised it in terms of recovery time. In the following section, theory and assumptions underpinning the study's perspective of operational resilience are provided.

2.4.1 Assumptions and Theory

Consistent with (Davidson *et al.* 2016), this study takes the position that some conceptual elements (innovation, resilience building/disruption preparedness initiatives, anticipation, etc.) are not essential to the core meaning of resilience as implying persistence/disruption absorption (Holling's 1973 perspective), recoverability (ODP), and adaptability and transformability (dynamic perspective)[8]. This position is necessary as it permits analysis of resilience as a concept distinct from factors that form or drive it. The study also takes the view that operational resilience is part of a firm's response capabilities activated in the face of disruptions and cannot be predetermined (Sutcliffe and Vogus, 2007; Weick *et al.*, 1999). This means that firms that anticipate and prepare for disruptions cannot be presumed to be operationally resilient (Sutcliffe and Vogus, 2007; Weick *et al.*, 1999). Accordingly, this study regards operational resilience as a theoretically and verifiably unique (although multifaceted) concept that can be detached from factors that form or explain it. Also, the study maintains that since operations has to do with how the firm makes a living *presently*, unlike other forms of response capabilities such as adaptability and transformability that alter how the firm makes a living presently (cf. Folke *et al.*, 2010; Davidson *et al.*, 2016), operational resilience will be that part of response capabilities that safeguards how the firm makes a living presently, given a disruption. This

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[8] Nevertheless, in line with scholars such as Christopher and Peck (2004), Brandon-Jones *et al.* (2014), and Kwak *et al.* (2018), it is admitted that the non-essential elements are potential determinants of the essential ones. It is on this front that the study proposes the notion of attention to threats as a potential determinant of operational resilience.

'present' view of operational resilience[9] is analogous to how *operational/ordinary/substantive capability* is distinguished from *dynamic capability* (see Helfat and Martin, 2011; Zahra *et al.*, 2006; Teece, 2014).

In as much as being resilient as a 'whole' firm is necessary, so it is with making the subsystems resilient (McManus *et al.*, 2008; van der Vegt *et al.*, 2015). Operations is a subsystem of the firm in that it is made up of interdependent basic elements (e.g., people and pattern of activities or processes) that produce and deliver product/service offerings (Slack *et al.*, 2011). The domain of attraction concept (Gallopín, 2006) suggests that a system has a region of state space where it would tend to remain in the absence of disruptions. For any snapshot of time, firms have specific domains of operations (e.g., type and number of product offerings, scale of producing each, and target markets). A firm operating at any trajectory within a given domain of operations at normal levels of performance (say, outputs) can be assumed to have stability. Overtime, however, given their organic nature, the domain of operations of firms can get recalibrated, particularly, when there is a change in strategic direction, whether deliberately or induced. This 'dynamic' behaviour of firms does not, however, presuppose that they will not at any point in time attempt to monitor the performance of their operations and ensure that normal operating performance level is safeguarded or restored when it falls below specified critical thresholds (Sutcliffe and Vogus, 2007). In his study of hospitals' responses to a sudden and unprecedented event (i.e., doctors' strike), Meyer (1982) noted and proposed that in events of disruptions, organisations would initiate first-order response action intended to allow their

[9] The study argues that there is one thing having an ability to perform regular activities that earn the firm a living in the present (referred to as operational/ordinary/substantive capability [Helfat and Martin, 2011; Zahra *et al.*, 2006]) and there is another thing having an ability to maintain structure and normal functioning of operations in the face of disruptions and restore operations to prior normal level after being disrupted (referred to as operational resilience in this study) (see Section 2.4.3 for discussion).

operations to absorb or recover from impacts and refers to the capability for executing this action as resiliency.

Given that firms have stability and continuity motive (Bode *et al.,* 2011) concerning their operations, it is argued that they would strive to operate at "normal levels" at any point in time, and process control or monitoring system plays a key in that regard. Holding determinants of production requirement (particularly, demand) constant, for a manufacturing firm, normal operating level can be defined as the average production/ output rate in a month (e.g., average cartons of coke produced). Also, for a bank or a supermarket, holding demand constant, average number of customers served in a month can represent a normal operating level. For a listed firm, average stock price in a week is a good proxy for normal operating level. Other things being equal, drops in normal operating level will result from disruptions. However, due to survival or profit motive (for example), not only will firms make effort to at least protect and maintain normal operating level, but also attempt to restore it (when it falls below expectations due to disruptions, for example), particularly, in the 'short-run', i.e., a period when there is no need to redefine of new levels of operations or modify the present domain of operations (Sutcliffe and Vogus, 2007). In this sense, operational resilience can be viewed as a firm's ability to ensure that operations go on normally as it was before a disruption occurred.

2.4.2 Operational Resilience: Defining and Explicating its Components

In explaining the conceptual components of operational resilience, the process perspective of resilience appears to be very relevant. This view of resilience suggests that how resilient operations is to disruptions can be ascertained by first knowing normal operating level (called "normal performance") before a disruption occurred. Based on this information, operational resilience can be determined in two ways (DesJardine *et al.,* 2017; Buyl *et al.,* 2017):

1. Calculating the *size* of drop in normal operating performance level after the occurrence of a disruptive event and just before recovery actions were initiated.
2. Calculating the *time* it takes for a firm to get back to normal operating performance level after recovery actions are initiated.

A greater drop in size of normal performance level suggests that the firm's operations is less 'resilient', i.e., it lacks disruption absorption, the opposite is true (Blackhurst *et al.*, 2011; Sheffi and Rice, 2005). Firms with high disruption absorption can accommodate disruptions or persist in the face of disruptions. Li and Fung's ability to continue serving its customer base despite the Indonesian currency crises when many of their competitors had to halt production (Tang, 2006) exemplifies this type of operational resilience. On the other hand, longer recovery time suggests that the firm's operations is less 'resilient', i.e., it lacks recoverability, the opposite is true (Blackhurst *et al.*, 2011; Sheffi and Rice, 2005). A case that illustrates this type of operational resilience is Toyota's ability to resume production at twenty-nine plants just three to four days after the Kobe earthquake of 1995 (Fujimoto, 2011).

Per the foregoing discussion, the study formally defines operational resilience and its dimensions (disruption absorption and recoverability) as follows:

> *Operational resilience* refers to the ability of a firm's operations to absorb and recover from disruptions.
>
> *Disruption absorption* refers to the ability of a firm to maintain the structure and normal functioning of operations in the face of disruptions.
>
> *Recoverability* refers to the ability of a firm to restore operations to a prior normal level of performance after being disrupted.

As explained in Section 2.3.3.2, and consistent with Buyl *et al.* (2017), DesJardine *et al.* (2017), and Brandon-Jones *et al.* (2014), it is possible for a firm to possess both components of operational resilience. From the process perspective of resilience, the study contends that it will be almost impossible for a firm to activate both capabilities simultaneously in that recovery remedial action logically and practically follow that of disruption absorption. Also, it is not all circumstances that may call for recovery medial action. High disruption absorption coupled with low impact disruptions may not cause normal operating performance level to fall below specified critical thresholds that will require the activation of recoverability. In essence, the possession of disruption absorption does not prevent a firm from possessing recoverability, and vice versa.

Also, that a firm has disruption absorption does not necessarily imply that it has recoverability. As Holling (1973) asserts, a system can be 'resilient' (i.e., "persist in the face of, or absorb, disruptions") and yet lack 'stability' (i.e., the ability to return to an equilibrium state after being exposed to disruption), and vice versa. Nevertheless, since it is same resource base (e.g. employee skills, employee knowledge on disruptions, and slack resources) and disruptionpreparedness measures (e.g., contingency plans) that underlie both capabilities (Blackhurst *et al.*, 2011), one can expect them to correlate positively. For example, Brandon-Jones *et al.* (2014) show that while supply chain robustness (i.e., disruption absorption) and supply chain resilience (i.e., recoverability) are distinct disruption management capabilities, they are also positively related.

2.4.3 The Nature of Operational Resilience as an Organisational Capability

As part of developing the conceptual domain of operational resilience, this study focuses on explaining the capability nature of operational resilience.

2.4.3.1 Summary of the Controversy

Resilience is generally regarded as a capability. However, somewhat insufficient effort has been devoted to expounding its capability nature at the firm-level or supply chain-level. An obvious challenge in doing this is the existence of several competing conceptual perspectives on the concept. Yet, even scholars who share similar conceptual perspectives explain the capability nature of resilience differently. For example, some authors whose thinking are consistent with the formative and the process perspectives regard resilience as an adaptive capability (e.g., Jain *et al.*, 2017; Liu *et al.*, 2017; Birkie *et al.*, 2017; Tukamuhabwa *et al.*, 2015; Ambulkar *et al.*, 2015; Ponomarov and Holcomb, 2009) or a dynamic capability (in a sense that is consistent with the strategic management literature's position on dynamic capability [see Helfat and Martin, 2011]) (e.g., Mandal 2016:2017; Chowdhury and Quaddus, 2017; Li *et al.*, 2017; Eltantawy, 2016). Fundamentally, these authors argue that resilience allows organisations/supply chains to prepare for, adapt to, or cope with, changes/disruptions, through combining, transforming, or renewing firm-/supply chain-level resources. Notwithstanding, Brusset and Teller (2017), who measured supply chain resilience based on the formative perspective argued that supply resilience constitutes operational capability[10]. Also, Kwak *et al.* (2018) who studied the ideas of resilience (recoverability) and robustness (disruption absorption) argued that these capabilities constitute dynamic capabilities.

Per these confusions, the researcher finds it necessary to attempt to clarify the nature of operational resilience as an organisational capability. It should be emphasised that the study's

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[10] For Brusset and Teller (2017), operational capabilities "provides the means by which a firm function or operates to make a living in the present". Specifically, it allows a firm to execute and coordinate the various tasks required to perform operational activities" (p. 60).

perspective of operational resilience is aligned with the ODP and Holling's (1973) perspective of resilience rather than the formative, or the process, or the dynamic perspectives of resilience.

This section discusses two extreme types of organisational capabilities: *operational* and *dynamic*; which appear to be surfacing in the business and management-related resilience thinking, and accordingly suggests where disruption absorption and recoverability components of operational resilience may fit. First, the notion of organisational capabilities is explicated.

2.4.3.2 What are Organisational Capabilities?

According to the resource-based view, an organisational capability is a firm resource[11] (see Wernerfelt, 1984; Barney, 1991; Hunt, 1997). But what *resource* is it? From a dictionary perspective, capability can generally be understood as a "capacity to perform a particular activity in a reliable and at least minimally satisfactory manner" (Helfat and Martin, 2011, p. 1244). The implications of this definition are that, organisational capabilities (1) have intended purposes as envisioned by decision-makers (i.e., management develop them for specific reasons) (Zahra *et al.*, 2006), (2) are directed towards execution of specific tasks, and (3) should allow the firm to reliably execute the task intended for (Helfat and Martin, 2011).

Applying this description of capability at the firm level, Amit and Schoemaker (1993) defined and explained capabilities as:

> …a firm's capacity to deploy *Resources*, usually in combination, using organizational processes, to effect a desired end. They are information-based, tangible or intangible processes that are firmspecific and are developed over time through complex interactions among the firm's *Resources*.

---

[11] Nevertheless, for the purposes of clarify and theory-building, some resource-based thinkers (e.g., Amit and Schoemaker, 1993) have attempted to distinguish between resources and capabilities. This debate is beyond the scope of this study. The position this study takes is capability is just a *particular* resource-type (Makadok, 2001; Hunt, 1997; Barney, 1991; Wernerfelt, 1984).

> They can abstractly be thought of as 'intermediate goods' generated by the firm to provide enhanced productivity of its *Resources*, as well as strategic flexibility and protection for its final product or service (p. 35) [italics in the original].

Relatedly, Makadok (2001) defined capability as:

> …a special type of resource—specifically, an organizationally embedded nontransferable firmspecific resource whose purpose is to improve the productivity of the other resources possessed by the firm (p. 389).

Winter (2003) also defined organisational capability as:

> An organizational capability is "a high-level routine (or collection of routines) that, together with its implementing input flows, confers upon an organization's management a set of decision options for producing significant outputs of a particular type.

Last but not the least, Grant (1996) defined organisational capability as

> …a firm's ability to perform repeatedly a productive task which relates either directly or indirectly to a firm's capacity for creating value through effecting the transformation of inputs into outputs (p. 377).

An important point that should be made here is how organisational capabilities differ from other firm resources (see Barney [1991] and Hunt [1997]). First, unlike other firm resources, organisational capabilities are primarily used to enhance the productivity of other resources that the firm has in its possession (Makadok, 2001). In addition, unlike other resources, capabilities are used to develop, carry, and exchange information through the firm's human capital (Makadok, 2001). Moreover, they emerge from combination of physical, human and technological, and the firm processes. They are knowledge (tacit)-, experience-, competence-, skills-based, learned behaviour, and often path-dependent (i.e., built over time) (Grant, 1996; Amit and Schoemaker, 1993; Makadok, 2001; Teece *et al.*, 1997; Kusunoki *et al.*, 1998; Winter 2003). All these make *some* organisational capabilities (e.g., process-based ones [Kusunoki *et* *al.*, 1998]) structurally and socially embedded, and thus idiosyncratic (i.e., specific to firms), difficult to duplicate and transfer (from one firm to another), or buy on the market (Barney, 1991; Makadok, 2001; Teece *et al.*, 1997).

Organisational capability is a complex and a multi-dimensional phenomenon (Winter, 2003), exists in various forms, and has been described in different ways by different scholars[12]. However, the regular way through which scholars differentiate between different organisational capability types has been labelling them according to their intended purpose(s) and outcome(s) (see e.g., Teece, 2014; Zahra *et al.*, 2006; Helfat and Martin, 2011). To identify a capability's intended purpose and outcome, and accordingly develop a simple classification for discussion purposes, this study asks the question: *is the capability in question used to enable to the firm to make a living in the present or modify how it makes a living?* An answer to this question is offered in the strategic management literature as follows:

Some organisational capabilities may be utilised to execute *primary* activities— activities that create value or constitute how a firm makes a living in the present (Drnevich and Kriauciunas, 2011)—while others may permit a firm to change its *primary* activities or modify how it makes a living as well as its resource base (Teece, 2014). The strategic management literature labels capabilities whose intended purpose is to allow firms make a living in the present as operational capabilities (Helfat and Martin, 2011), or ordinary capabilities (Teece, 2014), or substantive capabilities (Zahra *et al.*, 2006), or zero-level capabilities (Winter, 2003). Operational capabilities may be embedded in employees' skills and knowledge, organisational processes and routines, technology, supporting technical manuals, etc. (Teece, 2014; Wu *et al.*, 2012), and are utilised to perform activities that primarily create and deliver value for customers. How

[12] For example, Kusunoki *et al.* (1998) classified organisational capabilities into: local (individual knowledge), architectural (dynamic), and process capabilities. For more examples, see Newbert (2007).

well a firm is able to produce and deliver products to customers indicates the extent of its operational capabilities. Dynamic capabilities on the other hand represents a firm's "…ability to integrate, build, and reconfigure internal and external resources/competences to address, and possibly shape, rapidly changing business environments" (Teece, 2012, p. 1395). Often, dynamic capabilities is captured via its microfoundations: sensing, seizing, coordination, reconfiguration, learning, innovation, etc. (Teece, 2007; Helfat and Peteraf, 2015; Fainshmidt *et al.*, 2016). Like operational capabilities, dynamic capabilities is knowledge-, experience-, skills-based, learned behaviour; embedded in social systems and is supported by the firm's technology, and processes and routines (Zollo and Winter, 2002; Helfat and Peteraf, 2015; Teece, 2014: 2012; Grant, 1996; Amit and Schoemaker, 1993; Makadok, 2001; Teece *et al.*, 1997; Kusunoki *et al.*, 1998; Winter, 2003).

2.4.3.3 The Present Study's Position

In the operations management literature, Wu *et al.* (2012, p. 125) have defined operational capabilities as "firm-specific sets of skills, processes, and routines, developed within the operations management system, *regularly used in solving its problems* through the means of *configuring its operational resources*" [italicised words are for emphasis]. Relying on this definition, one can classify disruption absorption and recoverability as operational capabilities. Such decision should, however, be based on the assumption that some operational capabilities are used to solve problems confronting operations without changing the domain of operations while others are used to specifically carryout operations. In fact, in their use of the term "substantive" capabilities (to mean "operational/ordinary capability"), Zahra *et al.* (2006) contended that substantive capabilities are utilised in "*solving a problem* or achieving an outcome" [italics added for emphasis] (p. 921). They differentiated substantive capability from dynamic capability by suggesting that the latter is used to "change or reconfigure existing substantive capabilities" (p. 921). However, a closer look at the examples that they cited respectively for sustentative and dynamic capability: "the substantive ability to *develop new products*" [italics added for emphasis] and "the ability to *reform* the way the firm develops new products)" [italics is in the original] cast doubt on whether operational resilience (comprising disruption absorption and recoverability) is an operational capability.

In Section 2.4.1, it was indicated that since operations has to do with how the firm makes a living in the present, unlike other forms of capabilities for responding to disruptions (including adaptability and transformability) that alter the domain of operations (Folke *et al.*, 2010; Davidson *et al.*, 2016), operational resilience will be that part of response capabilities that safeguards how the firm makes a living in the present, given a disruption. While disruption absorption and recoverability have 'the present' intended purposes, none appears to constitute capabilities used to carry out the *primary activities* that create value for the firm. For example, a manufacturing firm's operational capability will be its ability to execute operational activities such as producing products. This capability is clearly different from one that, in events of disruptions (e.g., supplier failure/raw material shortage), ensures that the same task is executed normally.

In line with these discussions, the study does not view operational resilience as either an operational capability or a dynamic capability. In fact, the suggested qualifiers "disruption absorption" and "recoverability" clarify what type of organisational capabilities that operational resilience (as defined in this study) is. The study argues that there is one thing having the capability to perform operations (referred to as operational capability) and there is another thing having a capability that ensures stability and continuity of operations in the face of disruptions (referred to as operational resilience in this study).

2.5 A REVIEW OF EMPIRICAL STUDIES

This section reviews empirical studies that focused on resilience at the supply chain/firm level. Given that the previous sections discuss conceptualisation issues (in both the conceptual and the empirical literatures), this section focuses on discussing prior empirical insights on the antecedents and outcomes of firm/supply chain resilience. The section further highlights variables analysed as moderators in models of antecedents and outcomes of firm/supply chain resilience. Moreover, the section highlights theories that have been used in these streams of studies. The last subsection is a short discussion of the gaps in prior research and the direction of the present research.

2.5.1 Antecedents

Empirical research on antecedents of firm/supply chain resilience has been both exploratory and explanatory in nature. Key findings from the exploratory studies (see Table 2.6) are that supply chain/ firm resilience (in terms of the core conceptual elements such as disruption absorption, recoverability, adaptability, transformability) is affected by flexibility (Sheffi and Rice, 2005; Pal *et al.*, 2014; Scholten and Schilder, 2015; Pettit *et al.*, 2013), redundancy/ buffers/ reserves (Sheffi and Rice, 2005; Pal et al., 2014; Blackhurst et al., 2011), collaborative/ cooperative/ integrative activities (including information sharing, communication, mutually created knowledge, joint relationship efforts, strategic alliance) and networking (Reinmoeller and van Baardwijk, 2005; Scholten and Schilder, 2015; Pettit et al., 2013; Leat and RevoredoGiha, 2013, Lam and Bai, 2016), visibility/visibility tools (Scholten and Schilder, 2015; Pettit *et al.*, 2013; Blackhurst *et al.*, 2011), supply chain network characteristics (e.g., structure and diversity) and flows (Todo *et al.*, 2015; Blackhurst *et al.*, 2011), organisational culture (Ate and Bititci, 2011), supply chain design resilience orientation (Leat and Revoredo-Giha, 2013), forecast accuracy (Lam and Bai, 2016), information technology (Lam and Bai, 2016), supply chain relationship management (Lam and Bai, 2016, Blackhurst *et al.*, 2011), education and training (Blackhurst *et al.*, 2011), contingency plans (Blackhurst *et al.*, 2011), risk management

(Leat and Revoredo-Giha, 2013), monitoring (Lam and Bai, 2016), financial resources (Pal *et al.*, 2014; Pettit *et al.*, 2013), leadership (Pal *et al.*, 2014), anticipation (Pettit *et al.*, 2013), and threats/disruptions (e.g., Pettit *et al.*, 2013; Blackhurst *et al.*, 2011).

Table 2.6: Antecedents of Firm/Supply Chain Resilience: Insights from Exploratory Research

Author(s)	*Design*	*Unit of Analysis*	*Label of Resilience*	*Antecedent of Resilience*
Sheffi and Rice Jr. (2005)	Situational/ survey study	Supply chain	Resilient enterprise	Flexibility, Redundancy
Pal *et al.* (2014)	Case study/survey	Firm	Organisational resilience	*Assets (& resourcefulness):* material, financial, social, network, and intangible resources *Learning and culture*: leadership (e.g., attentiveness) and top management decision making, collective and sense-making, employee well-being *Dynamic competitiveness:* flexibility, redundancy, robustness, and networking
Reinmoeller and van Baardwijk (2005)	Longitudinal study	Firm	Resilience	*Innovation diversity*: Exploration, Knowledge management, Cooperation, Entrepreneurship
Scholten and Schilder (2015)	Case study	Supply chain	Supply chain resilience	*Collaborative* activities: Information sharing, Communication, Mutually created knowledge, Joint relationship efforts Visibility, Velocity, Flexibility
Pettit *et al.* (2013)	Case study	Supply chain	Supply chain resilience	*Capability:* Market position, Recovery, Financial strength, Security, Organisation, Dispersion, Efficiency, Anticipation, Visibility, Flexibility in sourcing & order fulfilment, Adaptability, Capacity, Collaboration *Vulnerability:* External pressures, Connectivity, sensitivity, Resource limits, Turbulence, Supplier/customer disruptions, Deliberate threats
Todo *et al.* (2015)	Situational/ survey study	Supply chain	Firm resilience: recovery	*Network structure/diversity:* Number of suppliers and clients inside and outside the affected areas *Extent of network damage*[1]
Ate and Bititci (2011)	Case study	Firm level	Firm resilience	Organisational culture management, Change management
Leat and RevoredoGiha (2013)	Case study	Supply chain	Supply chain resilience	Supply chain design resilience orientation, risk management focus, collaboration, third-party support, business environment

Note: [1]Moderator

Insights from the explanatory studies (see Table 2.7) indicate three broad categories of factors that influence firm/ supply chain resilience: (1) inter-/organisational resources/ capabilities/ practices, (2) organisational culture/ structure/ orientations, and (3) top management/ leadership characteristics.

Table 2.6: Antecedents of Firm/Supply Chain Resilience: Insights from Exploratory Research (continued)

Author(s)	*Design*	*Unit of Analysis*	*Label of Resilience*	*Antecedent of Resilience*
Blackhurst *et al.* (2011)	Case study	Supply side	Global supply resiliency	*Human capital resources:* Education & training, Cost/benefits knowledge, Post-disruption feedback; *Organisational & inter-organisational capital resources*: Communication protocols, Cross-functional risk management teams, Contingency plans, Customers programmes/port diversification plans, Supplier relationships management; *Physical capital resources*: safety stock, visibility tools, node monitoring exception tools, and redesign tools; *Flow activities:* Number of nodes, Stringent security and customs regulations, Port/vessel capacity restrictions; *Flow units:* Product complexity, Stringent storage/quality requirements; *Sources of flow units:* volatility of supplier's location, supplier capacity/labour restrictions
Lam and Bai (2016)	Case study	Supply chain	Maritime supply chain resilience	Contingency plan, Forecast accuracy, Strategic alliance, supply chain relationship management, Advanced IT system/Real time tracing system, Monitoring & Maintenance

2.5.1.1 Inter-/organisational Resources/Capabilities/Practices

Available evidence from the studies reviewed largely offers support for the proposition that inter-/organisational resources (in general terms) are key enablers of resilience (Blackhurst *et al.* 2011; Pal *et al.*, 2014; Ponomarov and Holcomb, 2009). For example, Ambulkar *et al.* (2015) report that a firm's resource reconfiguration capability positively affects its resilience (in terms of coping, adaptability, quick response, etc.). Brandon-Jones *et al.* (2014) also find that resources such as supply chain connectivity and information sharing affect visibility which in turns positively drives supply chain resilience (recoverability) and robustness (disruption absorption). In a related study, Dubey et al. (2017) find that information sharing, supply chain connectivity, and visibility correlate positively with supply chain resilience (recoverability).

Other relational competences and assets have been found to positively affect different resilience elements. For instance, Brusset and Teller (2017) find that integration capabilities and external capabilities positively drive supply chain resilience (in terms of visibility, ability to evaluate process vulnerabilities and risk, and deploy alternative plans associated with risks). Also, Wieland and Wallenberg (2013) find that organisational communication and cooperation affect supply chain resilience (in terms of agility, and robustness [disruption absorption]) positively. Dubey *et al.* (2018) on the other hand find that inter-firm trust positively drives supply chain resilience (recoverability).

Moreover, organisational learning, innovation, and risk management have all been found to be crucial drivers of different resilience elements. For example, Chowdhury and Quaddus (2016) report that organisational learning positively affects supply chain resilience (in terms of readiness, response, and recovery). Kwak *et al.* (2018) also find that firm innovation positively affects resilience (recoverability) and robustness (disruption absorption). In addition, Wieland and Wallenburg (2012) find that risk management positively affects supply chain robustness (disruption absorption).

Furthermore, DesJardine *et al.*'s (2017) and Ortiz-de-Mandojana and Bansal's (2016) analyses of longitudinal data from U.S. firms reveal that social and environmental practices (SEPs) of firms can have different implications on different aspects of firm resilience. DesJardine *et al.* (2017) find that strategic SEPs reduces severity of shocks (i.e., enhances disruption absorption) as well as recovery time (i.e., recoverability). They also find that unlike strategic SEPs, tactical SEPs have weak effect on recoverability, and have no effect on disruption absorption. Ortizde-

Mandojana and Bansal (2016) on the other hand find that high SEPs lower financial volatility and enhance growth in performance and survival rates.

2.5.1.2 Organisational Culture/Structure/Orientations

Some scholars (e.g., van der Vegt *et al.,* 2015; Pal *et al.,* 2014) have argued that organisational resilience does not only depend on the availability and accessibility of resources, but also the prevailing structures that guide decisions and how resources are deployed. Studies by Mandal (2016), Chowdhury and Quaddus (2016), and Ambulkar *et al.* (2016) offer some support for this proposition. Mandal (2016) find that while development culture, group culture, and rational culture positively affect supply chain resilience (in terms of, proactiveness, response, recovery, & robustness), hierarchical culture exerts negative effect. Chowdhury and Quaddus (2016) also find that supply chain orientation and risk management culture both affect supply chain resilience (in terms of readiness, response, and recovery) positively. Moreover, Ambulkar *et al.* (2015) demonstrate how disruption orientation in different disruption impact contexts can affect resilience (in terms of coping, adaptability, quick response, etc.). Generally, the authors find that disruption orientation correlates positively with firm resilience.

2.5.1.3 Top Management/Leadership

Some scholars (e.g., Pal *et al.*, 2014; Ponomarov and Holcomb, 2009) argue that leadership/top management matters in driving firm/supply chain resilience. Consistent with this argument, Buyl *et al*. (2017) find that CEO narcissism, via riskiness of policies, undermines recoverability.

Table 2.7: Antecedents (and Moderators) of Firm/Supply Chain Resilience Empirically Tested

Author(s)	*Context/ Date*	*Labelling of resilience*	*Operationalisation/ Dimensions of resilience*	*Antecedents*	*Moderators*	*Theory*	*Key findings*
Buyl *et al.* (2017)	U.S. commercial banks Longitudinal data	Organisational resilience	Drop in performance (ROA) immediately after the shock Recovery to preshock performance level (ROA)	CEO narcissism Riskiness of policies[1]	Corporate governance: CEO stock options; Block ownership; outsider director experience	Agency theory	CEO narcissism affects risk policies positively, especially when stock options are high and when there are no outsider directors with banking experience. CEO narcissism and risk policies do not affect drop in performance; but both slow down recovery.
DesJardine *et al.* (2017)	U.S.- based publicly listed firms Longitudinal data	Organisational resilience	Time to recover Severity of loss	Social and environmental Practices (SEPs): -*Strategic* -*Tactical*		Systems theory	Strategic SEPs reduces severity of shocks as well as recovery time. Tactical SEPs reduces recovery time, but weaker, compared to the effect of strategic practices. Tactical SEPs has no significant effect on severity of shocks.
Ortiz-de-Mandojana and Bansal (2016)	U.S. firms Longitudinal data	Organisational resilience	Financial volatility Growth in performance Survival rates	Social and environmental Practices (SEPs)		*Not explicitly discussed*	High SEPs lowers financial volatility, enhances growth in performance and survival rates.

Ambulkar *et al.* (2015)	*Context not clarified* Survey (Questionnaire data)	Firm resilience	Cope, adapt, quick response to disruptions, and maintain high situational awareness at all times	Supply chain disruption orientation Resource reconfiguration[1]	Risk management infrastructure Disruption impact level	*Not explicitly discussed*	In high impact disruption context, resource reconfiguration positively mediates the SC disruption orientation–firm resilience link. In low impact disruption context, SC disruption orientation and risk management infrastructure have synergistic effect on firm resilience.

Note: [1]mediator

Table 2.7: Antecedents (and Moderators) of Firm/Supply Chain Resilience Empirically Tested (Continued 1)

Author(s)	*Context/ Date*	*Labelling of resilience*	*Operationalisation/ Dimensions of Resilience*	*Antecedents*	*Moderators*	*Theory*	*Key findings*
Brandon-Jones *et al.* (2014)	UK manufacturing plants Survey (Questionnaire data)	Supply chain resilience Supply chain robustness	Recovery Maintain functions Continue operations despite disruptions	Supply chain connectivity Supply chain information sharing Visibility[1]	Supply-base complexity (moderator): *Geographic dispersion; Scale complexity; Differentiation; Delivery complexity*	Resource-based theory Contingency theory	SC connectivity and information sharing have positive effects on SC resilience and SC robustness via visibility. Visibility interacts with scale complexity to significantly affect SC resilience and SC robustness positively.
Brusset and Teller (2017)	Context not clarified Survey (Questionnaire data)	Supply chain resilience	Visibility; Ability to evaluate process vulnerabilities; Ability to evaluate risks; Deploy alternative plans associated with risks	Flexible capabilities Integration capabilities External capabilities	Supply chain risks: *External, internal/supplier, internal/customer*	Resources-based view/dynamic capabilities	Internal and flexible capabilities affect supply chain resilience positively. External capabilities and external risks interact to affect resilience negatively. Internal integration and supplier risks

							interact to affect resilience positively.
Chowdhury and Quaddus (2016)	Apparel industry of Bangladesh Survey (Questionnaire data)	Supply chain resilience	Readiness, response, recovery	SC orientation SC risk management culture Learning Support factors		Natural accident theory High reliability theory Organisation crisis perspective	SC orientation, Learning, and SC risk management culture affect SC resilience positively.

Note: [1]mediator

Table 2.7: Antecedents (and Moderators) of Firm/Supply Chain Resilience Empirically Tested (Continued 2)

Author(s)	*Context/ Date*	*Labelling of resilience*	*Operationalisation/ Dimensions of Resilience*	*Antecedents*	*Moderators*	*Theory*	*Key findings*

Wieland and Wallenburg (2013)	Manufacturing firms in Germany, Austria, and Switzerland Survey (questionnaire data)	Supply chain resilience	Robustness Agility	Communication Cooperation Integration		Relational view	Communication and cooperation affect agility and robustness positively.
Wieland and Wallenburg (2012)	Manufacturing firms in Germany, Austria, and Switzerland Cross-sectional survey Questionnaire	Supply chain (SC) robustness	Maintain structure and function despite disruptions	SC risk management		*Not explicitly discussed*	SC risk management positively affect SC robustness.
Lee and Rha (2016)	Korean Firms Cross-sectional survey Questionnaires	Supply chain (SC) ambidexterity	Simultaneous exploitation and exploration of competences and opportunities	SC sensing (visibility), SC seizing (agility), and SC reconfiguring (flexibility)		Dynamic capabilities theory	Sensing (visibility) positively affects ambidexterity through seizing (agility) and while seizing directly and indirectly affects ambidexterity via configuring (flexibility) positively.
Kwak *et al.* (2018)	South Korean manufacturers and logistics intermediaries Questionnaires Cross-sectional survey	Risk management capabilities	Robustness capability Resilience capability	SC innovation		Resource-based view	SC innovation positively affects both resilience capability and robustness capability. The effect of supply chain innovation on robustness

							capability was however greater.

Table 2.7: Antecedents (and Moderators) of Firm/Supply Chain Resilience Empirically Tested (Continued 3)

Author(s)	*Context/ Date*	*Labelling of resilience*	*Operationalisation/ Dimensions of Resilience*	*Antecedents*	*Moderators*	*Theory*	*Key findings*
Mandal (2017)	Sub-Indian continent Online questionnaires Cross-sectional survey	Supply chain resilience	Recover, adapt, taking advantage of disruptions, minimise losses	Supply competence Demand competence	Process compliance	Resource-based view/dynamic capability theory	Both demand and supply competences positively affect supply chain resilience. Process compliance positively moderates both the links from demand and supply competences to supply chain resilience.
Mandal (2016)	Multi-healthcare supply chain industry Online questionnaires Cross-sectional Survey	Healthcare supply chain resilience (HSCR)	Recover, robust, adept financially to be proactive, response	Organisational culture: development culture, group culture, rational culture, and hierarchical culture	Technology orientation	Competing Values Framework	Development culture, group culture, and rational culture positively affect HSCR. Hierarchical culture has negative effects on HSCR. Technology orientation positively moderates the links from development culture, group culture, and relational culture to HSCR. Technology orientation does not moderate the hierarchical culture-HSCR link.

Dubey *et al.* (2017)	Manufacturing firms in India Cross-sectional survey Questionnaire	Supply chain resilience	Recovery	Supply chain connectivity Information sharing Supply chain visibility Trust Cooperation	Behavioural uncertainty	Resource-based view Relational view	Information sharing, supply chain connectivity correlate positively with supply chain resilience Supply chain visibility, trust, and cooperation positively affect supply chain resilience Behavioural uncertainty positively moderate the links from trust and cooperation to supply chain resilience

2.5.2 Outcomes

Table 2.8 shows how different resilience elements have been linked to different business performance outcomes. At least, three concerns can be raised on these studies. First, it is seen that firm/supply chain resilience is conceptualised and operationalised differently, although the formative and the process perspectives dominate. Second, for any specific aspect of performance, different labels have been used to describe them. For example, indicators used in Chowdhury and Quaddus (2016:2017) to capture "supply chain performance" are not different from those used in Liu et al. (2017) to capture "firm performance". Third, and maybe, a more serious concern is, some studies (e.g., Liu *et al.* 2017; Chowdhury and Quaddus 2016:2017) lump both more proximate (operational) (e.g., cost, customer satisfaction, on-time delivery, customer loyalty, and service level) and less proximate (financial) (e.g., profit, sales, market share) performance indicators together in their analyses, ignoring the logical casual links between these groups of indicators. All these concerns make the synthesis of the performance outcomes of firm/supply chain resilience quite difficult. Accordingly, a case-by-case approach is used here to discuss the findings. The findings from the studies are summarised in Table 2.9.

In their study of firms in the Midwestern city (U.S.), Li *et al.* (2017) find that preparedness as well as alertness and agility (as elements of supply chain resilience) affects financial performance positively. As well, results from Liu *et al.*'s (2017) study of Taiwanese liner shipping companies indicate that agility, integration, and supply chain re-engineering (as element of supply chain resilience) positively affect risk management performance, but not financial performance. Nevertheless, risk management performance was found to positively affect financial performance. These findings suggest that the agility, integration, and supply chain re-engineering formative elements of supply chain resilience may positively affect financial performance through risk management performance.

Table 2.8: How Prior Studies have matched Different Resilience Elements with different Performance Outcomes

Empirical Study	*Conceptual Elements of Resilience/Resilience Operationalisation*	*Outcomes of Firm/Supply Chain Resilience*
Li *et al.* (2017)	Preparedness, Alertness, Agility	• Financial performance
Liu et al. (2017)	Risk management culture, Agility, Integration, Supply Chain (re-)engineering	• Risk management performance • Firm performance
McCann *et al.* (2009)	Sense of identity and purse to survive, Support network of, and Expanding external alliance; Access to capital and resources weather anything, Defined widely held values and beliefs	• Firm competitiveness • Firm profitability
Chowdhury and Quaddus (2016)	Readiness, Response, Recovery	• Supply chain performance
Wieland and Wallenburg (2013)	Robustness, Agility	• Supply chain customer value
Akgün and Keskin (2014)	Behavioural preparedness, Competence orientation, Deep social capital, Original/unscripted agility, Practical habits, Broad resource networks	• Firm product innovativeness • Firm performance
Wieland and Wallenburg (2012)	Supply chain robustness	• Supply chain customer value • Business performance
Lee and Rha (2016)	Supply chain ambidexterity	• Supply chain disruptions' negative magnitudes • Firm performance
Kwak *et al.* (2018)	Robustness (disruption absorption) capability, Resilience (recovery) capability	• Competitive advantage (in terms of operational performance)
Mandal (2017)	Recovery, Adaptability, Taking advantage of disruptions, Minimisation of losses	• Operational performance (in terms of delivery performance) • Relational performance
Chowdhury and Quaddus (2017)	Proactive: disaster readiness, flexibility, redundancy/reserve capacity, integration, efficiency, market strength, financial strength; Reactive: response, recovery; Supply chain design: density, complexity, criticality	• Operational vulnerability • Supply chain performance

Table 2.9: Outcomes of Firm/Supply Chain Resilience Empirically Tested

Author(s)	*Context/Data*	*Labelling of resilience*	*Operationalisation/ Dimensions*	*Moderators*	*Outcome*	*Theory*	*Key findings*
Li *et al.* (2017)	Firms in the Midwestern city (USA) Survey (questionnaire data)	Supply chain resilience	Preparedness, Alertness, and Agility		Financial performance	Dynamic capabilities theory	Preparedness, Alertness, and Agility have positive effects on financial performance.
Liu *et al.* (2017)	Taiwanese liner shipping companies Survey (questionnaire data)	Supply chain resilience	Risk management culture, agility, integration, supply chain (re)engineering		Risk management performance Firm performance	Resourcebased theory	Risk management culture positively drive agility, integration, and supply chain reengineering and these in turn affect risk management performance positively, but not financial performance. Risk management performance affect financial performance positively.
McCann *et al.* (2009)	Firms in Canada, Mexico, and U.S. Survey (questionnaire data)	Organisational resiliency	Sense of identity and purse to survive, Support network of, and Expanding external alliance; Access to capital and resources weather anything, Defined widely held values and beliefs		Firm competitiveness Firm profitability		Organisational resiliency positively affects firm competitiveness and profitability.

Table 2.9: Outcomes of Firm/Supply Chain Resilience Empirically Tested (Continued 1)

Author(s)	*Context/Data*	*Labelling of resilience*	*Operationalisation/ Dimensions*	*Moderators*	*Outcome*	*Theory*	*Key findings*
Wieland and Wallenburg (2013)	Manufacturing firms in Germany, Austria, and Switzerland Survey (questionnaire data)	Supply chain (SC) resilience	Robustness Agility		SC customer value	*Not explicitly discussed*	Robustness and agility impact SC customer value positively.
Akgün and Keskin (2014)	Firms in Istanbul Survey (questionnaire data)	Organisational resilience capacity	Behavioural preparedness; Competence orientation; Deep social capital; Original/unscripted agility; Practical habits; Broad resource networks	Market turbulence Technological turbulence	Firm product innovativeness Firm performance	*Not explicitly discussed*	Original/unscripted agility and competence orientation affect firm product innovativeness positively. Technological turbulence enhances the positive effects of original/ unscripted agility, practical habits and behavioural preparedness on product innovativeness and weakens the positive effect of competency orientation on product innovativeness. Product innovativeness mediates the resilience capacity and firm performance link.

Wieland and Wallenburg (2012)	Manufacturing firms in Germany, Austria, and Switzerland Survey (questionnaire data)	Supply chain (SC) robustness	Maintain structure and function despite disruptions		SC customer value Business performance	*Not explicitly discussed*	Robustness positively affects both SC customer value and business performance. However, it has a stronger effect on the former.

Table 2.9: Outcomes of Firm/Supply Chain Resilience Empirically Tested (Continued 2)

Author(s)	*Context/Data*	*Labelling of resilience*	*Operationalisation/ Dimensions*	*Moderators*	*Outcome*	*Theory*	*Key findings*
Lee and Rha (2016)	Korean Firms Survey (questionnaire data)	Supply chain (SC) ambidexterity	Simultaneous exploitation and exploration of competences and opportunities		SC disruptions' negative magnitudes, firm performance	*Dynamic capabilities theory*	Ambidexterity mitigates the impacts SC disruptions' negative magnitudes on firm performance.
Mandal (2017)	Sub-Indian continent OnlineQuestionnairebased Survey	Supply chain resilience	recover, adapt, taking advantage of disruptions, minimise losses	Environment uncertainty	Operational performance (delivery performance) Relational performance	Resourcebased view/ dynamic capabilities theory	Supply chain resilience positively affects both operational performance and relational performance. Environment uncertainty positively moderate the effects of supply chain resilience on operational and relational performance.

Chowdhury and Quaddus (2017)	Apparel industry in Bangladesh Cross-sectional survey Questionnaire	Supply chain resilience	Proactive: disaster readiness, flexibility, redundancy/reserve capacity, integration, efficiency, market strength, financial strength Reactive: response, recovery Supply chain design: density, complexity, criticality		Operational vulnerability Supply chain performance	Dynamic capabilities theory	SCR positively and negatively affects supply chain performance and operational vulnerability respectively. Operational vulnerability negatively affects supply chain performance.

Table 2.9: Outcomes of Firm/Supply Chain Resilience Empirically Tested (Continued 3)

Author(s)	*Context/Data*	*Labelling of resilience*	*Operationalisation/ Dimensions*	*Moderators*	*Outcome*	*Theory*	*Key findings*
Kwak *et al.* (2018)	South Korean manufacturers and logistics intermediaries Questionnaire survey	Risk management capabilities	Robustness capability Resilience capability		Competitive advantage (in terms of operations)	Resourcebased view	Both robustness capability and resilience capability positively affect competitive advantage. The effect of resilience capability is, however, greater.

Birkie *et al.* (2017)	Secondary + survey data	Supply chain resilience	Proactive (internal + external) and reactive (internal + external) resilience building strategies	Supply chain complexity	(Operational) performance	*Not explicitly discussed*	Both supply chain complexity and supply chain resilience relate positively with operational performance. Supply chain complexity strengthens the positive relationship between supply chain resilience and operational performance.
Chowdhury and Quaddus (2016)	*Apparel industry of Bangladesh* Survey (Questionnaire data)	Supply chain (SC) resilience	Readiness, response, recovery		SC performance	*Not explicitly discussed*	SC resilience affects SC profitability positively.

Again, evidence from Bangladesh's apparel industry indicates that supply chain resilience (readiness, response, recovery) relates positively with supply chain profitability (Chowdhury and Quaddus, 2016). McCann *et al.* (2009) also find that among firms based in Canada, Mexico, and the U.S., organisational resiliency (in terms of sense of identity and purse to survive, support network of, and expanding external alliance, access to capital and resources weather anything, defined widely held values and beliefs) positively affects both firm competitiveness and profitability.

Besides, results from Wieland and Wallenburg's (2013) study of manufacturing firms in Germany, Austria, and Switzerland indicate that supply chain resilience (robustness and agility) positively affects supply chain customer value. Using same data, Wieland and Wallenburg (2012) find that robustness dimension of supply chain resilience also affects business performance (in terms of financial performance), although it has stronger effect on supply chain customer value. Further, Akgün and Keskin (2014) find that, among firms in Istanbul, organisational resilience capacity (in terms of behavioural preparedness, competence orientation, deep social capital, original/unscripted agility, practical habits, and broad resource networks) positively affects firm performance through product innovativeness. In addition,

Kwak *et al.*'s (2018) analysis of data from South Korean manufacturers and logistics intermediaries reveals that risk management capabilities, including robustness (disruption absorption) and resilience (recoverability), positively affect competitive advantage. Using data from firms operating in the Sub-Indian continent, Mandal (2017) finds that supply chain resilience (in terms of recovery, adaptiveness, taking advantage of disruptions, and minimisation of losses) positively affects both operational performance (in terms of delivery) and relational performance. Lastly, Lee and Rha (2016) study of Korean firms reveals that supply chain ambidexterity resulting from resilience-building factors such as supply chain sensing, seizing, and re-configuration mitigates supply chain disruptions' negative magnitudes, and also positively affects firm performance (in terms of operational and financial performance [combined]).

2.5.3 Moderators

Factors proposed as antecedents of firm/supply chain resilience are often found to be moderated by contextual variables. For example, in Ambulkar *et al*.'s (2015) study of the relationship between disruption orientation and resilience (in terms of coping, adaptability, quick response, etc.), it was found that, for firms experiencing high disruption impact, the positive effect of disruption orientation on firm resilience on via resource reconfiguration strengthens. Also, the study finds that, in a low impact disruption context, disruption orientation interacts with risk management infrastructure to affect firm resilience positively. Buyl *et al.* (2017) report that the effect of CEO narcissism on riskiness of policies, and accordingly organisational resilience [in terms of recovery and disruption absorption] is more positive when stock option is high, and when there are no outsider directors with banking experience. Brandon-Jones et al. (2014) find that visibility interacts with supply complexity (in terms of scale complexity) to significantly affect supply chain resilience (recoverability) and supply chain robustness (disruption absorption) positively. Again, Brusset and Teller (2017) report that while external supply chain risks interacts with external capabilities to affect supply chain resilience (in terms of visibility, ability to evaluate process vulnerabilities and risk, and deploy alternative plans associated with risks) negatively, and supplier risks interacts with internal integration to affect supply chain resilience positively. Further, Mandal (2017) finds that process compliance strengthens the positive effects of demand and supply competencies on supply chain resilience (in terms of recovery, adaptability, taking advantage of disruptions, minimisation losses). Moreover, Mandal (2016) finds that technology orientation strengthens the positive effects of development culture, group culture, and relational culture on supply chain resilience (in terms of recovery, robustness, proactiveness, and response). Lastly, Dubey *et al.*'s (2017) study reveals that a firm's behavioural uncertainty positively moderates the effects of inter-firm trust and cooperation on supply chain resilience (recoverability).

Other studies also find that the link between resilience (in general terms) and its outcomes may be moderated by contextual factors. For example, Mandal (2017) find that environment uncertainty positively moderates the effect of supply chain resilience (in terms of recovery, adaptiveness, taking of advantage of disruptions, and minimisation of losses) on operational and relational performance. Akgün and Keskin (2014) on the other hand find that technological turbulence enhances the positive effects of original/unscripted agility, practical habits, and behavioural preparedness on product innovativeness, and weakens the positive effect of competency orientation on product innovativeness. Birkie *et al.* (2017) also find that supply chain complexity positively moderates the relationship between supply chain resilience (competitive of proactive and reactive formative items) and (operational) performance.

2.5.4 Theoretical Underpinnings

In investigating factors that might affect firm/supply chain resilience, prior studies have drawn the following theories: systems theory (in general), competing values framework, resourcebased view, and relational view. Among these, the resource-based view has been the frequently used theoretical lens. This is possibly so as throughout the entire resilience literature it is generally believed that 'resource' differences among systems lead to differences in their resilience to disruptions. Researchers (e.g., Blackhurst *et al.*, 2011; Brandon-Jones *et al.*, 2014; Brusset and Teller, 2017; Ponomarov and Holcomb, 2009) who drew on the resource-based view argue that conceiving and implementing strategies to boost firm/supply chain resilience require resources of various kinds, including financial resources, physical resources (e.g., technology, plant & equipment), information, human resources (e.g., skills, experience, and knowledge), and other organisational capabilities. Notwithstanding the role of organisational resources in developing resilience, other researchers (e.g., Dubey *et al.*, 2017; Wieland and Wallenburg, 2013) argue based on the relational review that relational competencies (e.g. communication, cooperation, and integration) and assets (e.g., trust) among firms are key to extracting and leveraging external resources to develop resilience. In line with the systems theory, Blackhurst *et al.* (2011) explain how sources of interdependencies and complexities within a firm's supply chain (e.g., product/material flows, sources of these flows, and activities required to move them) can undermine its resilience in a global business environment. Moreover, Mandal (2016) drew on the competing values framework to explain how different organisational cultural elements (development culture, group culture, rational culture, hierarchical culture) can affect firm resilience in a healthcare supply chain environment.

The resource-based view and its extension, dynamic capabilities theory, are the main theoretical lenses used to explain the performance consequences of different conceptual elements of firm/supply chain resilience. Studies drawing on either theory regard the conceptual elements of firm/supply chain resilience as important aspects of organisational resources (particularly, capabilities) that can be levered on to improve business performance outcomes. For instance, Li *et al.* (2017) argue that supply chain resilience elements such as preparedness, alertness, and agility are distinct dynamic capabilities that can positively affect financial performance. Also, Chowdhury and Quaddus (2017) draw on the dynamic capabilities theory to contend that proactive (i.e., disaster readiness, flexibility, redundancy/reserve capacity, integration, efficiency, market strength, financial strength) and reactive (i.e., response and recovery) conceptual elements of resilience constitute dynamic capabilities that can improve supply chain performance. Moreover, Kwak *et al.* (2018) suggest that resilience (i.e., recoverability) and robustness (i.e., disruption absorption) constitute dynamic capabilities that can account for differences in competitive advantage. Furthermore, from the resource-based view, Liu *et al.* (2017) argue that supply chain resilience elements such as agility, integration, and supply chain (re-)engineering are organisational resources for driving risk management performance and firm performance.

The contingency theory and the agency theory are two theoretical lenses that were found to have been explicitly used in studies examining the conditional effects of certain variables in model of antecedents of resilience. For example, Brandon-Jones *et al.* (2014) draw on the contingency theory to analyse the effects of visibility on supply chain resilience (recoverability) and robustness (disruption absorption) under differing levels of supply base complexity (i.e., geographic dispersion, scale complexity, differentiation, and delivery complexity). Also, Buyl *et al.* (2017) drew on the agency theory to examine whether corporate governance (i.e., CEO stock options, block ownership, and outside directors with banking experience) moderate the indirect effect of CEO narcissism on organisational resilience via riskiness of policies.

2.5.5 Discussion and Direction of the Present Study

The review finds that several factors have been linked to different resilience elements at the firm-/supply chain-level as antecedents, although most of them have not been empirically tested. Insights from the empirical studies suggest three broad categories of factors: inter-/ organisational resources/ capabilities/ practices, organisational culture/ structure/ orientations, top management/ leadership characteristics; that can influence operational resilience. The review also reveals that majority of the studies so far have focused on the first category of antecedents. Within this category, majority of the studies focused on organisational resources and capabilities. Even though like resources and capabilities, disruption-preparedness/readiness is considered a crucial determinant of the core elements of resilience (i.e., disruption absorption, recoverability, adaptability, and transformability) in the conceptual literature, the reviewed empirical studies did not examine this proposition[13]. While Chowdhury and Quaddus' (2016:2017) studies are the only ones that considered readiness, they treated it as a dimension of resilience, and therefore never theorised or tested causal linkages between it and other core elements of resilience such as disruption absorption and recoverability.

Building on the disruption-preparedness literature and drawing the attention-based view of the firm, this study proposes on the notion of "attention to threats" as a critical driver of operational resilience. As discussed in Section 3.2.2.1.2, attention to threats constitutes disruptionpreparedness. However, it focuses on resource investment in disruptions-preparedness strategies relating to information search and processing. By focusing on attention to threats, the study shifts the extant literature's attention on "stock of resources" to emphasis on "resource investment in resilience-building", and further explores whether these perspectives are complementary or competing. Also, the attention to threats proposal allows for investigating the assumption that firms that prepare for disruptions are resilient (i.e., effective in managing disruptions).

The review also reveals that prior empirical studies have investigated different performance effects of firm/supply chain resilience, including competitiveness/competitive advantage profitability/financial performance, supply chain value/performance, operational performance (in terms of delivery performance), operational vulnerability, and risk management

[13] Given the presumed value of the roles of disaster/disruption readiness/preparedness in disruption management, some scholars (e.g., Kamalahmadi and Parast, 2016; Ponomarov and Holcomb, 2009; Chowdhury and Quaddus, 2016:2017) consider it an element of resilience, although some other scholars (e.g., Davidson *et al.*, 2016) clarify that it is a non-essential aspect of the meaning of resilience.

performance. However, despite the concern that mixing the core conceptual nature of the term with its antecedents (as most of the studies have done) creates theoretical and empirical challenges and may misguide policy and practice (Davidson *et al.*, 2016), there is a dearth of empirical knowledge of how resilience relates to operational efficiency. Thus, in extending this body of research, the present study explores the relationship between operational resilience and operational efficiency. The operational efficiency construct is not only of strategic essence (Gligor *et al.*, 2015; Boyer and Lewis, 2002) but also a logical performance construct to study in relation to operational resilience (van der Vegt *et al.*, 2015; World Economic Forum Report, 2013).

Again, the review finds that majority of the variables studied as moderators in models of firm/supply chain resilience have been firm-level factors. The emerged evidence indeed suggests that internally-related contingent factors are crucial in understanding the nuances regarding the effects of antecedents of firm/supply chain resilience. Advancing this stream of resilience research, the current research examines the moderating roles of strategic mission rigidity and disruption orientation in the relationship between attention to threats and operational resilience. The resilience literature recognises that change, learning, and innovative behaviours are key inherent characteristics of resilient systems (Meyer, 1982; Folke *et al.*, 2010; Reinmoeleer and van Baardwijk, 2005; Chowdhury and Quaddus, 2016). Meanwhile, strategy scholars (Mone *et al.*, 1998; Atuahene-Gima *et al.*, 2005; Li *et al.*, 2008) point out that such behaviours may be suppressed by strategic mission rigidity. On the other hand, Bode *et al.* (2011) find that resilience building strategies thrive among disruption-oriented firms while Ambulkar *et al.* (2015) find that disruption orientation impacts firm resilience through resource reconfiguration at differing levels of risk management infrastructure and disruption impacts. Drawing on these literatures, the study suggests that corporate strategic behaviours/dispositions (i.e., strategic mission rigidity) as well as resilience-building specific behaviours/dispositions (i.e., disruption orientation) are important organisational contingencies that can moderate the effects of attention to threats.

Moreover, the review (see Tables 2.7 and 2.9) indicate that empirical research on firm/supply chain resilience have been conducted among firms operating in developed and emerging economies (or Western and Asian counties). Majority of these studies relied on data from Asia, followed by the U.S. Evidence from developing and African economies has been is missing in the literature. Regarding data issues, it is observed that with the exception of Buyl *et al.* (2017), DesJardine *et al.* (2017), and Ortiz-de-Mandojana and Bansal (2016) that relied on longitudinal data, all the other studies relied on cross-sectional survey data (collected using questionnaires). The main difference between the two research designs is that, the studies (Buyl *et al.*, 2017; DesJardine *et al.*, 2017) that relied on longitudinal data focused on one particular disruption (an exogenous and a high impact one) that all firms considered in their studies experienced it, while those that relied on cross-sectional data did not focus on any particular disruption. By studying one particular disruption, the former studies were able to assess resilience elements such as a disruption absorption and recoverability. This approach has the advantage of making it easy and more appropriate to compare and conclude on the relative resilience level of firms that were all exposed to the same disruptive event. The challenges with implementing this approach, however, are that, for a given context, (1) one should be able to identify one significant exogenous disruptive event, and (2) there should be available and accessible data on how the firms under consideration performed before and after the disruption. The latter approach, which this study follows, implicitly assumes that disruption (in any form, in terms of source and impact level) is a common phenomenon that firms experience every now and then. Accordingly, studies that follow this approach and measure the core elements of resilience[14] (e.g., recovery and disruption absorption) (e.g., Brandon-Jones *et al.*, 2014; Kwak *et al.*, 2018; Mandal, 2016:2017; Wieland and Wallenburg, 2012) do not make reference to any particular disruption. Largely, this approach makes comparison, and also assessment of the causes and the performance outcomes, of the core elements of resilience not only difficult, but also, quite problematic. Nonetheless, this study considers that by capturing and controlling for differences in important and common operationally-related disruptions, and exogenous triggers of operational disruption (e.g., environment dynamism), a better conclusion can be reached. Yet, the prior studies reviewed did not duly address this concern. To obtain robust estimates, the present study controls for these factors.

2.6 CHAPTER SUMMARY

This chapter has provided an in-depth assessment of literature on resilience, particularly, as studied in the business and management field. The chapter synthesised and discussed the definitional/ conceptual perspectives on resilience under two broad themes: core perspectives and non-core perspectives. The core perspectives (original dictionary, Holling's (1973), and dynamic) propose that the notion of resilience fundamentally connotes the ideas of persistence/ resistance, disruption absorption, recovery to previous state, and system identity retention, renewal/ self-organisation, adaptability, and transformability/ transformation. Studies grounded within these schools of thoughts detach the meaning, conceptualisation, and measurement of the concept from factors that potentially drive it. On the other hand, the noncore perspectives (formative and process) argue that factors that potentially drive the core conceptual elements of resilience are critical to the definition, conceptualisation, and

[14] The measurement of the formative elements of resilience (including the readiness/preparedness dimension of the process perspective) does not require the consideration of, or referring to, any disruptive event.

measurement of resilience. Thus, studies that draw on these perspectives often utilise formative indicators in attempt to capture resilience.

In relation to the study's first objective and the associated knowledge gap, this chapter focused on developing the conceptual domain of operational resilience. To end this, and consistent with Davidson *et al.* (2016), it was argued that resilience should be conceptualised as concept distinct from its potential drivers. Drawing on relevant streams of studies, operational resilience was defined as the ability of a firm's operations to absorb and recover from disruptions, and was conceptualised it as comprising two theoretically unique components: disruption absorption and recoverability. The chapter concludes that though both components of operational resilience constitute organisational capabilities, their intended purpose (i.e., for managing operational disruption) is not the same as that of operational capability or dynamic capability.

Also, the chapter sheds light on several factors that have been studied as antecedents of firm/supply chain resilience, and how different performance outcomes have been linked to different aspects of firm/supply chain resilience. In advancing these streams of research, the study investigates attention to threats and operational efficiency as an antecedent and an outcome of operational resilience respectively. Lastly, the review also finds that the effects of antecedents of firm/supply chain resilience are often moderated by organisational contingencies. In enriching this knowledge this body of knowledge, the study examines the contingency roles of strategic mission rigidity and disruption orientation in the link between attention to threats and operational resilience.

The next chapter focuses on developing a model and hypotheses about how attention to threats relates to operational resilience, how strategic mission rigidity and disruption orientation moderate the attention to threats-operational resilience relationship, and how operational resilience relates to operational efficiency.

CHAPTER THREE

RESEARCH MODEL AND HYPOTHESES

3.1 INTRODUCTION

This chapter focuses on developing a model and hypotheses relating to the second and the third objectives of the study. Prior studies investigating the antecedents and consequences of firm/supply chain resilience have drawn on several theories (see Tables 2.7 and 2.9 in Chapter Two). Among them, the RBV is the dominant theoretical lens used to understand the antecedents/formative indicators of firm/supply chain resilience (see Brusset and Teller, 2017; Brandon-Jones *et al.,* 2014; Blackhurst *et al.,* 2011; Ponomarov and Holcomb, 2009; Kwak *et al.,* 2018). Other theoretical lenses that have been utilised in this line of enquiry include the systems theory (DesJardine *et al.*, 2017; Blackhurst *et al.*, 2011), the relational view (Dubey *et al.*, 2017; Wieland and Wallenburg, 2013), and the competing values framework (Mandal, 2016). Regarding the contingencies in models of antecedents of firm/supply resilience, a couple of studies have drawn on the contingency theory (Brandon-Jones *et al.*, 2014) and the agency theory (Buyl *et al.,* 2017). Also, about the performance outcomes of resilience, prior studies have drawn on the RBV (Mandal, 2017; Liu *et al.*, 2017) and the dynamic capabilities theory (Li *et al.*, 2017, Chowdhury and Quaddus, 2017, Kwak *et al.*, 2018). The present study draws on the ABV (Ocasio, 1997), the contingency theory (Donaldson, 2006; Ginsberg and Venkatraman, 1985), and the RBV (Wernerfelt, 1984; Barney, 1991). The subsequent section discusses the study's theoretical approach as well as each of the theories in terms of their core propositions and they are applied in the study. Next, the chapter presents the research model and hypotheses and chapter summary.

3.2 THEORETICAL BACKGROUND

3.2.1 Theoretical Approach

This study adopts a theory testing approach, which involves formulating and testing hypotheses about relationships between variables based on relevant theories/logics and prior research evidence (Fisher and Aguinis, 2017; Creswell, 2003; Crossan, 2003). As opposed to other approaches such as theory generation and theory elaboration, theory testing is useful when the proposed relationships between variables can be explained using a well-developed, tried and tested existing theory (Fisher and Aguinis, 2017). Both the RBV (Kraaijenbrink *et al.*, 2010; Barney *et al.*, 2001) and the contingency theory (Van de Ven *et al.*, 2013; Tosi and Slocum, 1984) have had long-standing applications and impacts in several streams of business and management studies. While similar assertion can be made for the ABV (Ocasio *et al.*, 2018; Ocasio, 2011), unlike the others, it is yet to gain interest in resilience research.

In using existing theories, one can identify important variables and specify and explain the 'causal' linkages between them, and accordingly test related hypotheses on a suitable piece of real-world data (Fisher and Aguinis, 2017). This study draws on the ABV and McMullen *et al*.'s (2009) notion of managerial (in)attention to competitive threats to propose and situate the concept of "attention to threats" within the disruption-preparedness/readiness view of resilience thinking (Kamalahmadi and Parast, 2016; Ponomarov and Holcomb, 2009; Chowdhury and Quaddus, 2016). The ABV is further used to explain the links from attention to threats to operational resilience. The notion of operational resilience is grounded in the RBV as an organisational capability (see Section 2.4.3) and the same theory is used to explain the relationship between operational resilience and operational efficiency. Lastly, the moderating variables: strategic mission rigidity and disruption orientation; are grounded in the ABV as firm-level attention structures, while their moderating roles in the attention to threatsoperational resilience relationship are explained using the contingency theory.

Mayer and Sparrowe (2013, p. 917) observe and conclude that "many research questions can't be fully addressed by drawing only upon a single theory". For Mayer and Sparrowe (2013), theory integration can provide a better explanation to a given phenomenon that a single theory cannot provide in isolation. For example, the ultimate construct in the study is operational efficiency. Yet, the ABV appears incapable of explaining the relationship between operational resilience and operational efficiency.

The ABV's principles are situated within the contingency theory. It contends that attentional focus (and accordingly, organisational moves and performance) is contingent upon in the decision-making environment/context (Titus and Anderson, 2016). Accordingly, prior studies drawing on the ABV (Titus and Anderson, 2016; Clercq and Zhou, 2014; Ambos and Birkinshaw, 2010; Bouquet *et al.*, 2009; Laursen and Salter, 2006) have implicitly or explicitly recognised the value of the contingency theory. To improve the explanatory power of attentional focus, these studies capture relevant contingency variables. Accordingly, this study argues that complementing the ABV with the contingency theory could help clarify the attention to threats-operational resilience relationship.

Like the RBV (Barney, 1991), the ABV (Ocasio, 1997) recognises the importance of organisational resources in driving organisational success. It argues that organisational resources play critical role in structuring managerial attention to issues and answers (Ocasio, 1997). Nonetheless, whereas the RBV emphasises resource possession and control, the ABV emphasises resource allocation. Also, although the RBV primarily directs attention to explaining why the possession and control of resources that exhibit VRIN (valuable, rare, inimitable, and non-substitutable) attributes lead to sustained competitive advantage, it also recognises that such resources need to be developed and or acquired (Makadok, 2001; Teece, 2014; Teece *et al.,* 1997; Barney *et al.,* 2001; Wernerfelt, 1984). Thus, by focusing attention on issues and answers (Durand, 2003), organisations can develop relevant and idiosyncratic resources (in the form of capabilities) that can then be levered on to drive business performance outcomes (Aral and Weill, 2007; Makadok, 2001).

3.2.2 Theoretical Underpinnings

Theories underpinning the proposed research model are discussed in this study.

3.2.2.1 The Attention-based View of the Firm (ABV)

The overview of the ABV (in terms of core propositions) and how it is applied in the study are presented in this section. Again, the section explicates the notion of attention to threats and the attention structure nature of strategic mission rigidity and disruption orientation.

3.2.2.1.1 Overview and Core Propositions

Understanding when, why, and how organisations anticipate or respond to issues in their task environment, or why organisations take certain decisions and moves but not others are central to strategy research (Ocasio, 1997). To this end, the ABV focuses on understanding/ explaining how attention in organisations shape strategic decisions and responses to issues within the business environment (Ocasio *et al.,* 2018 Ocasio, 1997). Within the ABV's logic, a firm's strategy is a "pattern of organisational attention, the distinct focus of time and effort by the firm on a set of issues—problems, opportunities, and threats—and on a particular set of action alternatives—skills, routines, programs, projects, and procedures" (Ocasio *et al.,* 2018, p.156). In other words, the ABV contends that the dominant attentional perspective (i.e., heightened *focus* over time to relevant issues and answers) of the firm is equivalent to its dominant strategy (i.e., how it allocates its limited resources to particular issues and answers) (Ocasio, 2011).

Accordingly, the ABV proposes that it is organisational attention that generates a "firm's strategic agenda—issues and action alternative that guides the allocation and deployment of resources" (Ocasio *et al.* 2018, p.156). Influenced by the behavioural theory of the firm, the ABV, by and large, views organisations as problem-solving entities with limited attention (or resources, including managerial time and finance, for example). By implication, it contends that at any point in time, decision-makers will be selective in the issues and answers they attend to, or focus on limited number of issues and answers (Ocasio, 1997; Ocasio, 2011).

Generally, the ABV offers wide range of testable propositions (see e.g., Ocasio, 1997; Ocasio, 2011). Yet, almost all are grounded in three related principles (Ocasio, 1997):

1. *Focus of attention*, i.e., organisational decision-makers will be selective in the issues and the answers they attend to, and what they do depends on what they focus their attention on.
2. *Situated attention*, i.e., what issues and answers organisational decision-makers focus attention on and what they do are contingent upon the particular situation (or context) they are located in.
3. *Structural distribution of attention*, i.e., what specific situation organisational decisionmakers find themselves in and how they attend to it depend on how the firm's rules, resources, and relationships distribute various issues, answers, and decision-makers into specific communications and procedures.

Based on these principles, ABV-inspired studies have focused on addressing two noticeable objectives, namely:

1. Understanding/explaining the sources of heterogeneity in organisational/managerial attention (in terms of selection, perspective/allocation/focus, and engagement [see

Ocasio, 2011]) to issues and answers (see e.g., Madsen *et al.*, 2015; Plourde *et al.*, 2014; Tuggle *et al.*, 2010; Clercq and Zhou, 2014; Conroy and Collings, 2016; Durand and Jacqueminet, 2015; Barreto and Patient, 2013; Blettner *et al.*, 2015; Cho and Hambrick, 2006).

2. Understanding/explaining strategic moves and organisational outcomes as consequences organisational/managerial attention to particular issues and answers and the underlying contingencies (see e.g., Titus and Anderson, 2016; Madsen *et al.*, 2015; Clercq and Zhou, 2014; Ambos and Birkinshaw, 2010; Bouquet *et al.*, 2009; Yadav *et al.*, 2007; Laursen and Salter, 2006; Durand, 2003).

The present study draws on the ABV's tenets guiding the second groups of studies to explain the link from attention to threats to operational resilience. A general proposition of this stream of ABV-inspired research is that, attentional focus allows firms to gain better understanding of, and responses to, issues and accordingly identify opportunities to improve organisational outcomes (Ocasio, 1997). Table 3.1 present sample studies that have drawn on the ABV in effort to address objectives that bear similarities with those addressed in the present study. Generally, findings from these studies indicate that while attentional focus can be beneficial, there are often contingencies regarding its relationship with relevant organisational outcomes.

3.2.2.1.2 The Notion of Attention to Threats

Firms allocate attention to issues and answers for varied reasons, two of which may include: (1) solving problems undermining how they make a living presently in an attempt to least protect/maintain their competitive position, and (2) searching for, and exploiting, better ways of making a living in the present and in the future so as to maximise their competitive position; all in an effort to improve profitability and survival. Accordingly, this study contends and develops arguments that attention to threats constitutes an important strategic investment that has implications on operational resilience, and consequently operational efficiency. To advance this assertion, this section will define and delineate the notion of attention to threats. The section starts with a discussion on the term “threats” as used in the study.

The concept of threat has long history in strategy research. Within this research field, what is (not) threat can be a matter of interpretational differences (Julian and Ofori-Dankwa, 2008). However, the ABV lists threats and opportunities as different issues, both of which compete for decision-makers’ attention. In strategy-related studies, the term is generally used to represent a negatively framed issue or event. It connotes issues characterised as negative, uncontrollable, and involving potential loss (Barr and Glynn, 2004). Along this line, and consistent with the resilience literature, the study’s use of the term threats is synonymous to terms such as disruptions, catastrophes, crises, disturbances, perturbations, and jolts.

Table 3.1: Empirical Studies on the Link between Attention Allocation and Organisational Outcomes

Author (Year)	*Data*	*Attention-based construct*	*Moderator*	*Organisational outcome*	*Key finding*
Titus and Anderson (2016)	Secondary (longitudinal) data U.S. publicly traded firms	Corporate venture capital (CVC) investments	Operational structure (OS) Environment munificence (EM)	Firm value (Tobin's Q)	1. CVC investments does not affect firm value 2. OS strengthens the positive effect of CVC investments on firm value 3. EM attenuate the positive effect of CVC investments on firm value 4. CVC investments, EM, and OS interact to negatively affect firm value
Ambos and Birkinshaw (2010)	Primary (survey) and secondary cross-sectional data	Headquarters' attention (relative, supportive, & visible)	Subsidiary strategic choice: Autonomy, Power, and Initiatives	Subsidiary performance (financial & management)	1. Headquarters' attention does not have significant direct effect on performance 2. Subsidiaries that have a high strategic choice and a high level of attention, the better their performance
Bouquet et al. (2009)	Qualitative and quantitative (survey and secondary) data Cross-national sample of MNEs (headquarters) from multiple countries	International attention of headquarters (HQ)	Industry dynamism (ID), International experience of HQ executives (IEHQE), Independence of value-adding activities (IVA)	Multinational enterprise performance (ROA, ROE, ROS)	1. International attention has a curvilinear (inverted U-shape) relationship with MNE performance 2. The performance benefit of IA increase when international assignment experience of top executives, the independence of value-adding activities across country locations, and industry dynamism is high
Clercq and Zhou (2014)	Survey (crosssectional questionnaire) data International ventures located in China	International learning effort	Competitive intensity Social interaction	International performance	1. Learning effort positively affects international performance. 2. This effect amplifies when competitive intensity and social interaction are high
Laursen and Salter (2006)	UK Survey data	External search breadth and depth (for innovative ideas)	Novelty of innovation (radicalness) R&D intensity	Innovation performance	1. Both external search breadth and depth and are curvilinearly (inverted Ushaped) related to innovative performance 2. The more radical the innovation, the more effective external search 3. depth is in shaping innovative performance 4. The more radical the innovation, the less effective external search breadth is in influencing innovative performance

Jääskeläinen et al. (2006)	Secondary (longitudinal) data U.S. venture capital firms	Allocation of attention to portfolio companies (AAPC)	Syndication frequency (SF) Syndication role (SR)	VC performance (number of IPOs)	1. There exists inverted U-shape relationship between AAPC and VC performance 2. SF positively moderate the inverted U-shape relationship between AAPC and VC performance ositive effect of SF on the inverted U-shape relationship between AAPC and erformance is high among non-lead VCs than lead VCs

In the resilience literature (Brandon-Jones *et al.*, 2014; Ambulkar *et al.*, 2015), the term "threat" has been used interchangeably with terms such as disruptions or disruptive event, defined in this study as unplanned and unintended events (or issues) whose occurrence undermine the normal functioning and survival of firms (Blackhurst *et al.*, 2011; Linnenluecke, 2015). Threats are unplanned and unintended events as they are not purposefully initiated by the firm and their occurrence are beyond the control of the firm. Threats in the business environments may include fluctuations in the demand and the supply markets, technological turbulence, technology and communication failure, financial crisis, transport system/network failure, energy shortage, outsourcer failure, loss of talent/skills, currency exchange rate volatility, instability in and unfavourable industry regulations and policies, political instability, product liability/ failure and recalls, failure of the supplier to meet production requirements [because of e.g. bankruptcy/ liability], and fire outbreak. Still, other forms of threats may include natural disasters and deliberate threats (e.g., terrorism and sabotage, piracy and theft, cyber-attacks, labour disputes, industrial espionage, and pressures from special interest groups) (Pettit *et al.*, 2010; Pettit *et al.*, 2013; Business Continuity Institute, 2017). For profitability and survival motives, the study assumes that, other things being equal, firms will allocate attention to such issues within their environment.

Attention involves the distinct focus of time and effort by the firm on a particular set of issues (such as threats) as well as relevant answers (Ocasio, 1997). Prior studies (e.g., Durand, 2003; Clercq and Zhou, 2014; Bouquet *et al.*, 2009; Ambos and Birkinshaw, 2010) examining strategic moves and performance outcomes of attentional focus have defined and measured the concept in terms of extent of allocation of resources, comprising (top executives') time, energy, and effort and (firm's) finance, to particular issues and answers. For example, Bouquet *et al.* (2008) define the notion of *international attention* as "the extent to which they [headquarters] invest time and effort in activities, communications, and discussions aimed at improving their understanding of the global marketplace" (p. 108). Also, Durand and Jacqueminet (2015) define *subsidiary's attention to the demands of both its headquarters and its external constituents* as "comprising their notice of these demands, allocation of time and effort to understand these demands, and elaboration of a response strategy" (p. 4). Moreover, Durand (2003) captures *organisational attention to external information* as "the differences between expenditures a firm devoted to gathering market information (expressed as a percentage of sales) relative to its competitors' expenditures" (p. 872). Within the ABV, attention is involves cognitive activities, such as maintaining situation awareness and mindfulness, stimuli/information interception, issue interpretations, and action/responses as well as organisational practices including discussion of issues and answers (Bouquet *et al.*, 2009; Ocasio, 1997: 2011).

In line with the foregoing discussions, the notion of "attention to threats" is defined in this study as t*he extent to which a firm invest resources (including time, effort, and money) in information search and processing aimed at enhancing its understanding of, and responses to, disruptions.* This definition portrays attention as a broad vehicle for learning about, and responding to, disruptions in the firm's environment (Bouquet *et al.*, 2009). Thus, attention to threats can viewed as constituting a critical part of the firm's information search and processing system (Durand, 2003; Ocasio, 1997; Bouquet *et al.*, 2009), but focused specifically on disruptions. The definition also invokes the ideas of situational awareness, vigilance, mindfulness, and anticipation, which are central to the notion of attention (Ocasio, 2011: 1997; Yadav *et al.*, 2007; McMullen *et al.*, 2009), and also the disruption-preparedness view of resilience thinking (Ambulkar *et al.*, 2015; Chowdhury and Quaddus, 2016). Situational awareness, vigilance, and mindfulness will manifest in focus of resources on monitoring and gathering information about, and discussion of, potential disruptions within the business environment. Similarly, these information search and processing activities reinforce situational awareness, vigilance, mindfulness, and anticipation (Yadav *et al.*, 2007). Accordingly, it is argued that attention to threat is consistent with the disruption-preparedness view of resilience thinking which involves anticipation, pre-empting, and putting in place appropriate response measures (Davidson *et al.*, 2016; Kamalahmadi and Parast, 2016; Chowdhury and Quaddus, 2016:2017). The disruption-preparedness view emphasises that "managers should anticipate the occurrence of disruptions and prepare their supply chains [or firms] for any expected and unexpected changes in the environment" and aim at gaining understanding of the occurrence and impacts of disruptions (Kamalahmadi and Parast, 2016, p. 121). Nonetheless, the channels through which disruption-preparedness works are numerous (see e.g., Chowdhury and Quaddus, 2016:2017; Kamalahmadi and Parast, 2016 for further discussions). The attention to threats aspect of it relates to resource investment specifically in information search and processing activities that enhance the firm's understanding of, responses to, disruptions. It should be noted that attention to threats as implying either resource investment in information search and processing is scarcely discussed in the resilience/disruption-preparedness literature.

Consistent with the disruption-preparedness view, the idea of attention to threats assumes that disruptions are unavoidable and are surprisal in nature (Linnenluecke, 2015; Blackhurst *et al.*, 2011; Jüttner and Maklan, 2011). This creates the need for organisations to be in a state of preparedness (Kamalahmadi and Parast, 2016; Ponomarov and Holcomb, 2009; Chowdhury and Quaddus, 2016). Also, that attention to threats involves information search and processing assumes the position of the organisational information processing theory (Galbraith, 1973; Tushman and Nadler, 1978) that, as open systems, firms encounter environment uncertainty and strive for order and stability (Bode *et al.*, 2011). Uncertain environment is problematic as it makes it difficult for the firm to plan and operate deterministically (Bode *et al.*, 2011). Addressing this requires investing resources in information search and processing activities.

3.2.2.1.3 Attention Structures: Strategic Mission Rigidity and Disruption Orientation

Organisations have several needs and face numerous issues, all of which require and compete for resources to address. However, since organisational input resources (e.g., finance, human resource, and management time) are limited (Amit and Schoemaker, 1993), resource allocation decisions will be governed by the nature of situational/contextual factors internal and external to the firm (Ocasio, 1997). According to the ABV, attention selection/attentional focus is shaped by the firm's attention structures, i.e., factors (both internal and external to the firm) that govern and regulate the evaluation, legitimisation, and prioritisation of issues and answers (Titus and Anderson, 2016; Ocasio, 1997).

A key attention structure of interest in this study is organisational rules, "a set of assumptions, norms, values, and incentives—usually implicit—about how to interpret organizational reality, what constitute appropriate behaviour, and how to succeed" (Ocasio, 1997, p. 196). Like any other attention structure, organisational rules generate set of values that order legitimacy, importance, and relevance of issues and answers (Ocasio, 1997). Consistent with this proposition, Clercq and Zhou (2014) conceptualised a firm's entrepreneurial strategic posture as constituting an attention structure that facilitate learning effort (conceived as attentional focus construct), and accordingly performance. Other studies (e.g., Titus and Anderson 2016) have, however, analysed how attention structures moderate the effect of attentional focus variables. Building on these ideas, the present study conceptualises strategic mission rigidity and disruption orientation as attention structures that may not only determine attention to threats, but also moderate its effect on operational resilience.

3.2.2.2 The Contingency Theory

> *It is perhaps a truism that any theory of corporate or business strategy must be, by definition, contingency-based* (Ginsberg and Venkatraman, 1985, p. 421).

The contingency theory is a major theoretical lens for researching the concept of (mis)'fit'performance relationship (Donaldson, 2006; Venkatraman and Prescott, 1990; Tosi and Slocum, 1984). Largely, many organisation and strategic management theories and practices have been based on the fundamental logic of the contingency theory (Van de Ven *et al.*, 2013).

For example, the ABV's (Ocasio, 1997) core tenets are contingency-based (see Section 3.2.2.1.1). Within the ABV, the contingency theory provides insight concerning how a specific managerial decision fits within the broader context of the firm and for predicting the performance consequence of that decision (Titus and Anderson, 2016). Also, the logic of the contingency theory has already influenced resilience thinking. A sizable number of resilience studies that were interested in understanding the boundaries of antecedents of resilience considered contingent variables (see Brandon-Jones *et al.*, 2014; Buyl *et al.*, 2017; Ambulkar *et al.*, 2015; Brusset and Teller, 2017; Mandal, 2017:2016; Dubey *et al.*, 2017).

Rindfleisch *et al.* (2008) contend that one way to minimise competing arguments in casualbased theoretical models, and therefore enhance causal inferences, is to incorporate relevant contingency variables. Andersson *et al.* (2014) also note that incorporating contingency variables can produce new theoretical insights. To these ends, the contingency theory is a suitable theoretical lens to draw on in an effort to understand the conditions under which attention to threats influences operational resilience (Donaldson, 2006; Lumpkin and Dess,
1996; Covin and Slevin, 1991; Venkatraman and Prescott, 1990; Tosi and Slocum, 1984; Ginsberg and Venkatraman, 1985).

A contingency approach to strategy assumes that no single strategy can apply in all circumstances (Ginsberg and Venkatraman, 1985). It also assumes that management's styles and firm's strategies are shaped by the firm's internal and external environment (Ginsberg and Venkatraman, 1985; Tosi and Slocum, 1984). From a contingency perspective, being 'strategic' is equivalent to being successful in aligning available organisational resources with the prevailing internal and external environmental conditions (Venkatraman, 1990). To enhance organisational outcomes, the contingency theory recommends firms to adapt their strategies (as well as structures and processes, for example) to the conditions in their environment (Donaldson, 2006; Ginsberg and Venkatraman, 1985). A key thrust of the contingency theory is that heterogeneity in organisational outcomes among firms results from variance in (mis)fit in their strategies, processes, structures, environment, etc. (Van de Ven *et al.*, 2013; Flynn *et al.*, 2010; Donaldson, 2006). According to the contingency theory, fit-misfit is a matter of degree, and that greater levels of fit between strategy and prevailing organisational factors can be expected to yield greater organisational outcomes (Donaldson, 2006).

Given the centrality of the contingency theory to the ABV (Titus and Anderson, 2016), it is necessary that ABV-based theoretical models (such as the relationship between attention to threats and operational resilience) incorporate relevant contingency variables. Attention to threats may drive organisational outcomes. However, the boundaries of the benefits of attentional focus can better be understood when relevant contingency variables are considered (Ambos and Birkinshaw, 2010; Bouquet *et al.*, 2009; Titus and Anderson, 2016). Consequently, this study focused on theorising about how strategic mission rigidity and disruption orientation moderates the relationship between attention to threats and operational resilience. Specifically, the study suggests that incongruency between attention to threats and relevant organisational rules such as strategic mission rigidity and disruption orientation undermines the operational resilience benefit of attention to threats.

3.2.2.3 The Resource-Based View

This section the presents the overview and core propositions of RBV and how it is applied in the study.

3.2.2.3.1 Overview and Core Propositions

Understanding sources of competitive advantage[15] and performance differences among firms has been central to strategy research, and the RBV has had significant influence in this pursuit and remained relevant across many research streams (Kraaijenbrink *et al.*, 2010; Ray *et al.*, 2004; Barney *et al.*, 2001; Mahoney and Pandian, 1992), despite some criticisms levelled against it[16]. Until the birth of the RBV movement, the neoclassical economic and industrial organisation paradigm attributed sources of competitive advantage to factors external (particularly, industry characteristics) to the firm (Kraaijenbrink *et al.*, 2010; Lado *et al.*, 1992). The RBV approach, however, aims at explaining why performance differences can be expected among firms, even among those in the same competitive environment (Kraaijenbrink *et al.*, 2010). The RBV emphasises attributes of the firm that are costly-to-duplicate as sources of economic rents and, hence as the core drivers of performance and competitive advantage (Conner, 1991).

The RBV advocates assume that for any given industry, firms may be heterogeneous, in terms of the resources they possess and control, and that these resources may be imperfectly mobile across firms, and thus heterogeneity can be long lasting (Barney, 1991; Hunt and Morgan,

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[15] "A firm is said to have a *competitive advantage* when it is implementing a value creating strategy not simultaneously being implemented by any current or potential competitors" (Barney, 1991, p. 102)

[16] Including (1) the RBV suggests infinite search for higher-order capabilities, (2) sustained competitive advantage as proposed by the RBV is not achievable or sustainable, (3) the RBV lacks managerial implications, (4) the applicability of RBV is too limited, (5) VRIN is not a necessary or sufficient condition for sustained competitive advantage, (6) the RBV does not qualify as theory of the firm, (7) the definition of resource is unworkable as it is all-inclusive, (8) the value of a resources is too indeterminate to provide for useful theory (see Kraaijenbrink *et al.* [2010] for discussions).

1995). Extending prior work and building on these assumptions, Barney (1991) articulates and proposes that heterogeneity in competitive advantage and firm performance results from unique and idiosyncratic attributes of the firm. The core message of the RBV is that in order for a firm to achieve sustained competitive advantage[17], and eventually economic rents, it must acquire/develop, control, and deploy resources that are value, rare, inimitable, and nonsubstitutable (VRIN) (Barney, 1991; Kraaijenbrink *et al.*, 2010). This core message is shared by several related theoretical perspectives, including the resource-advantage theory (Hunt and Morgan, 1995; Hun, 1997), the dynamic capabilities theory (Teece *et al.*, 1997), and the knowledge-based view (Grant, 1996).

Within the RBV, a resource is generally thought of as any strength that a firm can rely on to conceive of and implement it strategies (Wernerfelt, 1984; Barney, 1991). To put into perspective, resources represent "tangible and intangible entities available to the firm that enable it to produce efficiently and/or effectively a market offering that has value for some market segment(s)" (Hunt, 1997, p. 64). In other words, they are "anything available to the firm that has an enabling capacity" (Hunt, 1997, p.64) for it to achieve competitive advantage (Hunt and Morgan, 1995). Reinforcing the views of other RBV scholars (Barney, 1991; Wernerfelt, 1984), Hunt (1997) asserts that resources are not just tangible assets. Rather, they include physical resources (e.g., stock of raw materials, equipment, and plants), financial resources (e.g., access to credit facilities, cash-in-hand, and cash-at-bank), human resources (e.g., knowledge, experience, and skills of managers and employees), legal-based resources (e.g., patents, copyrights, trademarks, brand name, and licenses), informational resources (e.g., information/knowledge about the general business environment, suppliers, customers,

[17] A firm is said to have a sustained competitive advantage when current or potential competitors are unable to duplicate the benefits of its competitive advantage (Barney, 1991)

competitors, and technologies), organisational (e.g., capabilities/competencies, routines, culture, governance/controls), and relational resources (e.g., trust embedded within relationships with customers, channel members, suppliers, and other business stakeholders). As discussed in Section 2.4.3, operational resilience constitutes capability form of organisational resource.

According to the RBV, possessing and controlling resources alone may not lead to completive advantage, but rather, the extent to which they are deployed (Makadok, 2001; Barney, 1991). Also, in Barney's (1991) view, not all resources can lead to sustained competitive advantage. Barney (1991) argues that in order for any resource to be qualified as a driver of sustained competitive advantage it must be: *valuable* (i.e., when it allows a firm to exploit opportunities, or neutralise threats in its environment), *rare* (i.e., a valuable resource should be possessed and controlled by only limited numbers of players in the industry), *inimitable* (i.e., a valuable and rare resource should be difficult to be acquired, created, or duplicated by competitors), and *non-substitutable* (i.e., a valuable, a rare, and an inimitable resource should lack close substitutes in the marketplace, or should not have strategic equivalence[18]).

3.2.2.3.2 Can Superior Performance Outcomes be associated with Operational Resilience?

Basing on the RBV's (and its offspring, particularly, dynamic capabilities theory) tenets, scholars have had little disagreement about the potency of firm/supply chain resilience (in general terms) to drive business performance outcomes. Yet, there is limited theoretical development on why resilience can generate superior performance outcomes. Kwak *et al.* (2018) draw on the logic of competitive heterogeneity and the RBV to suggest that resilience

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[18] That is, when two valuable resources can both be exploited separately to implement the same strategies (Barney, 1991).

will lead to competitive advantage. Kwak *et al.* (2018) find that, among South Korean manufacturers and logistics intermediaries, risk management capabilities including robustness (disruption absorption) and resilience (recovery) positively relate to competitive advantage. In fact, the present study's definitions of, and measures for, the two dimensions of operational resilience (i.e., disruption absorption and recoverability) are closely related to what these authors refer to as risk management capabilities.

This study advances the RBV view of resilience by conceptualising operational resilience as a VRIN (valuable, rare, inimitable, and non-substitutable) resource. From this perspective, the study suggests that firm performance outcomes such as operational efficiency may increase with increases in operational resilience. Barney (1991) differentiates between two potential performance outcomes of a firm's resources and the necessary conditions under which each may be expected. For Barney (1991), competitive advantage, and accordingly performance improvement, result from possessing, controlling, and deploying valuable and yet rare resources. On the other hand, for a firm to enjoy sustained competitive advantage, and accordingly sustained performance, it must possess, control, and deploy resources that are not only valuable and rare, but also inimitable, and non-substitutable. An important question that should follow from here is: *when does (or how can) a firm possess and control resources that meet these conditions before it may enjoy superior performance and sustained performance?*

A resource is *valuable* when it allows a firm to exploit opportunities, or neutralise threats in its environment (Barney, 1991). The study takes a position that both disruption absorption and recoverability aspects of operational resilience meet this condition, i.e., they can allow firms to neutralise the negative impacts of disruptions, including inefficiencies, poor delivery performance, lost sales, and bad reputation (Ambulkar *et al.*, 2015; Revilla and Saenz, 2017). Disruptions interrupt normal flow of operations, and accordingly lead to inefficiencies [e.g., resulting from delays, idle resources, and extra cost of fixing the problem) and hurt profit (e.g., inefficiencies plus losing sales as a result of product/service unavailability). However, firms with greater ability to absorb disruptions or quickly and reliably recover from disruptions can be expected to stand in a better position to minimise underperformance which otherwise will be resulting from disruptions.

Rarity occurs when a valuable resource is possessed and controlled by only limited number of players in an industry. Also, for a resource to be *inimitable* and *non-substitutable,* it should be valuable and rare, and yet difficult to be acquired, created, or duplicated by competitors; and this valuable, rare, and inimitable resource should lack close substitutes in the marketplace respectively. As explained above, disruption absorption and recoverability constitute valuable resources. However, how "rare" are they? Barney (1991) admits that rarity is difficult to achieve. Yet, one can say rarity of a resource is a matter of degree. The argument is, even if a value-producing resource is available on the market and all competing firms have knowledge about it, not all of them can have the financial resources to purchase it. Unfortunately, disruption absorption capability and recovery capability are path-dependent, latent capabilities (DesJardine *et al.*, 2017; Ortiz-de-Mandojana and Bansal, 2016; Scott, 2013), and are not readily available on the market. They need to be built by through resource investment in relevant practices or by combining other firm resources (Makadok, 2001), including physical capital, human capital, and (inter-)organisational capital resources (Blackhurst *et al.*, 2011) for example. Moreover, they are embedded in the firm's social systems, culture, and values (Mandal, 2016; Liu *et al.*, 2017; McCann *et al.*, 2009; Akgün and Keskin, 2014). Like any other capabilities, they are knowledge (tacit)-, experience-, competence-, skills-based, learned behaviour (Grant, 1996; Amit and Schoemaker, 1993; Makadok, 2001; Teece *et al.*, 1997; Kusunoki *et al.*, 1998; Winter, 2003). This means that they can be firm-specific, and difficult to duplicate, trade, and transfer (Barney, 1991; Makadok, 2001; Teece *et al.*, 1997).

Lastly, given the specific nature of these capabilities (in terms of intended purposes and outcomes [i.e., preserving how the firm makes a living in the present in the face of disruptions]), they may not have close substitutes or strategic equivalence. Per the discussions in Section

2.3.3, there are other core resilience elements, including adaptability and transformability. However, the discussions point out that these resilience elements have their unique intended purposes and outcomes, and neither can replace disruption absorption nor recoverability. In fact, for operations-specific disruptions, which naturally require time-bound responses, it will be impractical and perhaps, more costly, activating either adaptive resilience or transformative resilience since each of these capabilities attempt to alter how the firm makes a living in the present.

3.3 MODEL AND HYPOTHESIS DEVELOPMENT

As illustrated in Figure 1, the study proposes attention to threats as a predictor of operational resilience (H1), strategic mission rigidity and disruption orientation as moderators in the attention to threats-operational resilience relationship (H2-3), and operational resilience as a predictor of operational efficiency (H4). Arguments for H1 are grounded in the ABV. Insights from the contingency theory and the RBV are used to develop H2-3 and H4 respectively.

3.3.1 Attention-Based Drivers of Operational Resilience

The ABV posits that firm behaviour and performance are determined by what top executives focus attention on and the organisational context that shapes their attentional focus (Titus and Anderson, 2016). Accordingly, this study proposes two categories of attention-based drivers of operational resilience: attention to threats (an attentional focus variable), and strategic mission rigidity and disruption orientation (attention structures). A section of ABV-research investigates attention structures as antecedents of attentional focus (e.g., Clercq and Zhou, 2014) while others (e.g., Titus and Anderson, 2016) examine how attention structures moderate the effect of attentional focus. This study follows the second stream of ABV-research to develop arguments about how strategic mission rigidity and disruption orientation moderate the relationship between attention to threats and operational resilience.

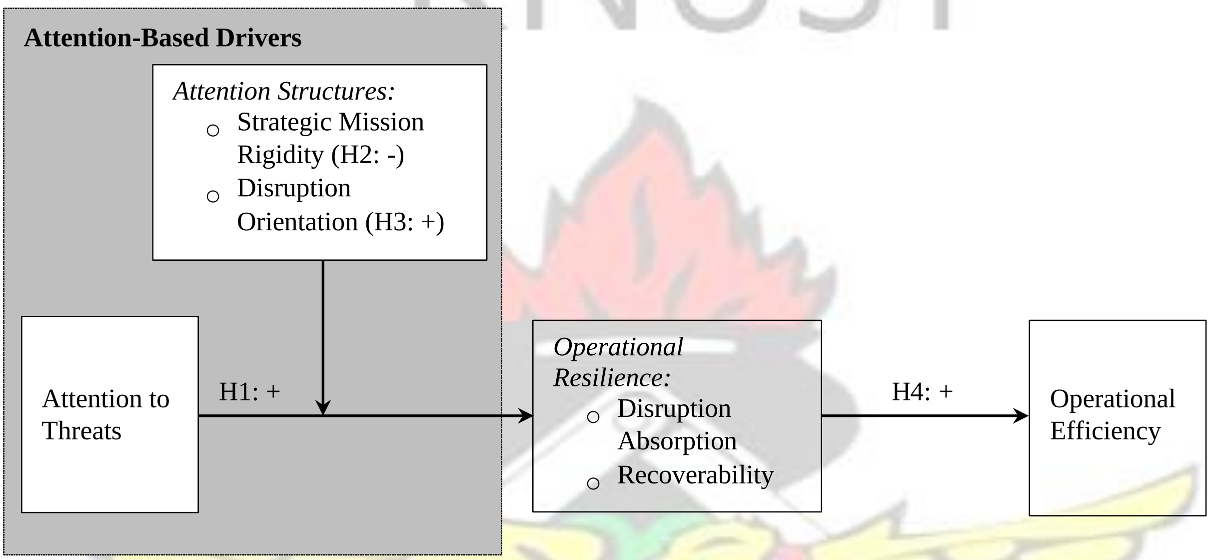

Figure 3.1: Research Model

3.3.1.1 Attention to Threats as a Driver of Operational Resilience

Tognazzo *et al.* (2016) find that investing in research and development (R&D) does not affect small firms' ability to be profitable and grow during recessions. Despite this finding, this study hypothesises that attention to threats enhances operational resilience in that the outcome variables in Tognazzo *et al.* (2016) are distal organisational outcomes (compared to operational resilience), in which case an analysis of their relationships with investment in R&D may necessitate consideration of relevant intervening forces. Besides, unlike attention to threats, R&D investment has multiplicity of purposes or does not solely focus on learning about, and responding to, disruptions.

Operational resilience refers to the ability of a firm's operations to absorb and recover from disruptions (cf. van der Vegt *et al.,* 2015; Buyl *et al.,* 2017). Attention to threats on the other hand refers to the extent to which a firm focuses resources (including time, effort, and money) on information search and processing aimed at enhancing its understanding of, and responses to, disruptions (cf. Bouquet *et al.*, 2008; Durand and Jacqueminet, 2015; Durand, 2003). Ocasio (1997) stresses that the focusing of attention by firms "...allows for enhanced accuracy, speed, and maintenance of information-processing activities, facilitating perception and action for those activities attended to" (p.204). A firm's ability to incorporate external information increases its odds of correctly predicting environmental changes and issues that pose danger to the firm (Ocasio, 1997; Corner *et al.*, 1994). Attention also enhances the firm's ability to better interpret the issues they attend to (Durand, 2003). Information processed and understanding obtained helps in evaluations of scenarios about, and responses to, issues (Durand, 2003).

By investing resources in information search and processing about disruptions, attention to threats allows the firm to increase its visibility in the business environment, which is key for driving resilience (Christopher and Peck, 2004; Brandon-Jones *et al.,* 2014; Scholten and Schilder, 2015; Pettit *et al.,* 2013). Visibility is important as it helps in successful calibration and quick discovery of disruptions (Brandon-Jones *et al.*, 2014). With this knowledge, firms can marshal appropriate resources to absorb and recover from the impact of imminent disruptions. As Brandon-Jones *et al.* (2014) find, visibility positively affects supply chain resilience (recoverability) and supply chain robustness (disruption absorption).

Durand (2003) finds that greater investment in collection of market information significantly minimises forecast error. Meanwhile, insight from Lam and Bai's (2016) qualitative study suggests that forecast accuracy is an important determent of maritime supply chain resilience.

Also, Yadav *et al.* (2007) find that CEOs with greater focus on the external environment (i.e., discussing market issues, e.g., about customers and competitors) are quicker at detecting new technological opportunities and also quicker at developing initial products based on these technologies. By investing more resources in information search and processing about disruptions, firms become more abreast with, and accordingly develop better knowledge of the patterns of emerging disruptions in their environment (Rerup, 2009; Bouquet *et al.*, 2009). First, this knowledge can help them better interpret and anticipate disruptions (Yadav *et al.*, 2007), detect weak cues that signal potential disruptions (Rerup, 2009; McMullen *et al.*, 2009; Yadav *et al.*, 2007). Second, it helps firms profile different categories of potential disruptions, in terms of probability of occurrence and likely impact, and determine the type of response(s) that will be appropriate for each. Third, it is a vital input for developing and rehearsing scenarios regarding how to respond when disruptions strike (Brandon-Jones *et al.*, 2014). Fourth, it allows the firm to put in place appropriate resources to absorb and recover from disruptions (Sutcliffe ad Vogus, 2007).

It is reported that when Philips semiconductor plant in Albuquerque caught fire, Ericsson, as unlike Nokia, was not prepared and could not notice the problem earlier and that made it unable to absorb the impact better or recover from the impact quickly (Latour, 2001). In fact, in the fire service, differences in investment in monitoring and response measures is a critical determinant of differences in the ability to respond effectively to fire outbreak, in terms of containing it and initiating remedial actions. The majority of disruptions firms face are unpredictable in nature (Weick and Sutcliffe, 2007; Linnenluecke, 2015; Blackhurst *et al.*, 2011; Jüttner and Maklan, 2011). Similarly, it can be difficult predicting the impact levels of disruptions. Yet, per the foregoing arguments, the study maintains that lack of attention to threats rather increases a firm’s exposure to disruptions, slows down early discovery of disruptions, increases operational sensitivity to disruptions, and slows down remedial actions.

In view of this, the study expects firms that score high on attention to threats will be more operationally resilient than those that score low on attention to threats. Formally, it is hypothesised that:

H1: Attention to threats is positively related to operational resilience.

3.3.1.2 Moderating Effect of Strategic Mission Rigidity

A firm's strategic mission is an important factor that guides its strategic moves and investment choices. As systems, firms need to 'fit' their strategic missions with other prevailing organisational factors (whether internal or external) before they can be successful (Covin *et al.*, 1994; Donaldson, 2006). To say there should be a fit between strategic mission and other factors in the organisational context implies the notion of "fit-as-moderation" perspective of coalignment argument (Venkatraman, 1989). Per this view of "fit", one can expect that strategic mission will moderate the effectiveness or benefits associated with the other factors within the organisational context (Covin *et al.*, 1994).

Strategic mission refers to a "firm's choices regarding actions designed primarily to increase sales revenue and build market share, generate cash flow and short-term profits, or some combination of the two" (Covin *et al.*, 1994, p. 482). Firms with rigid strategic mission have well-defined and yet narrowly focused mission statements and competitive strategies, and any activity outside their current domain of operation is discouraged (Atuahene-Gima *et al.*, 2005). By definition, strategic mission rigidity indicates the extent to which a firm's "mission is defined narrowly, is inflexible, discourages activities outside its scope, and difficult to change" (Atuahene-Gima *et al.*, 2005, p. 468).

High strategic mission rigidity can be incongruent with attention to threats. Due to their inward focused, exploitation, and efficiency motives, firms with high strategic mission rigidity are more likely to engage in corporate belt-tightening rituals, particularly when it comes to investment decisions that do not directly generate revenue like attention to threats. Such firms engage in less search and experimentation (Atuahene-Gima *et al.*, 2005; Li *et al.*, 2008), and thus will be more likely to see little essence in investing resources in scanning and monitoring the business environment for disruptions. However, this prevents them from staying up-to-date with the changes in the business environment. By implication, they are more likely to be taken by surprises from the business environment and could suffer greater impacts when disruptions strike. Consequently, the study expects that this lack of fit between strategic mission rigidity and attention to threats will undermine the operational resilience benefit of the attention to threats. This expectation is consistent with the arguments and the findings in Atuahene-Gima *et al.* (2005) and Li *et al.* (2008). Atuahene-Gima *et al.* (2005) find that strategic mission rigidity weakens the positive effect of proactive market orientation—which involves significant new and diverse information search—on new product program performance. Relatedly, Li *et al.* (2008) find that the positive effect of proactive market orientation on incremental innovation becomes negative for firms with high strategic mission rigidity.

Attention to threats increases firms' intrusiveness and visibility in the business environment through information search and processing about disruptions. However, strategic mission rigidity restricts external information search and interpretations as well as learning (Li *et al.*, 2008; Atuahene-Gima *et al.*, 2005), which can limit the advantages of attention to threats. On the other hand, a flexible strategic mission makes the firm open and look beyond how it currently makes a living. This comes with increases in exploration behaviour, external information search, learning, and experimentation, which can in turn can be levered on to boost the firm's information processing abilities and also overcome the challenges characterising attention to threats (i.e., information overload [Bouquet *et al.*, 2008]), and thereby increasing its (attention to threats') potency to enhance operational resilience. Also, the inclination of firms with flexible strategic mission towards information search and experimentation (Atuahene-Gima et al., 2005) can make them innovative (Mone *et al.,* 1998; Li *et al.,* 2008), and accordingly enhance their ability to absorb disruptions and recover from impacts (Kwak *et al.,* 2018). Thus, it is argued that strategic mission flexibility (as opposed to strategic mission rigidity) will complement attention to threats to enhance operational resilience. The hypothesis relation to these arguments is specified as follow:

> *H2: The positive effect of attention to threats on operational resilience is strengthened at lower levels of strategic mission rigidity.*

3.3.1.3 Moderating Effect of Disruption Orientation

Disruption orientation is about a firm's attitude (rather than behaviour) towards disruptions (Bode *et al.,* 2011). It reflects a firm's "general awareness and consciousness of, concerns about, seriousness toward, and recognition of opportunity to learn from disruptions" (Bode *et al.,* 2011, p.873). Bode *et al.* (2011) find that disruption orientation, uniquely and in interaction with prior experience, affect buffering and bridging strategies. Ambulkar *et al.* (2015) also find that disruption orientation indirectly, and in interaction with risk management infrastructure, affect firm resilience via resource re-configuration at differing levels of disruption impact. Consistent with these findings, study argues that disruption orientation will be a critical tool for leveraging attention to threats into enhanced operational resilience.

A context of heightened prevention focus is necessary for attention to threats to flourish (McMullen *et al.,* 2009). Disruption-oriented firms do not accept the environment as a given and, thus have risk-taking tendencies and are likely to be proactive in engaging in strategies that allow them to safeguard their stability (Bode *et al.,* 2011). The stronger disruption orientation, the more a firm will attach importance to issues that threaten its stability (Bode *et al.,* 2011). Thus, as disruption orientation increases, interest and commitment to attention to threats will become more sustained, allowing the latter to be more effective in contributing to operational resilience. In the wake of disruptions, firms with low disruption orientation have less motivation to act swiftly (Bode *et al.,* 2011) and search for means to enable them absorb and recover from disruptions (Ambulkar *et al.*, 2015; Bode *et al.*, 2011). Thus, in such a context, increasing attention to threats may be less rewarding. Besides, firms with low disruption orientation can be less knowledgeable about the nature of disruptions that normally occur in their business environment as they do not recognise the need to learn from prior ones (Bode *et al.,* 2011). This can make investment in information search and processing about potential disruptions, and consequent calibration and detection weak cues that signal disruptions as well as deployment of response actions less effective. Thus, as disruption orientation increases, attention to threats enhances a firm's understanding of, alertness and responses to, the changes in the business environment that can impact negatively on their operations. Corroborating these arguments with Bode *et al*.'s (2010) and Ambulkar *et al*.'s (2015) findings, the study expects that disruption orientation will foster attention to threats to enhance operational resilience. Accordingly, this study argues that:

H3: The positive effect of attention to threats on operational resilience is strengthened at higher levels of disruption orientation.

3.3.2 Operational Resilience and Operational Efficiency

Operational efficiency is a measure of how well a firm minimises costs associated with running its operations (Wong *et al.*, 2011; Ward and Duray, 2000). This definition suggests that operational efficiency can be improved either through incurring less monetary expenses in running operations or minimising wastes in operations (e.g., idle capacity and excess inventory) or both. There is a general consensus in the resilience literature that disruptions cause rippling and severe costs consequences (Craighead *et al.,* 2007; Tang, 2006; Kim *et al.*, 2015; Mohan and Bakshi, 2017; Brandon-Jones *et al.*, 2014; Christopher and Rutherford, 2004). Hendricks and Singhal's (2005) study of 885 supply chain glitches reports that firms that experienced disruptions comparatively recorded 10.66% higher increases in cost and 13.88% inventory growth.

The immediate problem that disruptions pose is interrupting the smooth flow of operations (e.g., flow of products/services and information) (Blackhurst *et al.*, 2011; Craighead *et al.*, 2007). For example, machine/technology/truck breakdown or shortage of raw materials can lead to delays in processes, idle time, and underutilisation of other resources (e.g., workforce and machines). There can also be additional cost for fixing the 'problem'. For instance, in order to not lose customers or disappoint them, some firms may go to the extent of incurring back order costs. These clearly have negative implications on operational efficiency. In this sense, it can be expected that firms having lower levels of capabilities that allow for mitigating wastes and costs associated with disruptions will be less operationally efficient, *cet. par.* In events of disruptions, firms with high disruption absorption are more likely to maintain the structure and functioning of operations within critical thresholds (Brandon-Jones *et al.*, 2014). This allows them to preserve normal operations and accordingly avoid costs with disruptions. Similarly, firms with high recoverability are more likely to quickly restore operations (Brandon-Jones *et al.*, 2014). This minimises the chances of recording spiralled levels of inefficiencies relating to idle capacity.

As explained in Section 3.2.2.3.2, operational resilience qualifies as a VRIN resource; thus, it can offer greater and sustained advantage (e.g., in terms of improving operational efficiency) for firms that possess greater levels of it. Consistent with this expectation, Kwak *et al.* (2018) find that, risk management capabilities including robustness (disruption absorption) and resilience (recoverability) positively relate to competitive advantage. Accordingly, this study hypothesises that:

H4: Operational resilience is positively related to operational efficiency.

3.4 CHAPTER SUMMARY

This chapter develops the study's research model and hypotheses. It starts by discussing the study's theoretical approach and then the theoretical underpinnings of, and the variables in, the research model. The model suggests that attention to threats, uniquely and in interaction with strategic mission rigidity and disruption orientation, drive operational resilience, which in turn drives operational efficiency. The subsequent chapter discusses the methodology used to test the model.

CHAPTER FOUR

METHODOLOGY

4.1 INTRODUCTION

This chapter presents the methodology used to test the research model and hypotheses developed in the previous chapter. The key sections of the chapter include: (1) philosophical position and choice of methodology, (2) empirical setting, (3) data, (4) approach to data analysis, (5) validity and reliability, (6) ethical concerns, and (7) chapter summary.

4.2 PHILOSOPHICAL POSITION AND CHOICE OF METHODOLOGY

Research methodology is a systematic approach to solving a research problem (Kothari, 2004). Post-positivists contend that there is no one best methodology for investigating all research problems/questions and that the methodology to apply in a particular research should be based on the research problem/question and context (Ryan, 2006; Wildemuth, 1993). Generally, research questions concerned with meaning or interpretation of behaviours and actions draw on social constructionism/interpretivism philosophical assumptions, necessitating the use of qualitative methodology. On the other hand, research questions that are concerned with the frequency of a particular behaviour or statistical regularities of behaviours are grounded in principles of positivism, resulting in the use of quantitative methodology (Ryan, 2006; Wildemuth, 1993). In this study, the researcher perceives that the research problems/questions under consideration: (1) what is the conceptual domain of operational resilience?, (2) how attention to threats relates to operational resilience at differing levels of strategic mission rigidity and disruption orientation, and (3) how operational resilience relates to operational efficiency; can better be investigated using relevant principles of positivism.

In general terms, positivism emphasises the use of scientific method and language in knowledge development (Ryan, 2006). To positivists, reality exists independent of one's mind (Easterby-Smith *et al.,* 2008; Gelo, 2012), and thus can be known 'objectively' (Gray, 2004; Scotland, 2012) via value-free observation/measurement and empirical/statistical analysis (Saunders *et al.*, 2007; Crossan, 2003). Positivism generally advocates for the use logic or existing theories to develop hypotheses about the causal relationships between variables (Saunders *et al.,* 2007). Such hypotheses are statistically evaluated and confirmed, in whole or in part, or rejected, leading to refinement of theory which then may be tested by further research (Saunders *et al.,* 2007). Besides, positivists recommend the use of empirical evidence from a large-scale sample, supported by relevant theory, to make generalisations (Saunders et al., 2007).

Consistent with prior resilience- (Brandon-Jones *et al.*, 2014; Buyl *et al.*, 2017; DesJardine *et al.,* 2017) and ABV-research (Bouquet *et al.,* 2009; Ambos and Birkinshaw, 2010), the researcher holds the view that the constructs in the study and the nature of relationships between them exist independent of his mind and that they can be investigated using theory/logic and empirical/statistical analysis. Thus, the study combines insights from existing theories with logic and prior findings (where necessary) to first develop the idea of resilience (see Section 2.4) and second, propose a testable model to investigate research problems two and three (see Chapter Three). The sections that follow discuss the quantitative methodology used in the study.

4.3 EMPIRICAL SETTING

The research model is estimated using data from firms in a major Sub-Saharan African economy – Ghana. The Ghanaian business environment and its suitability for the study are discussed as follows:

4.3.1 Ghana: An Important, and yet a Challenging Context for Businesses

As a developing/transition economy, Ghana presents many growth opportunities and challenges for businesses (Adomako *et al.*, 2018a; Banin *et al.*, 2016; Boso *et al.*, 2013a). Ghana's business environment has experienced considerable institutional and structural changes since independence (Lopez, 1997; IEA, 2006; Boso *et al.*, 2013a). Stimulating open market operation and liberalising trade and industry have been key to Ghana's economic growth and prospects. Successive governments have introduced several market-led economic policies and programmes (Alagidede *et al.*, 2013; Boso *et al.*, 2013a); with some recent ones including The One District One Factory Project, Ghana National Export Strategy for the Nontraditional Sector, Ghana Yam Sector Development Strategy, Ghana Trade Policy, The Ghana Sugar Policy, and the National Export Strategy. Moreover, they have been recognised the value of, and provided, institutional support for trade and industry (e.g., setting up, or working handin-hand with, institutions such as Ministry and Trade and Industry, National Board for Small

Scale Industry, Ghana Export Promotion Council, Ghana Investment Promotion Centre, Association of Ghana Industries, Ghana Free Zones Board, Ghana National Chamber of Commerce, Private Enterprise Federation, and Ghana Trade Fair Company). Ultimately, these efforts made over the years have aimed at promoting economic growth and competitiveness through the private sector (African Development Bank Group, 2018).

Available data suggest that Ghana has experienced steady economic growth rates over the past three decades (International Monetary Fund [IMF], 2018; African Development Bank Group, 2015; Alagidede *et al.*, 2013), recording 8.4% and 5.7% growth rates in real GDP and real per capital GDP respectively as at 2017 (IMF, 2018), following its implementation of market-led economic policies and programmes (Alagidede *et al.*, 2013). The prospects of the economy of

Ghana remains positive (IMF, 2018; African Development Bank Group, 2018). Largely, Ghana's growth has been supported by its natural resources (e.g., crude oil production, mining, and cocoa production) and increasing population and demand, and growth in consumer-facing businesses (particularly, services) (African Development Bank Group, 2018; World Bank Group, 2018; Ghana Statistical Service, 2018).

Ghana's business environment remains the most attractive setting for doing business in West Africa (African Development Bank Group, 2018; World Bank, 2017). Notwithstanding, numerous factors challenge the sustainability Ghana's growth prospects and the competitiveness of businesses. Issues such as unreliable power supply, fluctuations in exchange rate, and high utility tariffs with low financial resource availability have been major problems affecting the competitiveness of the private sector (which is predominantly small- and medium-scale enterprises (SMEs) over the last five years (World Bank, 2017). Further, businesses in the country have high susceptibility to the adverse effects of several disruption types, such as fire outbreaks, floods, and tropical storms (UNDP, 2017; Okyere *et al.*, 2012; Oteng-Ababio, 2013). Prior studies (Dadzie *et al.*, 2015; Boso *et al.*, 2013a) acknowledge that the Ghanaian business environment is very dynamic and posse substantial uncertainty and threats to businesses. Moreover, experts continue to question the sustainability of Ghana's recent policies and programmes and its growth base (e.g., natural resources). In fact, overdependence on government and its institutions to boost the competitiveness of businesses appears problematic, as they have been unable to sustain reforms and policies over the years (World Bank, 2017).

Accordingly, this study contends that businesses in the country have a major role to play to ensure survivability and competitiveness amid emerging disruptions in the global business environment (Ambulkar *et al.,* 2015; van der Vegt *et al.*, 2015). To avoid or respond effectively to operational disruption and remain competitive, firms need to emphasise attention to threats.

However, since most businesses in the country are under-resourced (particularly, in terms of finance, due to underdeveloped capital markets [Banin *et al*., 2016]), the question of (1) whether Ghanaian businesses allocate substantial proportion of their limited resources to dealing with disruptions in the business environment (as this does not represent a direct revenue generation investment) and (2) whether such effort pays off in terms of enhancing operational resilience, and accordingly operational efficiency, is worth investigating. Till date, however, these questions have not attracted either scholarly or policy consideration in the country.

Already, Acquaah *et al.*'s (2011) study which relied on data from Ghana suggests that it is strategically imperative for Ghanaian businesses to build resilience. However, the study neither assessed the firms' resilience to disruptions nor how much they invest in resilience-building vis-à-vis the associated costs and benefits. The present study addresses these contextual concerns.

4.3.2 Applicability of the Research Model?

The debate about the role of "context" (e.g., whether management theories are context-specific or context-free) among management scholars appears to be never-ending (Kolk and Rivera-Santos, 2016). Given Africa's unique institutional environment, there has been growing concerns about the relevance of Western-based management practices and theories for African businesses (Zoogah *et al.,* 2015; Nkomo, 2017). Nevertheless, there exists scarce attempt to prove the non-applicability of Western-based managerial theories in the African context. Zoogah *et al.* (2015) note businesses in Africa have remained a missing link in the application and exploitation of new business models. Research from the African setting has been less visible in the broader management literature, and there is the need to understand how studies from Africa can contribute to general management research (Kolk and Rivera-Santos, 2016).

Ghana has successfully operated as an open market economy for the past three decades; engaging in international trade with several countries (Banin *et al.*, 2016; Adjasi *et al.*, 2008). Coupling Ghana's trade liberalisation successes and receptiveness to globalisation (Grant, 2001) with its open economy policies allows local businesses to learn and tap into foreign management practices and theories through observation and constant interactions with foreign business partners operating within the domestic country as well as those overseas. This makes the Ghanaian business environment an important context to test how Western-based behavioural theories of the firm, such as the ABV, perform in an institutionally different and emergent African economy (cf. Banin *et al.*, 2016; Adomako *et al.*, 2016). The ABV (Ocasio *et al.*, 2018; Ocasio, 2011), the contingency theory (Van de Ven *et al.*, 2013; Tosi and Slocum 1984) and the RBV (Kraaijenbrink *et al.*, 2010; Barney *et al.*, 2001) which underpin the study's model have had long-standing application and impact in several streams of business and management studies. The study contends that by proposing a theoretically grounded and a robust model (including moderators and important and enough controls), as in the case of this study, 'context' is not much of a concern.

Moreover, empirical contexts that experience substantial disruptions are suitable for testing resilience models (see Section 4.4.2). Increases in disruptions in recent years is a global phenomenon (Kwak *et al.*, 2018; Ambulkar *et al.*, 2015; Linnenluecke, 2015). Recent studies (Business Continuity Institute, 2017:2018) show that firms in the Sub-Saharan African region experience several forms of disruptions, including transport network failure, technology and communication failure, energy shortage, outsourcer failure, loss of talent/skills, and currency exchange rate volatility are common disruptions that firms face. Among other things, Ghana, in particular, is noted to face high levels of economic shocks (e.g., exchange rate fluctuations) (World Bank, 2017), floods, fire outbreak (UNDP, 2017; Oteng-Ababio, 2013), transportation failure (Okyere *et al.,* 2019), unreliable power supply (World Bank, 2017), and banking crisis (The Business & Financial Times Online, 2018).

4.4 DATA

This section discusses the choice of data type and source, choice of research design, choice of instrument and method of instrument administration, target population and sample, choice of informants, measures and questionnaire development, data collection, response rate enhancers, and procedural remedies for common method bias.

4.4.1 Choice of Research Design

Research design details the plan for addressing research objectives or hypotheses (McDaniel and Gates, 2012), in terms of how data will be collected and analysed (Bryman, 2012). Research design exists in different shades, and different authors provide different classifications of research design. Common types of designs identified by Bryman (2012) include cross-sectional design (sometimes referred to as survey design), longitudinal design, experimental design, comparative design, and case study design. Different designs offer myriad of choices, each with certain strengths and weaknesses (McDaniel and Gates, 2012). Though it is often asserted that there is no single best research design (McDaniel and Gates, 2012; Cohen *et al.*, 2007), under certain circumstances, some designs may be more appropriate.

As emphasised by Cohen *et al.* (2007), "fitness for purpose" is a key governing principle in the choice of design. The research purpose (and the quality of information required) and the cost of implementing the study (e.g., time and finance) play instrumental roles in deciding on a particular design (McDaniel and Gates, 2012). Increasing quality of information required for addressing the research purpose often leads to increased cost, and vice versa (McDaniel and Gates, 2012). Largely, the starting point for considering any design is to clarify the research purpose, as this in turn determines the kind of data that ought to be collected. As indicated in Section 4.2, the research purpose of this study is explanatory.

A key question that arises while developing and testing models of resilience is: *resilience to what*? (DesJardine *et al.,* 2017). In line with this question, some prior research (DesJardine *et al.* 2017; Buyl *et al.,* 2017; Ortiz-de-Mandojana *et al.,* 2016) have focused on one major disruption (e.g., financial crisis and industrial strike), allowing researchers to utilise natural experimental design, while others, relying on cross-sectional survey design, focused on no particular disruption experienced by firms. While the former design appears interesting, it can only be implemented if all the sample firms experienced the same major disruption and when secondary data could be obtained on the variables of interest. The latter approach, which this study follows, implicitly assumes that disruptions are common phenomena that firms experience. Thus, studies that follow this approach and measure resilience (in general) (see e.g., Chowdhury and Quaddus, 2017; Brusset and Teller, 2017; Ambulkar *et al.*, 2015; Kwak *et al.,* 2018; Brandon-Jones *et al.,* 2014; Mandal, 2016:2017; Wieland and Wallenburg, 2012) do so with no reference to any particular disruption. The use of cross-sectional survey design (in this category of studies), despite its limitations, enhances external validity and is generally adequate for examining causal models grounded in relevant theories (Rindfleisch *et al.,* 2008; Malhotra and Grover, 1998).

A cross-sectional design involves collecting data about two or more variables from multiple cases at a single point in time so as to determine patterns of association between the variables (Bryman, 2012). A survey design also entails obtaining data (usually, quantitative) on a large scale (usually involving multiple cases and multiple variables) so as to assist in testing, and generalising findings (Cohen *et al.*, 2007; Malhotra and Grover, 1998). Therefore, survey design is often associated with cross-sectional design (Bryman, 2012) and both designs typically utilise structured questionnaires as the data collection instrument administered to a sample of the population (Malhotra and Grover, 1998; Saunders *et al.,* 2007; Bryman, 2012). It should be noted, however, that some surveys could span beyond a single point in time, allowing for the development of panel or longitudinal data rather than cross-sectional data (Bryman, 2012). Accordingly, this study's design will be referred to as "cross-sectional survey design" (Rindfleisch *et al.,* 2008).

Cross-sectional survey design is adequate for explanatory research (Malhotra and Grover, 1998; Rindfleisch *et al.*, 2008). Yet, it is frequently argued that, compared to experimental and longitudinal designs, cross-sectional survey design is less suitable for investigating into "causeand-effect" questions (Bryman, 2012) as it is prone to the problem of common method variance (Lindell and Whitney, 2001; Rindfleisch *et al.,* 2008). The trade-off, however, is, while high internal validity (i.e., cause-and-effect) can be gained through experimental and longitudinal designs, they may do so at the expense of generalisability/external validity which can be gained via cross-sectional design (Scandura and Williams, 2000).

Practically, the nature of the study's research questions vis-à-vis the unit of analysis (organisations) and the difficulty in identifying a single disruptive event in the research setting and obtaining secondary data from the firms make (natural) experimental design a less suitable option. Also, even though longitudinal design appears to be the next best option for determining casual effects, it is less appropriate for testing theoretical arguments that focus on betweensubjects rather than within-subjects (which is not the focus of this study). In addition, longitudinal design demands additional resources (Rindfleisch *et al.*, 2008) and that renders it unfeasible to implement in academic studies of this kind with limited budgets and restricted timelines. Indeed, it is easier to advocate for the use of longitudinal design than to implement it (Rindfleisch *et al.*, 2008). For the above reasons and more, the dominance of cross-sectional survey design in business and management studies (Ployhart and Vandenberg, 2010; Rindfleisch *et al.*, 2008; Saunders *et al.*, 2007) can be expected to last for long. As shown in Tables 2.9 and 2.11, except for Buyl *et al.* (2017) and DesJardine *et al.* (2017), prior studies focusing on sources and or outcome of resilience have relied on cross-sectional survey design. Also, several prior studies (e.g., Ambos and Birkinshaw, 2010; Clercq and Zhou, 2014; Laursen and Salter, 2006) drawing on the ABV and were interested in the outcomes of attention allocation have relied on cross-sectional survey design.

As far as issues of common method bias and causal inferences are concerned, longitudinal design cannot offer complete solution as it entails potentially troubling side effects (e.g., when intervening events occur) (Rindfleisch *et al.*, 2008). Rindfleisch *et al.* (2008) note that welldesigned cross-sectional surveys that are based theoretical frameworks that minimise competing theories (i.e., with clear causal flows and incorporate mediating, moderating, and important control variables) and tested on between subjects can enhance causal inferences.
Thus, the study's model (grouped in prior theories and incorporated important moderating and control variables) and its focus on between subject variability makes the reliance on crosssectional survey design appropriate. Also, Antonakis *et al.* (2010) assert that causal inferences can be made from correlational data (obtained using cross-sectional survey design, for example), when the design and the method of data analysis utilised address issues of endogeneity. As discussed in the subsequent sections, to minimise common method variance, several strategies were implemented at the design and the implementation stages of the study. Further, appropriate statistical analyses were utilised to address concerns of endogeneity and enhance the casual implications of the study's results.

4.4.2 Choice of Data Type and Source

Data for research can be qualitative (numeric) or quantitative (non-numeric) (or both). Any of these could be collected first-hand, purposely for the study (i.e., primary data), or extracted from already existing sources (i.e., secondary data). The choice between qualitative data and quantitative data is primarily influenced by the research purpose (and accordingly, the research objectives/questions). Saunders *et al.* (2007) noted that business and management research usually focus on addressing three basic purposes: (1) to explore (for deep/new understanding/insights), (2) to describe (what is happening), and (3) to explain (hypothesise, and test relationships between variables). As indicated in Section 4.2, this study is explanatory in nature as it focuses on hypothesis testing. Testing the relationships between variables requires the use of statistical methods, implying that the variables should be quantified. The study relied on quantitative data, collected using questionnaires. Drawing on primary and secondary sources of data can minimise common method bias (Podsakoff *et al.,* 2012; Podsakoff *et al.*, 2003). Yet, this study used only primary data for the following reasons:

The researcher encountered challenges in obtaining existing data on the substantive variables in the study (i.e., attention to threats, strategic mission rigidity, disruption orientation, operational resilience, and operational efficiency). It must be acknowledged that some prior studies have attempted to use secondary data to measure some of the concepts (related ones). For example, Durand (2003) measured organisational attention to external market information by relying on relative amount of expenditure committed by the organisation to gathering market information (expressed as percent of sales). Also, Buyl *et al.* (2017) and DesJardine *et al.* (2017) used secondary data to measure recoverability and disruption absorption. It should, however, be emphasised that Buyl *et al.* (2017) and DesJardine *et al.* (2017) approach for measuring recoverability and disruption absorption can only be used on when focusing on one major disruption faced by all firms under consideration. However, this current study assumes that firms may face several forms of disruptions every now and then (whether major or minor). Similar implicit assumption has underpinned majority of prior hypothesis testing studies in the resilience literature (see e.g., Ambulkar *et al.*, 2015; Brandon-Jones *et al.*, 2014; Wieland and Wallenburg, 2012) to measure firm/supply chain resilience without reference to any particular disruption. Besides, majority of the firms in the empirical setting are small- and medium- scale enterprises (SMEs) (see Ghana Statistical Service, 2016) and there exists no formal and comprehensive secondary data that could be relied on to capture any of the substantive variables. Even at the firm-level, obtaining secondary data on variables such as operational efficiency is challenging as majority of the firms do not prepare or publish their financial statements. Prior studies (Li *et al.,* 2017; Liu *et al.*, 2017; McCann *et al.,* 2009; Chowdhury and Quaddus, 2016:2017; Wieland and Wallenburg, 2013:2012; Akgün and Keskin, 2014; Lee and Rha, 2016; Kwak *et al.,* 2018; Mandal, 2017) examining the performance outcomes of resilience relied on questionnaires (subjective scales) to measure performance and resilience.

4.4.3 Choice of Instrument and Method of Instrument Administration

Having settled on cross-sectional survey as an appropriate research design for addressing the research objectives, there is the need to identify a feasible approach to collect data. That crosssectional survey is suitable for investigating into explanatory research objectives rests on the premise that it allows for obtaining quantifiable data on a large scale. To this end, the use of structured questionnaire is typical in cross-sectional surveys as it is does not only make quantification possible, but also it is easy to administer it to a large sample of the population (Malhotra and Grover, 1998; Saunders *et al.,* 2007; Bryman, 2012). Accordingly, this study used structured questionnaire as the data collection instrument.

The common options available for administering structured questionnaires in surveys include online (internet and intranet mediated) approach (involves self-administration/completion), postal/mail approach (involves self-administration/completion), delivery and collection approach (involves self-administration/completion), telephone approach (involves the interviewer administering the questions), and structured interview (involves the interviewer administering the questions) (Saunders *et al.*, 2007). A comparative assessment by authors such as Saunders *et al.* (2007) and Bryman (2012) indicates that each of these methods of administering structured questionnaires has its own strengths and drawbacks and that the suitability of each depends on several factors. This study relied on delivery and collection approach. What follows are the discussion on why this approach was chosen as the method of survey administration in the study despite its weaknesses (in relation to the other approaches).

The study's target informants are senior managers (see Section 4.4.6). These individuals have busy schedules. Coupling this with the length of the questionnaire (7.5 A4 pages), it became impractical to use either telephone or structured interview approaches. It was expedient that the informants take time to respond to the questionnaire at their own convenient time (Bryman, 2012). Besides, while these interviewer-administered questionnaire approaches can result in high response rate (Saunders *et al.*, 2007), they are prone to interviewer variability and biases (McDaniel and Gates, 2012; Bryman, 2012) which results from the interviewer (consciously or unconsciously) influencing the informants to provide untrue or inaccurate answers) (McDaniel and Gates, 2012).

Like online and postal approaches, delivery and collection approach involves the informant self-reading and completing the questionnaire. This requires that the informant is literate (Saunders *et al.*, 2007) and that the questionnaire is well-designed (Bryman, 2012). This helps reduce measurement instrument error and avoid biases associated structured interview and telephone interview. Online approach can appear suitable when the target informants are computer/internet literate and have high internet accessibility rate. Yet, even when these conditions are met, online approach notably performs worst on response rate (Saunders *et al.*, 2007), increasing the impact of nonresponse bias in surveys (McDaniel and Gates, 2012). Like online approach, postal approach tends to have low response rate (compared to the other three approaches [Saunders *et al.*, 2007]). Nevertheless, these approaches are less costly to implement. In addition, the use of postal approach requires good address and postal systems. Unfortunately, the study's setting does not meet these criteria. Indeed, prior experience (Acquaah *et al.*, 2011; Kuada and Buatsi, 2005; Boso *et al.*, 2013a; Boso *et al.*, 2013b) has shown that, for studies that focus on senior business executives, delivery and collection approach works best in the Ghanaian business context and contributes to higher response rate. This is necessary for realising the external validity value of survey design (Scandura and Williams, 2000).

The study was interested in profit-making firms operating either in the service or the manufacturing industry in Ghana. Despite the numerous challenges faced by firms in Ghanaian business environment (see Section 4.3.1), these industries remain vibrant and more economically relevant to the economy of Ghana. For example, in 2016 and 2017, the service sector's share of Ghana's GDP was 56.8% and 56.2% while that of manufacturing was 4.6% and 4.5% respectively (Ghana Statistical Service, 2018).

4.4.4 Population

Table 4.1 summarises the key characteristics of the target population of the study. The population is made up of autonomous firms operating in the service and manufacturing industries in Ghana and have between five and five hundred employees and operated for at least three years (cf. Boso *et al.*, 2013a; Clercq and Zhou, 2014). Firms in the service industry include those that engage in distribution and retaining, transport, storage, communication, hospitability, financial and insurance, real estate, repair of vehicles, administrative and support services, business and personal services, health and social work, among others) (Ghana Statistical Service, 2018). The manufacturing firms included those into the production of household and non-household goods. An integrated business establishment survey report by the Ghana Statistical Service (2017) reveals that service and manufacturing firms generate high revenue and are more profitable, making them important industries to consider in this study. At the meso-level, the business environment for firms from each industry could be very different. Thus, relying on firms from multiple industries and with different internal and external environment characteristics provide greater heterogeneity with regard to the study's dependent, moderating, and predictor variables (Bouquet *et al.,* 2009). Also, this helps appraise the robustness of the study's theoretical model and also enhances the generalisability of the study's findings (Bouquet *et al.*, 2009). Notwithstanding, compared to multiple industries, data from single industry helps control over secondary factors that can mask the relationships between variables under investigation. The study addresses this concern by controlling for industry-type, and also other theoretically important variables (Antonakis *et al.,* 2010) such as environment dynamism.

Table 4.1: Target Population

Location of firm (country)	:	Ghana
Location of firm (geographical)	:	Accra or Kumasi
Firm industry	:	Manufacturing or service
Firm ownership structure	:	Autonomous business organisation
Firm size (number of full-time employees)	:	Five to five hundred full-time employees
Firm age (number of years of operation)	:	Minimum of three years

The study focused on firms that share the above characteristics and operate within the regional capitals of Greater Accra Region (GA) (Accra) and Ashanti Region of Ghana (AR) (Kumasi).

The GA has about 70.8% economically active population. The region's dominant economic activities include wholesale and retail (30.4%) and manufacturing (16.7%) (www.ghana.gov.gh/index.php/about-ghana/regions/greater-accra; viewed on Sunday 16th December 2018). The AR has about 71.4% economically active population. The region's dominant economic activities include agriculture (44.5%), followed by wholesale and retail trade (18.4%), and manufacturing (12.2%) (http://www.ghana.gov.gh/index.php/aboutghana/regions/ashanti; viewed on Sunday 16th December 2018). Firms from capitals of these regions of Ghana were considered ideal for testing the study's theoretical model as they have the highest concentration of business and commercial activities and services in the country (Ghana Statistical Service 2017:2016).

4.4.5 Sample

4.4.5.1 Some Concerns: Sample Size Adequacy and Representativeness

Sample size adequacy is an important consideration in research. Yet, till date, debate on what should be considered an adequate sample size for any given study has not been settled. In fact, there is no clear-cut answer for how large a sample should be (Cohen *et al.*, 2007). For many scholars, the larger the sample, the better (Cohen *et al.*, 2007). Yet, in as much as too small sample size can be problematic[19], so is large sample size[20]. The emerged consensus, however,

[19] Large coefficients can be statistically insignificant due to large standard error (i.e., sampling error reduces but at a decreasing rate as sample sizes increases (Taherdoost, 2017).
[20] A trivial coefficient (i.e., practically irrelevant) can be statistically significant due to small standard error (Hair et al., 2014).,

is that sample size adequacy may depend on many factors, including, degree of heterogeneity in the population, method of statistical analysis, non-response rate, time and cost, etc. (Bryman, 2012; Cohen *et al.*, 2007). Bryman (2012) asserts that a good sample size needs not to be evaluated in terms of its relativeness to the population size; it is the absolute size of the sample that matters, and not its relativeness.

In as much as sample size adequacy matters, so is sample representativeness, i.e., the extent to which characteristics of the sample should reflect those of the population. In this sense, a sample can be large and yet contain characteristics that are less consistent with those of the population, leading to sampling error (Bryman, 2012). This problem can result from both nonprobability sampling techniques as well as probability sampling techniques (particularly, simple random and systematic) (Bryman, 2012). One way to improve sample representation is to collapse the population according to its distinct characteristics, or heterogeneous groups, and then sampling from the groups (Bryman, 2012). This can, however, become difficult implementing when there is lack of (or deficiency in the) sampling frame. With lack of reliable sampling frame, it even becomes difficult relying on random sampling techniques (Bryman, 2012).

4.4.5.2 Approach of the Study

Both sample size adequacy and representativeness were important considerations in this study, and efforts were made to address the concerns discussed above.

4.4.5.2.1 Required Minimum Usable Sample Size

The criteria informing the determination of a minimum sample size for this study are methods of statistical analyses and generalisability of results. As explained in Section 4.5.1, two broad statistical analyses were conducted, namely, scale validation and hypothesis testing. In the case of the first, two main statistical methods used were used, viz. exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). In the case of the second, three stage least squares regression analysis was used.

There is no clear-cut minimum sample size requirement for conducting either CFA or EFA (Tabachnick and Fidell, 2013; Field, 2009). However, it is believed that holding other things (e.g., size of factor loadings and method of estimation) constant, complex measurement models (i.e., involving several measurement items or more parameters to be estimated) require large sample size (Kline, 2011; Hair *et al.*, 2014; Field, 2009; Tabachnick and Fidell, 2013). Regarding model complexity-sample size rule of thumb, some scholars suggest a caseobserved variable ratio of 1:5 or 1:10 (Hair *et al.*, 2014; Field, 2009). In this case, while aiming for, at least, 5 cases per variable (Hair *et al.*, 2014), the 39 observed reflective variables[21] in the study will demand a minimum sample size of 195. Having reflected on the various debates, Bagozzi and Yi (2012, p.29) concluded that:

> Pressed, we would have to say that rarely (e.g., in a factor analysis of a small number of items with "well-behaved data") would a sample size below 100 or so be meaningful, and that one should endeavor to achieve a sample size above 100, preferably above 200.

Related to Bagozzi and Yi's (2012) recommendation, Kline (2011) finds that, in practice, a typical sample size in studies that utilise structural equation modelling (which involves CFA as its first stage process [Diamantopoulos and Siguaw, 2000]) is about 200 cases. This

[21] Attention to threats = 4 items, strategic mission rigidity = 4 items, slack resources = 5 items, recoverability = 5 items, environment dynamism = 6 items, operational efficiency = 5 items, disruption absorption = 6 items, disruption orientation = 4 items.

observation is consistent with the majority of resilience-based survey research[22] (e.g., Liu *et al.*, 2017; Kwak *et al.*, 2018; Li *et al.*, 2017; Brusset and Teller, 2017; Brandon-Jones *et al.*, 2014; Chowdhury and Quaddus, 2016; Akgün and Keskin, 2014) and the attention-based survey-based studies[23] (e.g., Bouquet *et al.*, 2009; Clercq and Zhou, 2014; Ambos and Birkinshaw, 2010) reviewed in the study.

Furthermore, a sample size of at least 200 is sufficient for the use of three-stage least squares regression analysis. Tabachnick and Fidel (2013) note that to test for multiple correlation and individual independent variables (IVs), a minimum sample size (N) can be determined as follows:

> $50 + 8m$ (where m is the number of IVs) and $104 + m$ respectively, assuming $\alpha = 5\%$ and $\beta = 20\%$.

In this study, the regression model with the highest number of IVs had operational resilience as the dependent variable (DV) (see Section 5.4.1). In this regression model, the number of IVs were 9[24], which requires a minimum sample size of between 122 and 113. In using multiple regression results for generalisation purposes, Hair *et al.* (2014) conclude that if a sample is representative, a ratio of 15 to 20 cases per IV is desirable. In this case, a desired sample size of 135 (i.e., 15 cases × 9 IVs) would be required in this study. Cohen *et al.* (2007) also observe that for inferential statistics-based survey research, a sample size of at least 100 for major subgroups and 20 to 50 in minor subgroups are appropriate.

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[22] Liu *et al.* (2017) used 253 cases, Kwak *et al.* (2018) used 174 cases, Li *et al.* (2017) used 77 cases, Brusset and Teller (2017) used 171 cases, Brandon-Jones *et al.* (2014) used 264 cases, Chowdhury and Quaddus (2016) used 272 cases, and Akgün and Keskin (2014) used 254 cases.

[23] Bouquet *et al.* (2009) used 135 cases, Clercq and Zhou 2014 used 158 cases, and Ambos and Birkinshaw (2010) used 283 cases.

[24] Attention to threats (ATT), Strategic mission rigidity (SMR), Disruption orientation (DO), ATT × SMR, ATT × DO, Slack resources, Firm size, Firm age, Firm industry.

The conclusion from the foregoing discussion is that at least a minimum sample size of 200 firms is needed for all types of statistical analyses to be conducted in the study, and that this sample is enough for generalisation purposes so long as a fairly representative sample was used. To be on a safer side, however, this study focused on collecting data from a minimum of 300 firms (assuming there will be non-usable/problematic responses). To realise this, several steps were taken. First, the study determined the likely non-response rate (Bryman, 2012). Basing on recent prior research[25] (Adomako *et al.*, 2018; Adomako *et al.*, 2018b; Adomako *et al.*, 2016; Acquaah, 2007) that used the similar/same survey instrument and survey administration technique and drew on samples of businesses in Ghana, the length of the questionnaire (see Section 4.4.7.2), and adjusting for the response rate enhancers incorporated in the questionnaire design and administration (See Sections 4.4.7.2 and 4.4.9), the study expected a non-response rate of about 60%. Thus, to obtain data from 300 firms, a minimum sample of 750 firms was considered. Accordingly, the study administered 750 questionnaires (cf. Chowdhury and Quaddus, 2016). Out of these, 284 were received and 259 were considered usable (see Section 5.2.1). Thus, the effective response rate was 34.53%. This response rate compares with those in studies that guided this study's determination of the likely non-response rate. Besides, a usable sample size of 259 compares favourably with those reported in prior resilience-based survey research (Liu *et al.*, 2017; Kwak *et al.*, 2018; Li *et al.*, 2017; Brusset and Teller, 2017; Brandon-Jones *et al.*, 2014; Chowdhury and Quaddus, 2016; Akgün and Keskin, 2014) and ABV survey-based studies (Bouquet *et al.*, 2009; Clercq and Zhou, 2014; Ambos and Birkinshaw, 2010). Moreover, a usable sample size of 259 is enough for estimating

[25] Adomako *et al.* (2018) obtained 35.3% response rate, Adomako *et al.* (2018b) obtained 30.96% response rate; Adomako et al. (2016) obtained 33.6% response rate; Acquaah (2007) obtained 53%.

both the measurement model (Bagozzi and Yi, 2012) and the structural model (Hair *et al.*, 2014; Tabachnick and Fidel. 2013).

4.4.5.2.2 Obtaining a Representative Sample

Non-availability of appropriate sampling frame made it difficult for the researcher to rely on random sampling approaches. There is a lack of reliable information on businesses in Ghana (Adomako *et al.*, 2016; Boso *et al.*, 2013a). Different institutional databases (including Registrar General's Department, the Association of Ghana Industries (AGI), the Ghana Business Directory, Yellow Pages Ghana, and Ghana Yello) provide different information. Prior research has approached this challenge from different perspectives. Some draw on single sources (Acquaah *et al.,* 2011; Adomako *et al.* 2018a; Acquaah, 2007) to identify a list of businesses of interest to study while others (e.g., Boso *et al.,* 2013a; Adomako et al., 2016) draw on multiple sources. Though the use of multiple sources appears ideal, it is difficult implementing as there is no standard format for maintaining information about the firms, and thus difficult synchronising. This study relied on the online database of Ghana Yello (https://www.ghanayello.com) to identify a list of firms of interest (see Section 4.4.4). Ghana Yello online does not only provide a readily available and an easy-to access information on businesses in the country, but also provides comprehensive information that allowed the researcher to identify firms that fall within the study's target population (e.g., information on firm size and date of registration are accessible), and administer the survey with ease (e.g., information the location addresses and contacts are accessible). Moreover, the database is updated almost every day, and thus making it an up-to-date database for the study.

In the Ghanaian context, having built a list of businesses of interest, some prior research (e.g., Boso *et al.,* 2013a; Adomako *et al.,* 2016) telephoned relevant contact persons to negotiate for access. This approach was not be followed in the present study as there was a limited budget.

To obtain a representative sample, the target population was split based on three distinct characteristics: industry (service and manufacturing), firm size (small=6 to 30 employees, medium = 31 to 100 employees, and large 101 to 500 employees [cf. Ghana Statistical Service, 2016]), and geographical location (Kumasi and Accra), and proportionate number of cases were drawn from each group till the overall sample size requirement (i.e., 750) was met (Bryman, 2012). This step was taken to help obtain data that reflect the target population. Following Chowdhury and Quaddus (2017:2016), the actual selection of the firms was done using purposive sampling technique as the researcher had to consider the location of the firms and the availability a key/competent informant in each firm and administer the instrument using face-to-face approach.

An integrated business establishment survey by Ghana Statistical Service (2016) reveals that most firms from both the service and the 'industry' (including manufacturing) industries are located in the Accra Metropolis and the Kumasi Metropolis, though those in Accra Metropolis are more, and also the service firms are more than twice as many as any category of firms in each location. To obtain sizable sample from each location, however, the study considered 60% and 40% of firms from Accra and Kumasi respectively. Also, the study considered 70% and 30% samples from the service and manufacturing industries. Again, guided by the distribution of firms by size as found by Ghana Statistical Service (2016), this study considered 60% (450) and 40% (300) small and medium/large firms from each location.

4.4.6 Choice of Informants

Deciding "who to provide what data" is an important methodological issue as it has a direct bearing on the quality of data obtained for a study, and accordingly, the validity of findings and conclusions. Largely, understanding the study's unit of analysis and the kind of information sought for helps identify the choice of informant(s) (see Brandon-Jones *et al.*, 2014; Ambulkar *et al.*, 2015). As explained in Section 4.4.4, the study's unit of analysis is the firm. In business and management studies focusing on the firm as the unit of analysis and are interested in overall firm-level issues (as in the case of this study), the established tradition has been relying on individuals holding senior executive/managerial positions as the key informants (Miles and Arnold, 1991). A key informant should be an individual who is knowledgeable about the issues under investigation (i.e., the questions being asked), has confidence in the responses provided, and believes in the accuracy of their responses (see Boso *et al.*, 2013a, Morgan *et al.*, 2012).

Accordingly, given that the study focuses on firm-level issues, individuals holding key senior management positions in their respective organisations were considered the ideal informants for the study. Prior questionnaire-based survey studies analysing attentional focus variables at the firm level (e.g. Bouquet *et al.*, 2009; Ambos and Birkinshaw, 2010; Clercq and Zhou, 2014), firm/supply chain resilience (Ambulkar *et al.*, 2015; Brandon-Jones *et al.*, 2014), and operational performance outcomes (Huo, 2012; Flynn *et al.*, 2010), for example, have relied on responses senior executives/managers.

For SMEs, the study targeted top management (e.g., chief executive officers (CEOs). Given the 'smallness' of their operations and the degree of involvement of CEOs in these firms in Ghana, it was perceived that these individuals can be competent enough to provide responses to both strategic and operational issues in the organisation and its business environment (cf. Boso *et al.*, 2013b). However, for large organisations, the study targeted both top level and middle level mangers (e.g., operations managers). The study contends that informants at any of these levels with adequate experience in the organisation would be competent enough to provide data on both strategic and operational issues in their organisation (see Ambulkar *et al.*, 2015).

Unlike some studies (Clercq and Zhou, 2014) that rely on multiple informants from same organisation to provide data (e.g., obtaining data on the predictor(s) from one person, and the outcome(s) from another person), this research collected data on all variables from single key informants (as applied in Ambulkar *et al.*, 2015; Brandon-Jones *et al.*, 2014 for example). Relying on multiple informants can minimise the presence common method bias in data (Podsakoff *et al.*, 2012). However, it requires more time and budget and can lead to loss of data when one of the informants fails to participate in the study (Podsakoff *et al.*, 2012; Podsakoff *et al.*, 2003). Rindfleisch *et al.* (2008) note that employing multiple informants by collecting data on the predictors and the outcomes from different informants may be appropriate in large firms, but difficult to implement in small firms, in which the owner-manager is in charge of everything. In this study, a small proportion of the firms considered could be regarded as large (see Section 5.2.4).

This study, unlike others (e.g., Brandon-Jones *et al.*, 2014), relied single key informants with diverse background to obtain data (Ambulkar *et al.*, 2015). In either way, relying on single informants with same/similar or dissimilar background characteristics can bias data unless appropriate controls are put in place. O'Leary-Kelly and Vokurka (1998) assert that key informants occupying same/similar positions (e.g., CEOs) may systematically vary from others holding dissimilar positions (e.g., operational managers). For example, the thinking patterns regarding the firm's operational efficiency between operation managers and CEOs, for example, may differ. Also, for single informants with diverse backgrounds, their knowledge level on the different issues (e.g., strategic versus operational) may differ which can also bias the data. The study examined this potential bias in data prior to conducting the analysis and found that informant position had no significant effects on any of the substantive scales in the study (see Table 5.4).

4.4.7 Variables, Questionnaire, and Measures

The substantive variables in the study include attention to threats, disruption orientation, strategic mission rigidity, operational resilience (disruption absorption capability and recovery capability), and operational efficiency. Section 3.3 specifies the relationships between these variables and provides arguments for each relationship. To obtain consistent estimates, the study included the following control and instrumental variables:

4.4.7.1 Control and Instrumental Variables

4.4.7.1.1 Control Variables in the Model of Operational Resilience

The study controlled for the potential effects of slack resources, firm size, firm age, and firm industry on operational resilience.

Slack resources refers the extent to which the firm has immediate access (in the short run) to uncommitted resources that can be used to fund organisational initiatives (Atuahene-Gima *et al.*, 2005). In line with the RBV, slack resources represent an important formative indicator of resilience or a pre-disruption feature of resilient firms (Blackhurst *et al.*, 2011; Sheffi and Rice, 2005) as it facilitates the conception and implementation of risk management strategies (e.g., contingencies) that help in the early discovery of, and response to disruptions. Slack resources can be relied on to build hedges against uncertainties which in turn serve as cushions for operations when disruptive events strike (Hohenstein *et al.*, 2015; Lampel *et al.*, 2014). In relation to these arguments, Tognazzo *et al.* (2016) find that during recession, financial slack is important in driving profitability. Also, Meyer (1982) finds that slack resources is a driver of disruption absorption/recoverability.

Firm size indicates how small or large a firm is, in terms of its assets volume, sales volume, scale and scope of operations, number of employees, etc. The operations of larger firms is often characterised with more complexity. Complexity, however, is a resilience reducer (Blackhurst *et al.*, 2011). The simple organisational structure and the flexibility of small firms can allow them respond swiftly to disruptions (Ismail *et al.*, 2011). Nevertheless, compared to large enterprises, small firms are more vulnerable in times of disruptions (Lai *et al.*, 2016; Pal *et al.*, 2014). Faced with limited financial resources, inadequate managerial competences, and weak control of the external environment, small firms perform poorly in their ability to absorb and recover from disruptions (Lai *et al.*, 2016). Lai *et al.* (2016) find that unlike large firms, small and medium firms are more vulnerable in times of economic hardship. Notwithstanding the logic underlying the expectation that firm size will be positively associated with operational resilience, Brandon-Jones *et al.* (2014) find that firm size is not correlated with either supply chain resilience (recoverability) and supply chain robustness (disruption absorption). Again, Dubey *et al.* (2017) find that firm size is not correlated with supply chain resilience (recoverability).

Firm age (i.e., number of years existed in an industry) is often used as a proxy for business/organisational experience. Knowledge and experience in a business environment can be critical for successful operations. The more exposure to disruptions a firm has, the better it can learn and respond to them. Moreover, older firms can also lever on experience to source and extract external resources when faced with disruptions.

Firm industry. The operational setup for service and manufacturing firms differ in many ways. Greater inter-dependency in operations or difficulty in decoupling operations within a manufacturing plant can make little disruptions spread into giant ones which may be difficult to contain.

4.4.7.1.2 Control Variables in the Model of Operational Efficiency

The study controlled for the potential effects of operational disruption, slack resources, firm size, firm age, and firm industry on operational efficiency.

Operational disruption refers to the frequency at which a firm experiences unplanned and unintended events that interrupt the normal flow of operations (Blackhurst *et al.*, 2011). The more a firm experiences operational disruption, the more wastes (e.g., idle capacity) and expenses (for restoring operations) it incurs (Hendricks and Singhal, 2005). Thus, operational disruption will relate negatively to operational efficiency.

Slack resources. The effect of slack resources on operational efficiency can be negative or positive. Slack resources allows for building excess capacity which has inefficiency associated with it. Nevertheless, firms with more slack resources can better implement strategies and methods (e.g., process improvement, acquiring efficient technology) that improve operational efficiency.

Firm size. The effect of firm size on operational efficiency is difficult to speculate. Larger firms often enjoy economies of scale/scope associated with operations (e.g., purchasing and producing in large volume and adding new product/service line). This, however, may be associated with inefficiencies (e.g., stock holding costs and supervision/administrative overheads). Smaller firms tend to be resource constrained and this can compel them to use resources judiciously.

Firm age. The effect of firm age on operational efficiency can be complex. Age may come with experience. Thus, older firms can lever on experience to improve operational efficiency. That notwithstanding, younger firms normally face resource constrains, and this can motivate them to be economical in the use of resources. Also, younger firms tend to have narrowed scope of operations; in other words, they are small in size. This means that while they may not enjoy cost-savings associated with large scope/scale of operations, they avoid costs associated with large scope/scale of operations (e.g. monitoring cost and overhead costs of holding large scale purchases/inventory).

Firm industry. Compared to manufacturing firms, service firms can be expected to be more operationally efficiency as, for example, their business processes appear to be more simplified and also characterised with less wastes (e.g., excess raw material inventory, work-in-progress, and finished goods).

4.4.7.1.3 Instrumental Variables

Consistent with ABV's propositions, attentional focus constructs are endogenous, in the sense that they are influenced by attention structures (Ocasio, 1997; Clercq and Zhou, 2014). Attention structures include both internal and external factors that govern and regulate the evaluation, legitimisation, and prioritisation of issues and answers (Titus and Anderson, 2016; Plourde *et al.*, 2014; Ocasio, 1997). Thus, proper model specification (Poppo *et al.*, 2016: Zaefarian *et al.*, 2017) should include relevant attention structure as instrumental variables in the model of attention to threats. Accordingly, in addition to the moderator variables, the study used environment dynamism, slack resources, and firm size on attention to threats as instrumental variables to mitigate the potential endogeneity problem in the research model.

Strategic mission rigidity. Generally, institutionalisation of strategic mission inhibits change, learning, and exploratory behaviours (Mone *et al.*, 1998; Li *et al.*, 2008). A rigid strategic mission thus creates a context in which firms become more focused on how they make a living presently. The "present" focus and efficiency motives as well as less external information search behaviour among such firms (Atuahene-Gima *et al.*, 2005; Li *et al.*, 2008) promote corporate belt-tightening rituals, particularly, when it comes to investment decisions that do not directly generate revenue. In view of these, it can be expected that as strategic mission becomes more rigid, attention to threats will decrease.

Disruption orientation. Although firms would naturally not entertain disruptions and might want to invest resources in preparing for them, there should be a motivation, particularly, an inherent one like disruption orientation (Bode *et al.*, 2011). Thus, it can be expected that as disruption orientation increases, attention to threats will increase (Bode *et al.*, 2011), as attention to threats can be regarded by management as means to attaining resiliency.

Environment dynamism reflects the absence of pattern, and unpredictability of events in the firm's environment. In other words, it is about the degree of stability-instability, or abrupt changes, in the business environment (Dess and Beard, 1984). Environment dynamism represents a key source of environment uncertainty and threats to businesses (Dess and Beard, 1984; Joshi and Campbell, 2003). High level of environment dynamism calls for and warrants investment in strategic responses such as information search, new technology, and innovation (Li and Atuahene-Gima, 2001; Story *et al.*, 2015). It is, thus, reasonable to expect that as a firm experience more environment dynamism, the more likely it will increase attention to threats, *cet. par*, as doing so can help it minimise uncertainties associated with environment dynamism and effectively navigate business operations. For instance, Brandon-Jones *et al.* (2014) find that visibility increases with environment dynamism.

Slack resources. According to the ABV, resources explain how firms actively structure and allocate attention to categories of issues and answers (Ocasio, 1997). That translating and implementing selected repertoire of answers in response to particular issues require the deployment of either existing or new resources (Ocasio, 1997) means scarcity of resources can limit emphasis on attention to threats. More slack resources, thus, frees organisational attention and fosters investment in exploratory initiatives (e.g., innovation) (Ren and Cuo, 2011). Accordingly, the study expects that firms with more slack resources will increase emphasis on attention to threats, cet. par.

Firm size. As firms increase in size, complexity and exposure to disruptions tend to increase (Revilla and Jesus, 2017). Accordingly, large firms may place more emphasis on attention to threats. Besides, large firms tend to have more financial muscles (Lai *et al.,* 2016) which frees up their attention. Moreover, unlike in large firms, managerial attention is more limited in small firms as top managers' roles extends well to tactical and day-to-day routines. All these suggest that attention to threats can be low among small firms.

4.4.7.2 Questionnaire Development

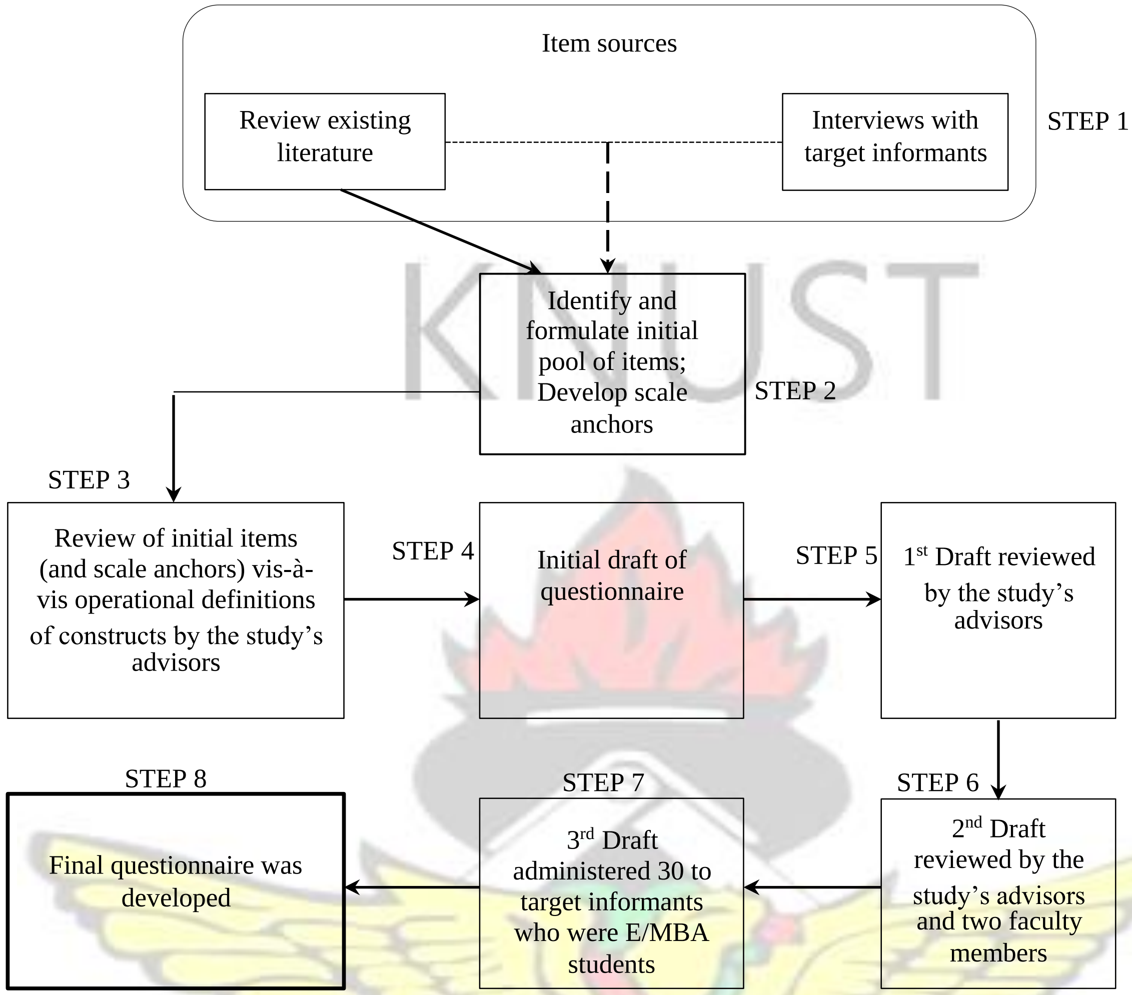
To obtain reliable and valid measures for the study and develop a questionnaire that contributes to data quality and high response rate, the researcher drew on complementary insights from multiple sources, including Podsakoff *et al.* (2003), DeVellis (2003), Rossiter (2002), and Churchill (1979). This section describes the steps followed in developing the questionnaire, the physical characteristics of the questionnaire, and the sources of the measures for the constructs. Figure 4.1 depicts the major steps followed in developing the study's questionnaire.

Step 1 focused on identifying appropriate sources to build an initial pool of items to capture the constructs. The study relied on two sources, viz., existing literature (both conceptual and empirical) and interviews with managers (where necessary). Except for attention to threats, prior research had suggested items that could tap into the study's constructs. Even for attention to threats, there existed indicative ways via which it could be captured. Nevertheless, the study complemented insight from relevant literature with the one obtained from interviews with target informants (see Section 4.4.7.3.1 for details).

Step 2 focused on developing a pool of items based the operational definitions of the constructs. Here, emphasis was placed on framing the items in ways that tap into the operational definitions of their respective constructs, fit the empirical setting, and could be easily understood by the target informants. Relevant measurement scales were suggested at this step too.

In Step 3, the study's advisors reviewed the output of Step 2 and provided constructive critiques to guide the development of the first draft of the questionnaire.

Step 4 focused on developing a first draft of the questionnaire. Some of the issues considered here included sequencing of items, formatting, and design (Section 4.4.7.2 discusses how issues of this kind were addressed).



Note: The dotted path shows the process involved in generating the initial pool of items for attention to threats, and also deciding the measures to include capturing operational disruption and environment dynamism.

Figure 4.1: Major Steps involved in developing the Study's Questionnaire

Source: Researcher's Construct (2018)

In Step 5, the questionnaire was given to the research advisors to review. The main concern raised had to do with poor introductory statement and improper sequencing and formatting of the items.

Step 6 acted on the feedbacks obtained in Step 5. The revised questionnaire was sent back to the study's advisors for further consideration. Also, two faculty with expertise in strategy and supply chain research were given copies to review. The study's advisors did not raise much concerns at this stage, except that they suggested that the A4 version of the questionnaire be converted into a booklet form and also given a professional to improve on the design. The feedback from the faculty members was largely about the bulkiness of the questionnaire. Certain items included for future research purposes were accordingly dropped.

Step 7 tested the revised questionnaire from Step 6 among thirty[26] target respondents. These participants were E/MBA students and were senior executives in firms that share the characteristics of the study's target population. The purpose of this exercise was as follows:

1. To know the extent to which the questionnaire was able to address the concern of clarity and elicit appropriate responses. Each questionnaire received was reviewed by the researcher to know how the respondents responded to the items. No major issues relating to poor responses (e.g., missing values and failure to pay attention to instructions).
2. To know how the respondents would react to the physical characteristics of the questionnaire. Here, no major concern was raised or detected.
3. The average number of days it would take for the respondents to complete the questionnaire. 23 out of the 30 questionnaires administered were received within 14 working days. The study did not follow up on the remaining 7 after the 14th working day.
4. To evaluate whether the phenomena of interest in the study were perceived to be present in the empirical setting and the extent of variability in the scores on items in the study.

[26] cf. Clercq and Zhou (2014)

The item mean results obtained generally indicated that the constructs were perceived to have some existence in the study's context, given that majority of the items were scored above average. Also, enough variability was observed in the data.

5. Since Step 7 did not result in further concerns, the researcher proceeded to draft the final version after discussing the results with the advisors. The questionnaire development started in February 2018 and the final draft was ready in May 2018.

4.4.7.3 Physical Characteristics of the Questionnaire

Response rate and response quality depend, in part, on the physical characteristics of questionnaires (e.g., layout of form, order and flow of items, paper quality, and questionnaire length) (Saunders *et al.,* 2007). Respondents can regard studies that use self-completion paperbased questionnaires that do not physically look attractive and professional as unimportant, leading to low response rate and or poor data quality (DeVellis, 2003; Saunders *et al.*, 2007). In line with this concern, the study contracted a professional printing house to re-format the final questionnaire and address any structural challenges, while ensuring that the original ordering of the items was not altered. The original A4 sheet designed questionnaire was converted into a booklet form as this is easier to handle and likely to look more appealing to senior managers (Bryman, 2012). While using coloured papers can enhance the professional look of the questionnaire (Saunders *et al.*, 2007), due to budget constraint, the questionnaires were printed using white papers. Of importance, the study ensured that high quality office papers were used and that the texts were readable. The study used a typical font type (Times New Roman) and ensured that it is consistent throughout (Bryman, 2012). A pilot-test version of the booklet form questionnaire suggested that a font-size of ten appeared readable. Thus, the final version for the main survey used a font size of ten throughout.

Another important physical characteristic of questionnaire that should be given due consideration is “length”. Not only there exists unsettled debate on the appropriate length of questionnaire, but also, there is no clear-cut principle for identifying long or short questionnaire (Bryman, 2012). In addition, studies on length of questionnaire and response rate (for example) have produced mixed results (Saunders *et al.*, 2007). Nevertheless, respondents may consider research with a very short questionnaire as insignificant, hence, not worth bothering with, which can affect the quality of responses provided (Saunders *et al.*, 2007; Bryman, 2012). On the other hand, too long questionnaire may not only lead to low response rate (Bryman, 2012), but also, poor quality responses resulting from respondent’s fatigue, and consequently, yea/nay-saying responses. Yet, respondents can be highly tolerant of long questionnaires with topical issues that interest them (Bryman, 2012). The preliminary interviews with managers indicated that the issues under investigation (particularly, threats in the business environment, attention to threats, and resilience) appear interesting in the research context. Against this, and with the view of the fact that professionally designed questionnaires can enhance response and response quality, this study opted for longer questionnaire (i.e., seven and half A4 pages, including the front page which captured the cover letter) that captured the study’s constructs and those for further research. Saunders *et al.* (2007) found that a questionnaire with a length of between four and eight A4 pages is acceptable for within-organisation self-completion questionnaire administration. Feedback from the pilot test indicated that the participants did have much concern with the length of the questionnaire as they were given ample time (at least 14 working days) to complete.

4.4.7.4 Measures

4.4.7.4.1 Attention to Threats

This study proposes the attention to threats construct. Thus, there was the need to develop measures to capture it. The study draws insights from Churchill (1979) to develop items to measure attention to threats. Following prior ABV survey-based studies (e.g., Ambos and Birkinshaw, 2010; Bouquet *et al.*, 2009; Stevens *et al.*, 2015), and with the goal of improving contend validity, the study focused on developing a multi-item scale to capture the notion of attention to threats. Figure 4.1 summarises the steps followed in identifying appropriate items for attention to threats.

Step 1: Conceptual domain and definition

Firms allocate attention to different issues/answers. Thus, to minimise ambiguity, the idea of attentional focus is frequently framed in terms of "attention to *particular issues/answers (say, X*)", where *X* defines the domain of measurement items. For instance, in this study, *X* represents "threats", unplanned and accidental events (or issues) that interrupt and undermine the normal of business operations. Hence, in this study, the measures identified to tap into attention to threats were tied to the idea of issues that threaten operations/business survival[27].

This study situates the notion of attention to threats within the disruption-preparedness reasoning (see Section 3.2.2.1.2). It should be noted, however, that the channels through which disruption-preparedness works are numerous (see Chowdhury and Quaddus, 2016:2017; Kamalahmadi and Parast, 2016 for further discussions). The attention to threats aspect of disruption-preparedness relates to resource investment specifically in information search and processing activities (including monitoring, information gathering, and discussions) that enhance the firm's understanding of, responses to, disruptions in the business environment.
This view of attention parallels Bouquet *et al.*'s (2008) definition of international attention as "the extent to which they [headquarters] invest time and effort in activities, communications,

[27] No specific threats were identified for the informants to evaluate as, in the first place, they (threats) can be numerous. Besides, some threats may be firm specific. The measures were framed in ways that connote what the study means by "threats".

and discussions aimed at improving their understanding of the global marketplace" (p. 108) and Durand and Jacqueminet's (2015) definition of *subsidiary's attention to the demands of both its headquarters and its external constituents* as "comprising their notice of these demands, allocation of time and effort to understand these demands, and elaboration of a response strategy" (p. 4). *Step 2: Item generation*

Several scholars (Ocasio, 2011; Surroca *et al.*, 2016; Eggers and Kaplan, 2009) acknowledge the measurement of the notion of attention as a difficult exercise and a key challenge in researching about attention in general. In their analyses of the pertinent empirical literature, Surroca *et al.* (2016) and Ocasio (2011) found that varied approaches have been utilised to measure attention. In part, Ocasio (2011) interpreted and attributed the differences in the measurement approaches to methodological choices (e.g., availability of information). Nevertheless, it is clear that majority of prior strategy-related studies that employ multivariate techniques have relied on textual analysis of letters or minutes to capture attention (Surroca *et al.,* 2016; Ocasio, 2011; Eggers and Kaplan, 2009). It is often argued in these studies that organisational attention to an issue reflects in the frequency at which the issue is mentioned or discussed. To generate relevant measurement items for measuring attention to threats, this study draws insights from prior research and interviews with senior managers.

Prior research. A review of prior studies suggested that attentional focus can be measured in terms of resource allocation/investment to particular issues/answers. For example, Durand (2003) measures organisational attention to the demand market by relying on the relative amount of expenditure committed by the organisation to gathering market information (expressed as % of sales). Also, Bouquet *et al.* (2009) capture international attention with items that reflect the frequency at which top executives collect strategic information about the market on regular basis, use business intelligence software to analyse global market developments, use email, letters and memos, etc. to communicate and discuss non-routine issues with overseas managers, and the amount of time (as a %) that CEO spends travelling abroad every year. These attentional practices (including scanning, discussion, and communication), as Bouquet *et al.*

(2009) assert, aim at improving headquarters' understanding of the global marketplace.

Interview responses. The ways through which attention to threats will manifest can be numerous (cf. Bouquet *et al.*, 2009) and can also be context specific. Thus, it became necessary to focus on generating items that represent the most critical ways through which attention to threats manifests within the empirical setting. To this end, and guided by insight from prior research, the researcher interviewed five senior managers (see Table 1, Appendix 2). An analysis of the indicative responses suggests that, within the research setting, attention to threats manifests in four principal areas: (1) top management time and effort allocated to collecting and processing information about threatening issues, (2) reliance on employees/units to collect information on threatening issues, (3) formal internal discussions on threatening issues, and (4) engaging people outside the firm to discuss threatening issues.

Step 3: Initial and final items

Combining insights from the interviews and previous research, the study developed a four-item scale to measure attention to threats. The process followed in refining the scale has been discussed in Section 4.4.7.2. The final items are shown in Tables 4.2. All items were measured using a 7-point scale that ranged from "strongly disagree (=1)" to "strongly agree (=7)". The respondents were asked to indicate the extent to which they agree or disagree with each item statement.

Table 4.2: Final Scale Items for Attention to Threats

Measurement items	Source

SCALE: 1= "strongly disagree" to 7= "strongly agree" *Over the past 3 years, …* 1. Our company has been holding frequent board meetings to discuss and find answers to issues that threaten its operation 2. Individuals in managerial positions in this company have been spending a lot of time and effort on studying and coming up with responses to threats in our industry 3. Our company has been utilizing employees (either individuals, or teams, or units) specifically in charge of monitoring the business environment for disruptive events 4. Our company has been engaging industry experts and business partners to discuss and find answers to threatening issues emerging in the business environment	Newly developed, based on insights from interviews and existing literature (e.g., Bouquet *et al.*, 2009)

4.4.7.4.2 Operational Resilience

The study defines operational resilience as the ability of a firm's operations to absorb and recover from disruptions (cf. van der Vegt *et al.*, 2015; Buyl *et al.*, 2017). Consistent with this definition, the study conceptualises operational resilience as comprising disruption absorption and recoverability. Recoverability refers to the ability of a firm to restore its operations to a prior normal level of performance after being disrupted. Prior studies (e.g., Buyl *et al.*, 2017; DesJardine *et al.*, 2017) relied on recovery time (i.e., the time it takes to return to a normal performance level before a disruption occurred) to objectively capture recoverability. Other studies relying on subjective scale (Brandon-Jones *et al.*, 2014) propose items that emphasise recovery speed. Accordingly, this study measures recoverability with five items (adapted from Brandon-Jones *et al.*, 2014) that reflect the idea of recovery speed (see Table 4.3). Since the analysis of recoverability in this study is not in relation to any specific disruption (see BrandonJones *et al.* [2014] and Kwak *et al.* [2018]), the items were framed not to reflect just recovery speed, but also recovery consistency/reliability over the past three years whenever operational breakdown due to disruption occurred. All items were measured using a 7-point scale that ranged from "strongly disagree (=1)" to "strongly agree (=7)". The respondents were asked to indicate the extent to which they agree or disagree with each item.

Table 4.3: Final Scale Items for Recoverability

Measurement items and scale	*Source*
SCALE anchors: Strongly disagree (=1) and Strongly agree (=7) *Over the past 3 years, whenever our operations fail or breakdown due to a disruptive event,* 1. it does not take long for us to restore normal operation 2. our company reliably recovers to its normal operating state 3. our company easily recovers to its normal operating state 4. our company effectively restores operations back to normal quickly 5. we are able to resume operations within the shortest possible time	Adapted from BrandonJones *et al.* (2014) with supplementary insights from Buyl *et al.* (2017) and DesJardine *et al.* (2017).

Disruption absorption refers to the ability of a firm to maintain the structure and normal functioning of operations in the face of disruptions. Buyl *et al.*'s (2017) and DesJardine *et al.*'s (2017) studies objectively measured this component of resilience in terms of the size of drop in normal performance just after a major disruption occurred. Other studies (Brandon-Jones *et al.* 2014; Wieland and Wallenburg, 2012) that use subjective scales measured disruption absorption[28] using items that reflect the idea of persistence and maintenance of structure and function of operations in the face of disruptions. Since this study does not assess disruption absorption in relation to any specific disruptive event (see also Brandon-Jones *et al.* [2014] and Wieland and Wallenburg [2012]), the items were framed to reflect the consistency at which a firm has exercised this capability over the past three years when disruptions occurred. Six items were adapted from Wieland and Wallenburg (2012) and Brandon-Jones *et al.* (2014) to capture disruption absorption using a 7-point scale that ranged from "strongly disagree (=1)" to "strongly agree (=7)" (see Table 4.4). The respondents were asked to indicate the extent to which they agree or disagree with each item.

Table 4.4: Final Scale Items for Disruption Absorption

Adapted measurement items and scale	*Source*

[28] Referred to it as "robustness" in some prior studies (see Section 2.3.3.2).

SCALE anchors: Strongly disagree (=1) and Strongly agree (=7) *For the past 3 years, whenever disruptive events occur…,* 1. our company is able to carry out its regular functions 2. our company grants us much time to consider a reasonable response 3. our company is able to carry out its functions despite some damage done to it 4. without much deviation, we are able to meet normal operational and market needs 5. without adaptations being necessary, our company performs well over a wide variety of possible scenarios 6. our company's operations retain the same stable situation as it had before disruptions occur for a long time	Adapted from Wieland and Wallenburg (2012) and Brandon-Jones *et al.* (2014)

4.4.7.4.3 Disruption Orientation

Disruption orientation refers to a firm's general awareness and consciousness of, concerns about, seriousness toward, and recognition of opportunity to learn from disruptions" (Bode *et al.,* 2011, p.873). In essence, disruption orientation is more of an attitudinal or a dispositional concept. However, Bode *et al.* (2011) contend that capturing it in a behavioural sense minimizes the tendency of social desirability bias. To measure it, the study adapted four items from the supply chain disruption orientation scale developed by Bode *et al*. (2011). This scale was also adapted by Ambulkar *et al.* (2015). The results from these studies showed that the items are reliable and valid. Consistent with Ambulkar *et al.* (2015) study, the items were measured on a 7-point rating scale that ranged from "strongly disagree (=1)" to "strongly agree (=7)". The respondents were asked to indicate the extent to which they (dis)agree with each item statement. See Table 4.5 for the measures.

Table 4.5: Final Scale Items for Disruption Orientation

Measurement items and scale	*Adapted from*
SCALE anchors: Strongly disagree (=1) and Strongly agree (=7) *To what extent do you disagree or agree with the following statements?* 1. We always feel the need to be alert to possible disruptive events 2. Previous unplanned disruptions show us where we can help improve our company's operations 3. We think a lot about how threatening events could have been avoided 4. After an unplanned operational disruption has occurred, our management lead in analysing it thoroughly	Bode *et al.* (2011)

4.4.7.4.4 Strategic Mission Rigidity

Strategic mission rigidity indicates the extent to which a firm's "mission is defined narrowly, is inflexible, discourages activities outside its scope, and difficult to change" (Atuahene-Gima *et al.*, 2005, p. 468). Four items from Atuahene-Gima *et al.* (2005) were adapted to capture strategic mission rigidity. Atuahene-Gima *et al.* (2005) study as well that of Li *et al.* (2008) demonstrated the validity and reliability of the items. Instead of the 5-point (disagree-agree) scale used in Atuahene-Gima et al. (2005), the study used a 7-point scale that ranged from "strongly disagree (=1)" to "strongly agree (=7)" to measure all the items (see also, Li *et al.* [2008]). The items are shown in Table 4.6.

Table 4.6: Final Scale Items for Strategic Mission Rigidity

Measurement items and scale	*Source*
SCALE anchors: Strongly disagree (=1) and Strongly agree (=7) 1. Our company's overall mission is defined quite narrowly 2. Our company's overall mission allows little flexibility to modify the domain of operations 3. Any activity outside our overall mission is actively discouraged 4. We hardly change our strategic mission to meet new challenges	Adapted from Atuahene-Gima *et al.* (2005)

4.4.7.4.5 Operational Efficiency

Operational efficiency reflects how well a firm minimises costs associated managing its business operations. These "costs" include actual monetary expenses incurred (direct and indirect) and volume of wastes in operations (e.g., waste of material and idle capacity) (Gligor *et al.*, 2015; Ward and Duray, 2000). As shown in Table 4.7, the study adapted five items from prior research (Wong *et al.*, 2011; Gligor *et al.*, 2015) to capture operational efficiency. All items were measured using a 7-point scale that ranged from "very low (=1)" to "very high" (=7). Using this scale, the informants were asked to indicate their firm's operational efficiency in terms of each cost item over the past three years. This scale was reserved to help minimise common method bias. Higher scores (5-7) and lower scores (1-3) indicate operational inefficiency and operational efficiency respectively.

Table 4.7: Final Scale Items for Operational Efficiency

Measurement items and scale	*Source*
SCALE anchors: Very low (=1), Very high (=7). *Over the past 3 years, …* 1. the costs we incur in running our core operations has been… 2. the volume of waste in processes that we record has been… 3. the volume of material waste recorded in our company has been… 4. overhead costs incurred by our company has been… 5. the volume of idle capacity/ resources our company experiences has been…	Adapted from Wong *et al.* (2011), and Gligor *et al.* (2015)

4.4.7.4.7 Environment Dynamism

Environment dynamism reflects the absence of pattern, and unpredictability of events in the firm's environment. In other words, it is about the degree of stability-instability, or abrupt changes, in the business environment (Dess and Beard, 1984). Environment dynamism represents a key source of environment uncertainty (Dess and Beard, 1984; Joshi and Campbell, 2003) and it is typically partitioned into components such as customer dynamisms/demand fluctuations, technological dynamism, and fluctuations in competitor actions/strategies (Joshi and Campbell, 2003; Baum and Wally, 2003; Jaworski and Kohli, 1993). Nevertheless, interview responses in the study revealed other relevant components of environment dynamism in the research context: supplier/supply market dynamism and regulatory/policy dynamism. Thus, to measure environment dynamism, it was necessary to identify items (see Table 4.8) that tap into each of these components of the concept. All items were measured using a 7-point scale that ranged from "not at all (=1)" to "to an extreme extent (=7)". The respondents were asked to indicate the extent to which there has been irregular changes in each environment item over the past three years.

Table 4.8: Final Scale Items for Environment Dynamism

Measurement items and scale	*Source*
SCALE anchors: Not at all (=1), To an extreme extent (=7) *Over the past 3 years, there has been irregular changes in...* 1. the needs and preferences in our demand/customer market 2. the actions of our competitors, in terms of their promotions, innovations, etc. 3. terms, conditions, and structures in our supply markets 4. government policies and programmes for our industry 5. laws and regulations governing our industry 6. technological needs and advancement in our industry	Items 1, 2, and 6 were adapted from Baum and Wally (2003) while the rest were developed based on insight from the interviews

4.4.7.4.8 Operational Disruption

Operational disruption refers to the frequency at which a firm experiences unplanned and unintended events that interrupt its operations (Craighead *et al.*, 2007; Bode *et al.*, 2011). To capture this construct, the study relied on insights from prior research (Ambulkar *et al.*, 2015) and interviews with senior managers. In all, nine items were identified to measure operational disruption (see Table 4.9) using a 7-point scale that ranged from “strongly disagree (=1)” and “strongly agree (=7)”. The respondents were asked to indicate the extent to which the agree or disagree with each item.

Table 4.9: Final Scale Items for Operational Disruption

Measurement items and scale	*Source*
SCALE anchors: Strongly disagree (=1), Strongly agree (=7) *Unexpectedly,* 1. some of our employees leave their posts (i.e. quit their job) 2. some of our suppliers fail to make deliveries 3. we experience vehicular breakdowns 4. we experience service/product failure 5. we run out of cash for running day-to-day operations 6. we experience machine/technology downtime/ failure 7. we experience shortage of raw materials 8. we experience power cuts 9. some of our service providers fail to honour their promises	Developed based on insights from Ambulkar et al. (2016) and interviews

4.4.7.4.9 Slack Resources

Slack resources reflects the extent to which the firm has immediate access (in the short run) to uncommitted resources that can be used to fund organisational initiatives (Atuahene-Gima *et al.*, 2005). To tap into this construct, the study adapted five items (see Table 4.10) from

Atuahene-Gima et al. (2005). All items were measured using a 7-point scale that ranged from "strongly disagree (=1)" to "strongly agree (=7)".

Table 4.10: Final Scale Items for Slack Resources

Measurement items and scale	*Source*
SCALE anchors: Strongly disagree (=1), Strongly agree (=7) 1. Our company often has uncommitted resources that can quickly be used to fund new strategic initiatives 2. Our company usually has adequate resources available in the short run to fund its initiatives 3. We are often able to obtain resources at short notice to support new strategic initiatives 4. We often have substantial resources at the discretion of management for funding strategic initiatives 5. Our company usually has reasonable amount of resources in reserve	Adapted from Atuahene-Gima et al. (2005)

4.4.7.4.10 Other Variables: Firm Size, Firm Age, and Sector

Consistent with prior research (Boso *et al.,* 2013b; Boso *et al.,* 2013a), number of full-time employees and number of years of existence were used as indicators to tap into firm size and firm age respectively. Natural logarithm function was used to normalise firm size and firm age (Bouquet *et al.*, 2009; Boso *et al.*, 2013b; Boso *et al.*, 2013a). For industry, an industry dummy: with 1 = service, 0 = manufacturing; was created.

4.4.7.4.11 Informant Competence & Profile Information

The study captured data on informant competence using three indicators: knowledge about the questionnaire items, general confidence in responses to items, confidence in the accuracy of the responses (i.e., reflecting the firm's situation) (Morgan *et al.,* 2012; Boso *et al.* 2013a) (see Table 4.11). The respondents were asked to indicate the extent to which they agree or disagree with each item.

Table 4.11: Scale Items for Informant's Competence

Measurement items and scale	*Source*
SCALE anchors: Strongly disagree (=1), Strongly agree (=7) 1. The questionnaire deals with issues I am very knowledgeable about 2. I am completely confident about my answers to the questions 3. I am confident that my answers reflect the company's situation	Adapted from Boso *et al*. (2013a)

Other information about the respondents that the study captured include gender, age, education level, position, years of holding current position, and years spent with the firm. Table 4.12 present how each item was measured.

Table 4.12: Informant Profile Information

>> What is your gender? ☐ Male ☐ Female >> What is your age group? ☐ 20 to 29 ☐ 30 to 39 ☐ 40 to 49 ☐ 50 or more >> What is your highest level of education? ☐ Senior high school ☐ Diploma ☐ 1st Degree ☐ Masters' degree ☐ PhD >> What is your position in your company? ☐ CEO ☐ Managing director ☐ General manager ☐ Operations manager ☐ Other (kindly indicate____________________) >> How long (in years) have you held this current position? About _________________years

4.4.8 Main Data Collection

As indicated in Section 4.4.4, data for the study were collected from firms operating in the service and manufacturing industries in Kumasi and Accra. Given time constraint and the overwhelming task of conducting delivery and collection questionnaire administration, the researcher chose to employ data collection agents. This is consistent with prior research conducted in the research setting (e.g., Adomako *et al.*, 2018a; Adomako *et al.*, 2018b). To ensure that the agents contracted for the fieldwork are credible and competent enough, the study relied on the recommendations of other researchers who utilise the service of data collection agents in the country. Two agents (one in Kumasi and the other in Accra) were contacted. Background checks revealed that the agent in Kumasi and the one in Accra had done similar works for their respective references for the past 3 and 5 years respectively.

Separate meetings were held with each agent to discuss how the fieldwork should be conducted in order to increase response rate and at the same time minimise errors associated with fieldwork (e.g., questionnaire given to, and or, completed by other persons other than a target informant) and ensure that fieldwork ethics were upheld (e.g., using no persuasion to get the target informant consider participating in the study, or pressured to complete the questionnaire). The agents were not given the mandate to respond to any concerns that the informants may have while completing the questionnaire. The cover letter provided the researcher's contact via which all concerns by informants were supposed to be directed to.

Other instructions given to the agents were as follows:

1. Record when the questionnaire was delivered and when it was collected.
2. Collect all completed questionnaire from the target key informants whom the questionnaire was given to.
3. Contact the informant via phone or text message to remind him/her or find out if the questionnaire had been completed a week after the delivery was made.
4. Not to follow-up further on informants who did not complete the questionnaire in four weeks as this might indicate that they were either disinterested in the study or were just not ready to participate.

The agents were relieved from the task of entering the data. All received questionnaires were reviewed, sorted, and entered onto the computer by the researcher. The fieldwork in Kumasi started in May 2018 and ended in July 2018 while that of Accra started in July 2018 and ended in September 2018. Both could not be started concurrently as there were no enough budget as at the time the first one started.

4.4.9 Additional Response Rate Enhancers

Non-response is a common characteristic of survey research, and a major threat to the validity of research findings. It is thus a good idea to identify and implement measures that can help improve response rate. It is noted that both the design and the administration of a survey instrument are critical determinants of response rate (Bryman, 2012). Accordingly, some recommended and applicable measures were utilised at the questionnaire design and the administration stages in the study to help improve response rate:

1. Low response rate in surveys can result from the use of instruments that lack credibility, appear to be less valuable to informants, and do not guarantee the informants' privacy. Using a well-written covering letter can mitigate these concerns (Bryman, 2012). The first page of the study's questionnaire contained a cover letter[29] (it was edited and signed by the study's lead advisor and printed on the School's letterhead). In addition, the cover letter indicated the name and contact of the researcher (for which the informants could contact in case they had any concern) as well the name, contact, and signature of the study's lead advisor. Together, these measures lend credibility to the research. Regarding the value of the study, the cover letter explained the purpose of the study in terms how it is going to benefit learning and improve managerial understanding of strategies that contribute to operational resilience.
2. Provision of monetary and non-monetary incentives can improve response rate (Bryman, 2012). Consistent with prior research (Miles and Arnold, 1991), the questionnaire presented the respondents a chance to win GH₵500. Since this raises

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[29] The researcher preferred not to separate the cover letter from the questionnaire in order to avoid duplication of introductory and instructional statements in the study. Besides, this was necessary as already, the questionnaire was relatively long and thus there was no need bothering the informants (given their limited time) with too many text too read.

ethical concerns (i.e., it constitutes a form of inducement), it was indicated that the money should be donated to a favourite charity (e.g., church choir, school association, etc.) rather than for personal use. In addition, consistent with prior research (e.g., Ambos and Birkinshaw, 2010), the questionnaire promised to provide an executive report of the key findings and recommendations from the study.

3. Reminders: Following prior research (Stevens *et al.*, 2015), the fieldworkers made at least 1 reminder call/text message to the informants after the 7th day when the questionnaire was delivered.

4.4.10 Common Method Bias: Procedural Remedies

A key potential problem in behavioural/social science research in general is common method variance, i.e., "variance that is attributable to the measurement method rather than to the constructs the measures represent" (Podsakoff *et al.*, 2003, p. 879). This form of bias is one of the main sources of measurement error (Podsakoff *et al.*, 2003) which threatens construct validity and reliability, distort psychological domains, and obscure associations between constructs, and accordingly validity of research findings (Podsakoff *et al.*, 2012). Podsakoff *et al.* (2012) and Podsakoff *et al.* (2003) show that the types and sources of common method bias (CMB) can be numerous. Indeed, it is almost impossible for any single survey-based study to address all of them, ex-ante (Podsakoff *et al.*, 2012). Since ex-ante procedures can minimise CMB, the study attempted to consider those that could be implemented in the study.

Before detailing the ex-ante and post-ante remedies implemented, it must be mentioned that the study's proposed model poses a little concern for CMB. As demonstrated by Siemsen *et al.* (2010), unlike bivariate linear effects (which can be deflated or inflated by CMB), interaction and quadratic effects cannot be artefacts of CMB. Accordingly, Podsakoff *et al.* (2012) assert that for models hypothesising about interaction effects (as in the case of this study), statistically significant results observed cannot be attributed to CMB. They contended that, in such situation, procedural and statistical remedies for controlling for CMB serve as alternatives.

To be on a safer side, however, the study implemented relevant procedural remedies discussed in Podsakoff *et al.* (2003) and Podsakoff *et al.* (2012).

1. *When the predictor and the criterion variables are collected from same source (as in the case of this study) and the source of method bias cannot be identified, guaranteeing response anonymity in addition to psychologically separating the predictor and the criterion variables can prove useful.*

   Relating to these directions, the cover letter communicated the following to the informants: *we can assure you that your responses will be treated in the strictest confidence, with the results collected being anonymised and used for statistical and academic purposes only.*

   In addition, the questionnaire did not request for data that may reveal either the informants' identities or the identities of their firms.

   Also, the predictor and criterion variables in the study were placed far apart in the questionnaire. Even, the scales measuring the two dimensions of operational resilience were placed far apart. Other measures that are not used in this present study were introduced as separators.

   Again, the questionnaire avoided communicating any of the proposed relationships between variables in the study. What the cover letter informed the informants about was what the study seeks to achieve in general (see Figure 4.2). In addition, the questionnaire avoided naming any of the constructs. Only the word "resilience" appeared in the cover letter (see Figure 4.2).

A survey on Resilience of Business Organisations in Ghana

Dear Respondent,

Thank you for considering to participate in this study that seeks to investigate the health of businesses in Ghana. It is expected that the study's findings and discussions will shape learning as well as managerial understanding of strategies that contribute to organizational survival and performance.

Figure 4.2: Extract of the Cover Letter: Communicating the Purpose of the Study.

2. *Eliminating common scale properties*. Wide and different scales were employed in measuring the constructs.
3. *Improving scale items to eliminate ambiguity and reducing social desirability bias in item wording.* It was hoped that the series of steps followed in developing the questionnaire would help address this concern.

4.5 APPROACH TO DATA ANALYSIS

The study falls within the realms of explanatory research. Generally, addressing explanatory questions requires applying statistical tools to quantitative data. The choice of particular statistical tools and procedures, however, should be informed by issues such as: (1) the nature of research questions (they can be, for example, correlational- or cause-and effect-based (e.g., direct, indirect, and interaction effects), (2) how variables in the questions have been measured (in terms of scale of measurement or whether multi-items or single items were used to measure the variables), and (3) the structure of the dataset, i.e., whether it is cross-sectional or longitudinal). The focus of this section is to explain the choice of the main statistical tools used in the study, i.e., those that were used directly to obtain results related to the study's hypotheses) and the process followed in analysing the study's data. The main statistical software packages used are IBM SPSS 20 and LISREL 8.50.

4.5.1 Main Statistical Techniques

The main statistical tools used in the study include exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and three-stage least squares estimator. The ensuing subsections briefly explain each of them and the justifications for their use (discussions on how they were applied in the study are presented in Chapter 5). The first two were used in the analysis of the measurement model while last one was used to estimate the structural model.

4.5.1.1 Measurement Model Analysis

4.5.1.1.1 Exploratory Factor Analysis

EFA is an analytic technique used to explore for the underlying structure among observed variables (Hair *et al.,* 2014). The underlying structure is determined by the associations (i.e., correlations or shared variances) between/among the observed variables (Tabachnick and Fidell, 2013). EFA is generally utilised in the early stages of research, in *search* for unidimensional latent variables (O'Leary-Kelly and Vokurka, 1998). In other words, it allows the researcher to understand the common patterns of relationships that underlie observed variables and how these patterns can be consolidated into latent variables (Tabachnick and Fidell, 2013).

While EFA is used primarily in hypothesis-generation sense rather (i.e., hypothesising about the underlying processes that produce the observed variables) rather than hypothesis-testing sense (Tabachnick and Fidell, 2013), the study, although not exploratory in nature, still finds EFA useful for at least three reasons. First, a newly scale was developed for the study's predictor variable, i.e., attention to threats. It therefore becomes necessary to explore for the underlying structure of this scale (Hair *et al.,* 2014; Field, 2009). Except for the scale measuring firm attention to threats, all other scales were adapted from prior studies. In this sense, EFA was also used to explore whether each scale is unidimensional with regard to their respective predetermined latent variable (O'Leary-Kelly and Vokurka, 1998). Prior studies (e.g., Flynn *et al.,* 2010) have used EFA for same reason. Third, conducting EFA prior to CFA is generally a good practice as it helps speed up the CFA process. This is because, EFA can help the researcher spot on and purify (or drop) problematic observed variables (e.g., items with weak loading items). In essence, EFA is used in this study to explore and establish initial evidence of unidimensionality of the scales, and also help in the selection of items for the CFA (Clark and Watson, 1995).

4.5.1.1.2 Confirmatory Factor Analysis

Based on relevant theory, one could specify and test the relationships between (set of) observed variables and their respective latent variables, and a statistical tool that allows for this analysis is CFA. CFA statistically tests the extent to which an a-priori, theoretical, measurement model fits an observed data (Hair *et al.,* 2014). Unlike EFA, with CFA, one has to pre-specify the number of factors (or constructs) existing in a set of observed variables and, also, the factor each observed variable will load on (Hair *et al.,* 2014). CFA was found relevant in this study for the following reasons:

First, unlike EFA, CFA provides an explicit test and an objective interpretation of unidimensionality (Gerbing and Anderson, 1988), as well as other aspects of scale validity and reliability (e.g. composite reliability, convergent validity, and discriminant validity) (Hair *et al.,* 2014; Bagozzi and Yi, 2012; O'Leary-Kelly and Vokurka, 1998). As Gerbing and Anderson (1988) assert, CFA offers a more stringent assessment of unidimensionality per constraints imposed by internal (i.e., within-scale-items relationships) and external (betweenscale-items relationships) consistency. Second, using *t*-test, CFA avoids the problem of subjective interpretation of the factor loadings (as encountered in EFA). Third, it also enables the researcher to assess the overall measurement model fit to data via χ^2 test (and the use other practical model fit indices (Bagozzi and Yi, 2012) as discussed next.

4.5.1.1.2.1 CFA Model Fit Assessment Criteria

Model fit assessment involves comparing the extent of similarity or deviance between a proposed theory (theoretical model, measurement or structural) and reality (observed data) (Hair *et al.*, 2014). For a perfect theory, the observed covariance matrix (i.e., reality) and the estimated covariance matrix (i.e., proposed theory) would be indifferent (Hair *et al.*, 2014). To assess whether a proposed measurement or structural model fits a piece of data, several goodness-of-fit (GOF) indexes have been proposed (see e.g., Hair *et al.*, 2014; Hu and Bentler, 1999). This section discusses GOF indexes acknowledged as "best practices" in both the structural equation modelling (SEM) and the business and management literatures for assessing CFA/ SEM model fit.

The χ^2 statistic one of the absolute fit indexes, they measure of how well the specified model reproduces the observed data (Hair *et al.*, 2014). It is largely agreed that χ^2 statistics is the most fundamental GOF index (Bagozzi and Yi, 2012; Barret, 2007). Besides, it forms the basis for many other GOF indexes (Hair *et al.*, 2014). To Barret (2007), χ^2 is the only substantive statistical test for CFA and SEM models (Barret, 2007). χ^2 statistically assesses the difference between observed (reality) and estimated (proposed model) covariance matrices (Hair et al. 2014). Technically, it tests the null hypothesis that the observed sample and the estimated covariance matrices are indifferent (i.e., the proposed model fits the data perfectly) (Hair *et al.*, 2014; Bagozi and Yi, 2012). In testing CFA and SEM models, a non-significant χ^2 statistic (i.e., $p > .05$) indicates that the specified model statistically fit the observed data well (Bagozzi and Yi, 2012). Yet, since the χ^2 is sensitive to sample size, relying solely on it to evaluate models can lead to wrong conclusions (Bagozzi and Yi, 2012). In using χ^2, it becomes challenging to attain satisfactory model fit as sample size increases.

Given the sample size problem with the use χ^2 test, Bagozzi and Yi (2012) suggest that if "large" sample size (note: "large" is relative, for example, to the number of parameters to be estimated in a model) is perceived to be the cause of significant χ^2, then it may be appropriate to scrutinise other practical fit indexes. Based on a critical analysis of the pertinent literature, Bagozzi and Yi (2012) found that the root mean square error of approximation (RMSEA), the comparative fit index (CFI), the nonnormed fit index (NNFI) (also called Tucker and Lewis (TLI) index), and the standardised root mean square residual (SRMR) are the generally recognised and recommended practical fit indexes. In addition to these, Hair *et al.* (2014) also found normed χ^2 as a widely used GOF index. Accordingly, this study relied on these GOF indexes.

The normed χ^2, RMSEA, and the SRMR are also absolute fit indexes (Hair *et al.*, 2014). The normed χ^2 index is a measure of the ratio of χ^2 to the degrees of freedom for a model (Hair *et al.*, 2014). The smaller the value of χ^2 index, the better. The RMSEA indicates the average amount of misfit for a model per degree of freedom (Bagozzi and Yi, 2012). The SRMR indicates the square root of the average squared residual, and it is useful for comparing fit across models (Hair *et al.*, 2014). Lower RMSEA and SRMR values indicates better fit to data (Hair *et al.*, 2014). The NNFI compensates for model parsimony or penalises for model complexity (Bagozzi and Yi, 2012; Bentler and Hu, 1999). A higher NNFI value indicates a better-fitting model (Bagozzi and Yi, 2012). Though RMSEA and NNFI tend to reward for parsimony/penalise for complexity, at times, they can disagree between themselves (Bagozzi and Yi, 2012). CFI is an incremental fit index (i.e., it compares an estimated model to a baseline model that assumes that all observed variables are uncorrelated) (Hair *et al.*, 2012). CFI is insensitive to model complexity or tends to fit more complex models better than parsimonious ones (Bagozzi and Yi, 2012; Hair *et al.,* 2014). It measures relative noncentrality between a proposed model and the null model of modified independence (i.e., a model where only error variances are estimated) (Bagozzi and Yi, 2012). Higher values of CFI and NNFI indicate better fit to data. Unlike NNFI and SRMR, CFI and RMSEA are relatively independent of sample size (Bagozzi and Yi, 2012).

Different authors propose different cut-offs in the use of these indexes and Bagozzi and Yi (2012) note that some contention on what acceptable cut-offs should be. From their synthesis of prior recommended cut-offs, Bagozzi and Yi (2012) suggested that a model might be satisfactory with RMSEA $\leq$ .07, CFI $\geq$ .93, NNFI $\geq$ .92, and SRMR $\leq$ .07. These authors recommended that since χ^2 is frequently reported to be significant, one or more of these recognised practical fit indexes should be reported in addition to the χ^2 statistics. Regarding normed chi-square, Hair *et al.* (2014) indicate that a value of 3:1 or less are associated with a better-fitting model (Hair et al., 2014).

4.5.1.2 Structural Model Analysis

Three-stage least squares (3SLS) estimator was used to analyse the study's proposed model. 3SLS estimator involves three levels of analysis of regression models. 3SLS estimator is useful for analysing structural models containing moderator variables and at least one endogenous independent variable (Zaefarian *et al.*, 2017) with the tendency of the moderator variables directly predicting the endogenous independent variable. Like two-stage least squares estimator, a key advantage of 3SLS estimator is that, it is allows the researcher to effectively mitigate concerns in relation to endogeneity in theoretical models (Menguc *et al.,* 2014), such as the one proposed in this study. However, unlike two-stage least squares estimator, in 3SLS estimator, moderator variables are used as instrumental variables to obtain residuals for the endogenous independent variable(s) which is subsequently used to test for the main effect of the independent variable (Zaefarian *et al.,* 2017).

The study used 3SLS estimator to test the proposed theoretical model rather than structural equation modelling (SEM) although the latter appears to have received considerable attention and use in recent times. SEM has several advantages (Bagozzi and Yi, 2012) and has the ability to mitigate some of sources of endogeneity (e.g., error-in-measurement [Zaefarian *et al.*, 2017]). Nevertheless, the use of SEM does not rule out the inherent endogenous nature of the study's predictor variable (i.e., attention to threats), and the influence of the moderator variables (strategic mission rigidity and disruption orientation) as well as other factors: environment dynamism, slack resources, and firm size on it (see the discussion in Section 4.4.7.3). In fact, consistent with the ABV (Ocasio, 1997), any attentional focus construct is endogenous. Yet, scarcely do attention-based studies (e.g., Ambos and Birkinshaw, 2010; Bouquet *et al.,* 2009) empirically address this concern. These studies resorted to OLS regression analysis after successfully demonstrating the validity and reliability of their scales. Other stream of research that faced similar endogeneity problem (e.g., Poppo *et al.*, 2016; Menguc *et al.*, 2014; Luo *et al.*, 2007) and cared about effectively addressing it resorted to the use of 3SLS estimator, after validating their measures using CFA. Thus, not only does the present study's use of 3SLS estimator appropriate for estimating the proposed research model, but also it shows how the 3SLS estimator can prove useful in ABV research.

4.5.2 Data Analysis Procedure

As shown in Table 4.13, the analysis of the study's data was organised around three main stages. Stage 1 (response analysis) included response and non-response bias assessment, profiling of informants and firms, and descriptive analysis of substantive scales. Stage 2 (measurement model analysis) focused on assessing the validity and reliability of the study scales as well as the extent of common method bias present in the study. Stage 3 focused on generating results relating to the study's theoretical model and hypotheses. Table 4.14 summarises how the variables were treated in Stage 3. The respective key statistical tools utilised in each stage are provided in Table 4.13.

Table 4.13: Summary of Data Analysis Procedures

Major steps	*Sub-steps*	*Main analysis*	*Specific analysis*	*Key statistical tools used*
1	1	Response analysis	Response rate assessment, Test of data poolability Nonresponse bias test Profile of firms and informants Informant competent analysis Missing data analysis	Frequencies (percentages), mean analysis, *T*-test, Analysis of variance
2	1	Measurement model analysis	Item analysis	Item-wise correlations and Cronbach's alpha test
	2		Item selection	EFA
	3		Establishing initial evidence of unidimensionality, convergence validity, and discriminant validity	EFA
	4		Statistically-testing for unidimensionality, convergence validity, discriminant validity, and nomological validity	CFA & SEM
	5		Ex-ante common method bias assessment	CFA
3	1	Structural model analysis	Estimation of proposed conceptual model	Three-stage least squares (3SLS) estimator

4.6 RELIABILITY, VALIDITY, AND COMMON METHOD BIAS: APPLICABLE ONES AND CRITERIA FOR ASSESSING THEM

Measurement reliability and validity are the core criteria for evaluating the quality of any piece of quantitative data (McDaniel and Gates, 2012; Hair *et al.*, 2014). As it is in the case of this study, most of the theoretical constructs are latent (or unobservable), and relationships among latent constructs can only be examined via observed variables (or measures/ items/ indicators)

(Ping, 2004). Accordingly, to avoid erroneous conclusions, studies should ensure that measures identified to tap into theoretical constructs and the methods employed to collect data on the identified measures do not introduce errors that undermine the quality of the data (Churchill, 1979; O'Leary-Kelly and Vokurka, 1998).

Table 4.14: Treatment of Variables in the Analysis of the Structural Model

Dependent variable	*Independent variable*	*Control variable*
Disruption absorption	• Attention to threats (ATT) • Strategic mission rigidity (SMR) • Disruption orientation (DO) • ATT × SMR • ATT × DO	• Slack resources • Firm size • Firm age • Firm industry
Recoverability	• Attention to threats (ATT) • Strategic mission rigidity (SMR) • Disruption orientation (DO) • ATT × SMR • ATT × DO	• Slack resources • Firm size • Firm age • Firm industry
Operational efficiency	• Disruption absorption • Recoverability • Attention to threats	• Slack resources • Firm size • Firm age • Firm industry • Operational disruption
Attention to threats[1]		• Environment dynamism • Disruption orientation • Strategic mission rigidity • Slack resources • Firm size

Notes: [1]Considered in Stage 1 of 3SLS regression analysis

Two types of errors can contaminate measurement: systematic and random. Systematic errors (X_S) result from stable characteristics of the object (e.g., a naturally (dis)acquiescent manager) or the scale (e.g. poor calibration) which affect the score (Churchill, 1979). Put differently, systematic errors result from faults in the measurement instrument or process, and they lead to a constant bias in measurements (McDaniel and Gates, 2012). On the other hand, random errors (X_R) are transient in nature (e.g., a manager being in an electrifying or bad mood while completing the questionnaire), and they influence measurement unsystematically (McDaniel and Gates, 2012).

For a measure to be valid, the variations in observed scores (i.e., X_O) should reflect true variances (X_T) in the attributes (or characteristics) being measured and nothing else, i.e., $X_O = X_T$ (Churchill, 1979). Conversely, a reliable measure should produce consistent (or stable) scores (O'Leary-Kelly and Vokurka, 1998; McDaniel and Gates, 2012). In other words, a measure is reliable if independent but comparable measures of the same trait or construct of a given object agree (Churchill, 1979). A perfectly reliable scale is free from random error, i.e., $X_R = 0$ (Churchill, 1979). Though reliability is a necessary condition, it is insufficient for validity, i.e., a valid measure is reliable, but the reverse does not always hold since the X_O can equal $X_T + X_S$, even when $X_R = 0$ (Churchill, 1979).

4.6.1 Reliability Assessment

There are five common ways of assessing the reliability of measures, viz., test-retest method, equivalent (or alternative) forms method, split-half reliability method, Cronbach's alpha method, and Werts, Linn, and Jöreskog (WLJ) composite reliability method (O'Leary-Kelly and Vokurka, 1998; Field, 2009). Test-retest method involves measuring a construct at two points in time using the same set of measures and sample. Equivalent forms method involves measuring a construct at two different points in time using same sample and different (but similar or parallel) measures (McDaniel and Gates, 2012; O'Leary-Kelly and Vokurka, 1998). For both test-retest and equivalent forms methods, the correlation coefficient between the two set of test scores is used as an estimate of reliability, with a large correlation being a sign of reliability (O'Leary-Kelly and Vokurka, 1998). The split-half method randomly splits the dataset into two halves. The correlation between the scores on the measures in two halves is the statistics for reliability, with a large correlation being a sign of reliability (Field, 2009).

Cronbach's alpha method requires computing an index—ranging from 0 to 1—based on the correlations of the measures that measure the construct (O'Leary-Kelly and Vokurka, 1998).

Lastly, the composite reliability (also called "construct reliability", see Hair *et al.*, 2014) method utilises confirmatory factor analysis approach to obtain a composite index (ranging from 0 to 1) based on the proportion of variance attributable to only the latent variable (that is, excluding measurement error) (O'Leary-Kelly and Vokurka, 1998; Baggozi and Yi, 2012).

Among these methods for assessing scale reliability, this study utilised Cronbach's alpha and composite reliability (CR) methods for the following reasons. First, the study used crosssectional data, which makes the test-retest and equivalent (or alternative) forms methods nonapplicable. Second, multiple items were used to measure all the constructs. Thus, the aspect of reliability that became of interest in the study was the internal consistency among set of multiitems, and Cronbach's alpha method is the most applied method in such case (Hair *et al.*, 2014; O'Leary-Kelly and Vokurka, 1998). Besides, WJR composite reliability method was also considered as unlike Cronbach's alpha, it takes into account measurement error in its computations (O'Leary-Kelly and Vokurka, 1998). In addition, Cronbach's underestimates reliability (Ping, 2004). Composite reliability is based on the least restrictive assumption that the measures only have to be congeneric (the true scores of the measures should only be perfectly correlated, and not necessarily, equivalent), and since it incorporates confirmatory factor analysis, it allows for testing directly the assumption of congeneric measures (O'LearyKelly and Vokurka, 1998). The split-half method was not used as it presents a problem of how the dataset should be split. As Field (2009) points out, there are numerous ways in which a dataset can be split into two, and hence, the reliability value using split-half method can be a product of the way in which the data are split.

A concern worth noting is Cronbach's alpha (α) and composite reliability (CR) apply to unidimensional scales, i.e., scales with only one underlying factor, and both α and CR measure the strength (ranges from 0 to 1) of the underlying factor of the scale (Field, 2009; Bagozzi and

Yi, 2012; Hair *et al.*, 2014). Also, both α and CR apply to reflective measurement items, but not formative measurement items (Diamantopoulos *et al.*, 2008). For example, in this study, formative scale was used to measure operational disruption, hence reliability assessment does not apply to it (Bode *et al.*, 2011). While it is generally accepted that, the higher α, the better, there exists contention on an acceptable level of α (O'Leary-Kelly and Vokurka, 1998). One important argument has been that α depends on the number of items (N) (i.e., the more N, the better α) and thus, setting a single threshold for judging scale reliability can be problematic (Hair *et al.*, 2014; Field, 2009). Nonetheless, there appears to be some agreement that α of at least .70 demonstrates good internal consistency (Bagozzi and Yi, 2012; Hair *et al.*, 2014), and α ranging between .60 and .70 is acceptable in exploratory research (i.e., when developing a new scale) (Hair *et al.*, 2014). In this study, an α threshold of at least.70 is used evaluate to the internal consistency of unidimensional scales with a minimum of three items. Like α, there is no complete consensus on an acceptable minimum threshold for CR, and Bagozzi and Yi (2012) caution that recommended thresholds should be taken with some leeway in mind. Largely, CR of at least .70 is considered as good (Hair *et al.*, 2014; Bagozzi and Yi, 2012) while CR ranging between .60 and .70 may be deemed as acceptable (Hair *et al.*, 2014). As Hair *et al.* (2014) assert, scales should pass composite reliability before their validity should be assessed.

4.6.2 Validity Assessment

There are number of ways for establishing the validity of scales. The first (O'Leary-Kelly and Vokurka, 1998) and the most important (Hair *et al.*, 2014) is face validity (also referred to as content validity). Face validity measures the extent to which the scale’s items are logically, as well as theoretically, related to the construct, for which it supposed to measure (O'Leary-Kelly and Vokurka, 1998). Face validity is tested via an analysis of each item's theoretical meaning or content in relation to the operational definition of the construct (Ping, 2004). As detailed in Section 4.4.7, to improve face validity, the study relied on existing measures and followed recommended procedures developing the new scales (where necessary). The other tests (empirical) of scale validity include unidimensionality, convergent validity, discriminant validity, and criterion-related validity/ nomological validity (Hair *et al.*, 2014; O'Leary-Kelly and Vokurka, 1998). Together, these tests help to assess construct validity, the degree to which a scale measures the theoretical latent construct that it is designed to capture (Hair *et al.*, 2014). O'Leary-Kelly and Vokurka (1998) contend that treating multi-dimensional scales as if they are unidimensional can result in false conclusions. A scale is unidimensional if and if only it has one underlying trait (or factor) (O'Leary-Kelly and Vokurka, 1998). For a scale to be unidimensional, it should meet two conditions: (1) the scale items must be significantly related with an underlying latent variable, and (2) the scale items must be associated with one and only one latent variable (O'Leary-Kelly and Vokurka, 1998). These assumptions can be tested using either EFA or CFA. In EFA, the emergence of a single factor (component) that accounts for more than 50% of the variance explained, and with the items loading high (more than .50) on the factor demonstrate unidimensionality. In CFA, however, set of items specified to load onto a single latent variable should load significantly and the model should provide a good fit to the data. Convergent validity refers to the extent to which items of a specific construct share a high proportion of variance in common (Hair *et al.*, 2014). In CFA, convergent validity is demonstrated when the item standardised loadings are at least .50 (ideally, .70 or higher), are statistically significant, and their average variance extracted is at least .50 (Hair *et al.*, 2014).

Further, high internal consistency among the items (either Cronbach's alpha or Composite reliability) is a good indication of convergence validity (Hair *et al.*, 2014). Discriminant validity refers to the degree to which a scale empirically captures one and only construct. It provides evidence that a scale is unique and captures some phenomena that other scales do not (Hair *et al.*, 2014). Generally, weak correlations (typically, below .70) between scales suggests distinctiveness of scales (Vieira, 2011). In CFA, the presence of high cross-loadings is an indication of discriminant validity problem. A more stringent test of discriminant validity (via CFA) is to compare the average variance-extracted (AVE) values for any two constructs. AVEs greater than the squared correlation estimates demonstrate discriminant validity (Hair *et al.*, 2014). In CFA, a test of discriminant validity should be preceded by a test of convergent validity (O'Leary-Kelly and Vokurka, 1998). Nomological validity refers to the extent to which a scale (or construct) relates to other scale(s) in a predictable way (O'Leary-Kelly and Vokurka, 1998). This can be tested by examining whether the correlations between different scales capturing constructs in a theoretical model make sense (Hair *et al.*, 2014) or using SEM-based procedures to simultaneously examine the predicted causal linkages among theoretical constructs (Steenkamp and Trijp, 1991).

4.6.3 Common Method Bias: Statistical Remedies

Even after implementing procedural methods of control, CMB can still be a concern and thus, there is the need to rely on appropriate statistical remedies to assess its extent in the data (Podsakoff *et al*., 2012). Podsakoff *et al.* (2003, p.899) emphasise that:

> There is no single best method for handling the problem of common method variance because it depends on what the sources of method variance are in the study and the feasibility of the remedies that are available

After evaluating the weaknesses and the strengths of the available statistical remedy techniques (as discussed in Podsakoff *et al.*, 2012) vis-à-vis the nature of the study (e.g., design and research objectives), two statistical techniques for addressing CMB concerns were considered. The first is the common method factor technique and the second is the instrumental variable technique. Podsakoff *et al.* (2012) suggest that when the source of the method bias cannot be determined, common method factor technique can control for measurement error. The concern with the common method factor technique is that it may capture irrelevant trait variance as well as systematic method variance. Given this concern, the study followed a rigorous approach suggested by Cote and Buckley (1987) and implemented in Boso *et al.* (2013a) to test and compare series of CFA models involving method-only, trait-only, and method and trait. See Section 5.4.4 a discussion on how the instrumental variable technique was implemented in the study.

4.7 ETHICAL CONSIDERATIONS

The ethical concerns addressed in the study are as follows:

- The field study and the questionnaire were considered and approved by the faculty's ethics committee. In addition, the study's advisors approved both the field study and the questionnaire.
- The fieldworkers were admonished to only leave a questionnaire with firms that showed interest in the study after reading the cover letter. To elicit interest, the cover letter captured the purpose and the relevance of the study.
- The cover letter requested the informants to indicate their consent for participation.
  None of the questionnaires received had an informant indicating "I disagree" to participate in the study.
- The study offered both monetary and non-monetary incentives as a way of enhancing response rate (Bryman, 2012). As good practice (Ambos and Birkinshaw, 2010), a summary report of the implications of the study's results was given to informants who showed interest in it (i.e., provided their emails). Also, the study promised and offered

GH₵500 to one lucky informant for his/her favourite charity (for example, church choir, school association, etc.) rather for personal use.

- The study relied on multiple means to manage and protect the data(e.g., saving data in different and safe locations) so as to prevent data losses and also make sure that the data

  can be made available for rightful future usage (i.e., when necessary) without difficulties by using standardised coding system.
- The questionnaire did not capture/request for data that may reveal either the informants' identities or the identities of their firms. Besides, all analyses conducted and conclusions drawn were about average/aggregate firms.

4.8 CHAPTER SUMMARY

This chapter presented how the study's theoretical model was tested. Importantly, it discussed and justified choice of philosophical position, empirical setting, data, and data analytical approach (see Table 4.15). Also, data quality issues (validity, reliability, and biases) and ethical considerations were discussed. The next chapter presents the study results and the procedures followed in generating them.

Table 4.15: Summary of Key Methodological Choices

Key Methodological Issue	*Methodological Choice*
Empirical setting	Ghana
Data type and source	Quantitative and primary
Research design	Cross-sectional survey
Data collection instrument and method of administration	Self-completion questionnaire, and delivery and collection approach
Target population	Autonomous service- and industry-based firms (profit-making) with at least 3 years operating experience and having between 6 and 500 employees (inclusive) and operate in either Kumasi or Accra
Usable sample and effective response rate	295 and 34.53%
Sampling approach	Multi-stage (involving cluster, quota, and purposive sampling techniques)
Target informants	Single key informants holding senior management positions

Source of measures for constructs	Extant literature and interviews
Data collection	Outsourced and controlled
Measurement model analysis	Exploratory factor analysis and confirmatory factor analysis
Structural model analysis	Three-stage least squares estimator
Data analysis software packages	SPSS 20 and LISREL 8.50
Common method bias	Theoretical, procedural, and statistical remedies

CHAPTER FIVE

DATA ANALYSIS AND RESULTS

5.1 INTRODUCTION

This chapter focuses on data analysis and presentation of results. The main sections of the chapter include response analysis, measurement model analysis, structural model analysis and evaluation of hypotheses, post hoc tests, and chapter summary.

5.2 RESPONSE ANALYSIS

This section discusses issues relating response rate, data poolability, nonresponse bias, firm and informant profiles, informant competence, and missing data.

5.2.1 Response Rate

The study administered three hundred and four hundred and fifty questionnaires to firms (service- and manufacturing-based) in Kumasi and Accra respectively. Out of these, one hundred and thirty-three, and one hundred and fifty-one were received respectively. To ensure data quality, all questionnaires received from the fieldworkers were examined by the researcher. All informants who provided data for the study indicated consent for participation. Four of the questionnaires received were, however, filled to by informants who did not hold any managerial position. These were excluded from the study. The review also indicated that eight more questionnaires were filled by informants who scored below four (an average minimum score) on the three items measuring informant competence (see Section 5.2.6 for details). In accordance with prior research (Morgan *et al.*, 2004), these questionnaires were dropped. Six more questionnaires were found to have been filled by informants having less than one-year experience in their current position. These were also excluded. Moreover, seven more questionnaires with lots of missing data were eliminated.

In all, questionnaires from two hundred and fifty-nine firms were used in the study. This represented an overall effective response rate of 34.53% (see Table 5.1 for details). Whereas a response rate of 34.53% is relatively low for delivery-and-collection questionnaire administration, it could be expected given the nature of the informants (i.e., senior managers) (Menon *et al.,* 1996; Clercq and Zhou, 2014) and also, due to the longer length of the questionnaire (Bryman, 2012). That notwithstanding, it compares very well with those reported in recent studies (e.g., Adomako *et al.*, 2018a; Adomako *et al.*, 2018b; Adomako *et al.*, 2016) that utilised similar research design (i.e., survey instrument and administration approach) and drew on samples of firms in Ghana. Besides, an effective sample size of two hundred and fiftynine firms compares favourably with prior resilience-based survey research (e.g., Liu *et al.*, 2017; Kwak *et al.*, 2018; Li *et al.*, 2017; Brusset and Teller, 2017; Brandon-Jones *et al.*, 2014; Chowdhury and Quaddus, 2016; Akgün and Keskin, 2014) and attention-based survey studies (e.g., Bouquet *et al.*, 2009; Clercq and Zhou, 2014; Ambos and Birkinshaw, 2010).

Table 5.1: Results of Response Rate Analysis

Study area	*Questionnaires administered (A)*		*Questionnaires received*		*Questionnaires used (C)*		*Effective response rate = (C/A)*100%*
	No.	*Percent*	*No.*	*Percent*	*No.*	*Percent*	
Kumasi	300	40.0	151	53.17	136	52.5	45.33
Accra	450	60.0	133	46.83	123	47.5	27.33
Total	750	100	284	100	259	100	34.53

5.2.2 Test of Data Poolability

Consistent with Menon *et al.* (1996) and Menon *et al.* (1999), the study conducted several tests to find out if the data can be combined to estimate the research model. The first two tests involved examining whether the characteristics of the firms (including size, age, and industry) from Accra and Kumasi are different, and whether they score differently on the substantive variables.

Table 5.2: Test of Differences in the Characteristics between Accra-based Firms and Kumasibased Firms

Independent samples t-test							
Firm characteristic	*Study area*	*N*	*Mean*	*SD*	*t*	*DF*	*p*
Size (no. of fulltime employees)	Kumasi	136	29.22	38.201	-3.207	257	.002
	Accra	123	52.98	76.477			
Age (no. of years)	Kumasi	136	15.92	11.235	.514	257	.608
	Accra	123	15.25	9.398			

Crosstab and chi-square test	*Firm characteristic: Industry*		χ^2	*DF*	*Sig.*
Study area	*Manufacturing*	*Service*			
Kumasi	48.6%, N = 34	54.0%, N = 102	.597	1	.440
Accra	51.4%, N = 36	46.0%, N = 87			

Unlike firm size, firms from these geographical contexts did not differ in terms of industry and age (see Table 5.2). More importantly, the results of the second analysis also revealed that firms from these two geographical contexts do not differ on any of the substantive variables in the study (see Table 5.3). Per the results from these two analyses, the study deemed it appropriate to use the combined data from these geographical locations in estimating the research model, while controlling for firm size as well as the other demographic characteristics.

The last analysis involved checking whether data on the substantive variables were equivalent across the informant positions. This analysis was crucial as the study relied on key informants holding diverse senior management positions to obtain to data. Though this is consistent with both prior resilience-based research (Ambulkar *et al.*, 2015) and attention-based research (Bouquet *et al.*, 2009), it can still be contended that different informant groups (e.g., CEOs versus operations managers) may perceive issues differently or those holding same/similar positions may share similar perceptions (O'Leary-Kelly and Vokurka, 1998). In this sense, one can expect that the variances in the data may be attributed to heterogeneity in informant positions. ANOVA was used to investigate this concern. As shown in Table 5.4, the results showed no significant effect of informant position on any of the substantive variables in the study. Accordingly, it was concluded that data provided by informants holding different managerial positions can be combined to estimate the research model (Menon *et al.*, 1996; Menon *et al.*, 1999).

Table 5.3: Test of Differences in Scores on Substantive Variables between Accra-based Firms and Kumasi-based Firms

Substantive Variable	*Study Area*	*N*	*Mean*	*SD*	*t*	*DF*	*p*
Recoverability	Kumasi	136	4.79	1.527	-1.247	257	.214
	Accra	123	5.01	1.320			
Disruption absorption	Kumasi	136	5.28	1.098	-.268	257	.789
	Accra	123	5.32	1.081			
Strategic mission rigidity	Kumasi	136	3.89	1.705	.163	257	.871
	Accra	123	3.86	1.633			
Disruption orientation	Kumasi	136	5.35	1.051	-1.445	257	.150
	Accra	123	5.53	.9521			
Attention to threats	Kumasi	136	5.10	1.428	-.899	257	.369

	Accra	123	5.17	1.629			
Operational efficiency	Kumasi	136	4.48	1.166	1.231	257	.219
	Accra	123	4.29	1.302			

5.2.3 Nonresponse Bias Test

Nonresponse is common and a major concern in survey research (Bryman, 2012; McDaniel and Gates, 2012). The problem of nonresponse is that, the cases in a sample that respond to a questionnaire may differ in various ways from those that fail to do so (Bryman, 2012). When significant systemic difference can be found between these groups, it will be wrong to make generalisations based on the data received to the population (Bryman, 2012; McDaniel and Gates, 2012).

Table 5.4: Effects of Informant Position on the Substantive Variables

Substantive variable	*Means*						
	CEO	*Managing Other Director*	*General Manager*	*Operations*	*Manager*	*F*	*p*
1. Recoverability	4.94	5.36	4.93	4.81	4.73	1.380	.241
2. Disruption absorption	5.45	5.52	5.50	5.17	5.12	1.761	.137
3. Strategic mission rigidity	4.09	3.82	3.61	3.93	3.95	.511	.728
4. Disruption orientation	5.43	5.57	5.55	5.37	5.34	.614	.653
5. Attention to threats	5.19	5.62	4.93	4.73	5.20	2.143	.076
6. Operational efficiency	4.06	4.61	4.41	4.48	4.34	.948	.437
N	32	31	55	62	79		

To analyse nonresponse bias, two approaches were followed. The first involved comparing key characteristics of the effective sample data with those of the target population (Armstrong and Overton, 1997). To do this, the study made reference to findings from the integrated business establishment survey by Ghana Statistical Service (2016). Enough correspondence was found between the characteristics (i.e., size and age) of firms that participated in this study and those in Ghana Statistical Service (2016). As shown Table 5.7, 63.7%, 27.4%, and 8.9% of the firms had employee size of between six and thirty, thirty-one and one hundred, and one hundred and one and five hundred (with a mean score of forty-one approx. [standard deviation = 61 approx.]). Also, the average age was 15.60 years (standard deviation = 10.389). Besides, majority of the data (73.0%) were received from firms in the service industry. These results indicate that the characteristics of the firms that responded to the study are much similar to that of the target population.

The second assessment involved comparing key characteristics/ responses between early respondents and late respondents (Armstrong and Overten, 1977). This approach assumes that non-respondents are not much different from late respondents (Armstrong and Overten, 1977). Early responses is defined in this study to mean all questionnaires delivered and received within fourteen working days while late responses is defined to mean questionnaires delivered and received between fifteen and thirty workings days (cf., Zheng *et al.*, 2010; Zahra and Nielsen, 2002). Prior studies that assesses non-response bias using this second approach either compare the characteristics (e.g., Ambos and Birkinshaw, 2010) or the responses to substantive variables (e.g., Clercq and Zhou, 2014; Adomako *et al.*, 2018) between late respondents and early respondents. This study conducted both analyses and found no statically significant differences in the characteristics of the firms and also, the responses to the substantive variables between the two respondent groups (see Tables 5.5 and 5.6 respectively).

In sum, the results from both approaches for examining non-response bias provide adequate confidence in the representativeness of the sample used in analysing the study's model (Ambos and Birkinshaw, 2010). Thus, the study reached a conclusion that non-response bias is not a major concern in the study (Menon *et al.*, 1996; Ambos and Birkinshaw, 2010).

5.2.4 Profile of Firms

The summary results on the profile of the combined dataset of the firms are shown in Table 5.7. 73.0% of the firms are service-based. The average firm employs forty-one employees approx. (standard deviation = 61 approx. employees). Figure 5.1 however indicates that 25%, 50%, and 25% of them have about six to ten employees, ten to forty-five employees, and fortyfive to four hundred and thirty-two employees. These results generally show that more than

75% of the study's sample include small- to medium-size businesses (cf. Ghana Statistical Service, 2016). An average firm had operated for 6.60 years (standard deviation = 3.89 years). Figure 5.2 shows that 25%, 50%, and 25% of them have been in business for about three to eight years, eight to nineteen years, and nineteen to sixty years respectively. As indicated in Section 5.2.3, these the characteristics of the sample largely reflect those of the study's target population.

Table 5.5: Results of Non-Response Bias Test Using the Sample Characteristics

Independent samples t-test							
Firm characteristic	*Response category*	*N*	*Mean*	*SD*	*t*	*DF*	*p*
Size (no. of full-time employees)	Early (within 14 working days)	162	43.16	70.780	.911	257	.363
	Late (between 15 and 28 working days)	97	36.07	37.827			
Age (no. of years)	Early (within 14 working days)	162	16.13	11.043	1.060	257	.290
	Late (between 15 and 28 working days)	97	14.72	9.180			

Crosstab and chi-square test					
	Firm characteristic: Industry		*χ^2*	*DF*	*Sig.*
Response category	*Manufacturing*	*Service*			

Early (within 14 working days)	61.4%, N=43	63.0%, N=119	.051	1	.821
Late (between 15 and 28 working days)	38.6%, N=27	37.0%, N=70			

Table 5.6: Results of Non-Response Bias Test Using the Responses to the Substantive Variables

Substantive Variable	*Response time*	*N*	*Mean*	*SD*	*t*	*DF*	*p*
Recoverability	Early response (within 14 working days)	162	4.82	1.515	-1.138	257	.256
	Late response (between 15 and 28 working days)	97	5.02	1.285			
Disruption absorption	Early response (within 14 working days)	162	5.28	1.105	-.361	257	.719
	Late response (between 15 and 28 working days)	97	5.33	1.064			
Strategic mission rigidity	Early response (within 14 working days)	162	3.90	1.719	.244	257	.808
	Late response (between 15 and 28 working days)	97	3.84	1.588			
Disruption orientation	Early response (within 14 working days)	162	5.41	1.114	-.368	257	.713

Table 5.6: Results of Non-Response Bias Test Using the Responses to the Substantive Variables (Continued)

Substantive Variable	*Response time*	*N*	*Mean*	*SD*	*t*	*DF*	*p*
	Late response (between 15 and 28 working days)	97	5.46	.804			
Attention to threats	Early response (within 14 working days)	162	5.08	1.533	.077	257	.939
	Late response (between 15 and 28 working days)	97	5.07	1.521			
Operational efficiency	Early response (within 14 working days)	162	4.45	1.279	1.038	257	.300
	Late response (between 15 and 28 working days)	97	4.28	1.154			

Table 5.7: Profile of Firms

Variable			*Count*	*Percent*
Sector	Manufacturing		70	27.0%
	Service		189	73.0%
	Min	*Max*	*Mean*	*SD*
Firm age (in years)	3	60	15.60	10.389
Firm size (number of employees)	6	432	40.50	60.585

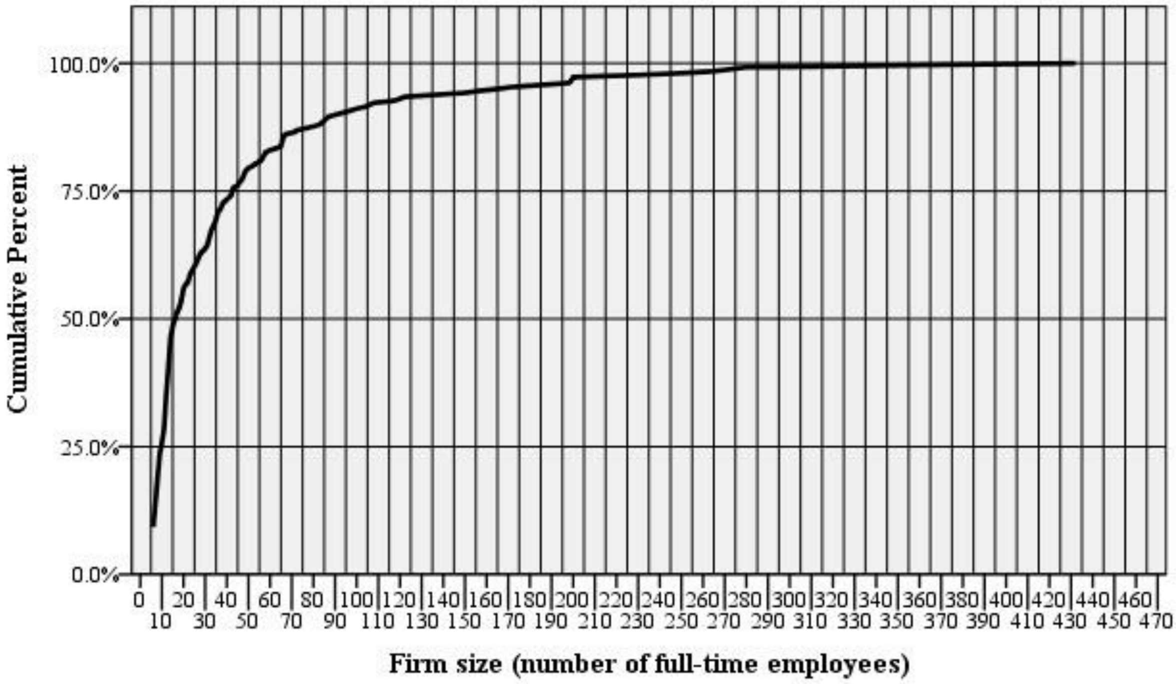


Figure 5.1: Distribution of Firm Size

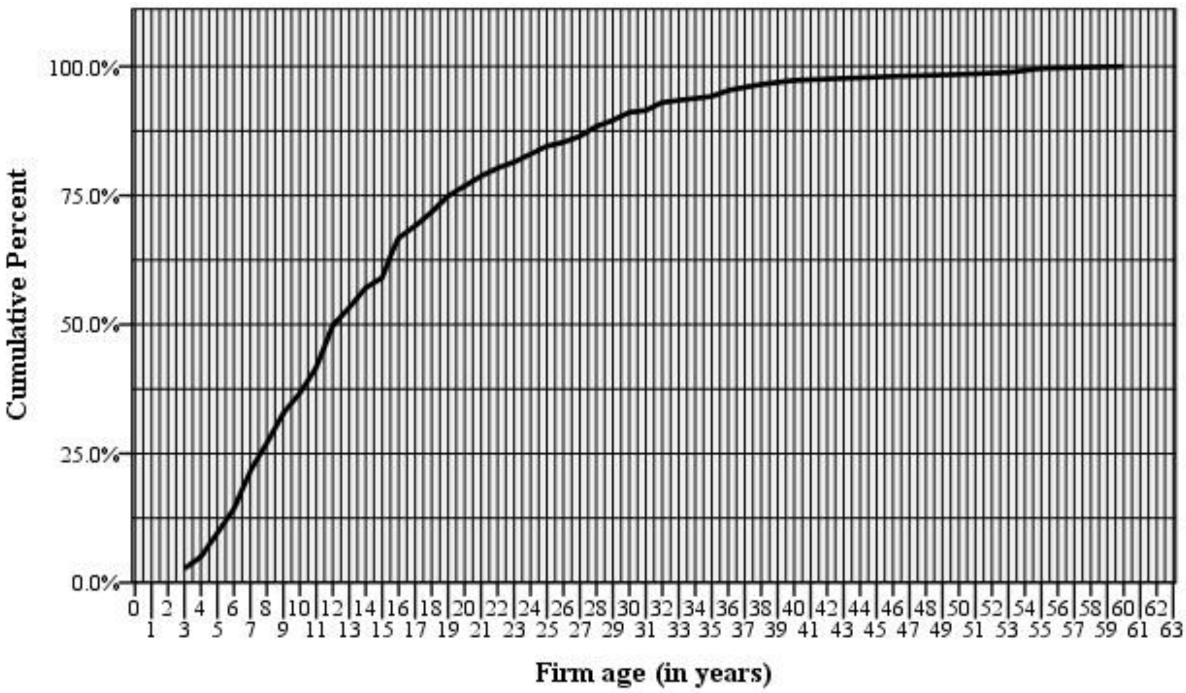


Figure 5.2: Distribution of Firm Age

5.2.5 Profile of Informants

Table 5.8 shows the demographic characteristics of the informants. 34.0% of them are females, which generally reflects the Ghanaian business setting where majority of individuals holding senior management positions are males. Also, approximately 83.0% of the informants have ages between thirty and forty-nine years. Of interest, more than 70% and about 50% of the informants hold at least 1st degree, and have held their current positions for at least five years (see Figure 5.3) with an average of 7.13 years (standard deviation = 5.583 years) respectively. The high educational level of the informants presupposes a high tendency for them to understand the study's instrument. On the other hand, an average experience of 7.13 years of holding current position indicates sufficient depth of organisational experience of the informants to provide responses that adequately reflect their firms' situations (cf. Miles and Arnold, 1991).

Table 5.8: Profile of Informants

Variable			*Count*	*Percent*
Gender	Male Female		171	66.0
			88	34.0
Age (years)	20 to 29		25	9.7
	30 to 39		105	40.5
	40 to 49		110	42.5
	50 or more		19	7.3
Education level	Senior high level		4	1.5
	Diploma		56	21.6
	1st Degree		118	45.6
	2nd Degree		76	29.3
	PhD		5	1.9
Position	CEO		32	12.4
	Managing Director		31	12.0
	General Manager		55	21.2
	Operations Manager		62	23.9
	Other Middle level Managerial Positions		79	30.5
	Min	*Max*	*Mean*	*SD*
No. of years held current position	2	39	7.13	5.583

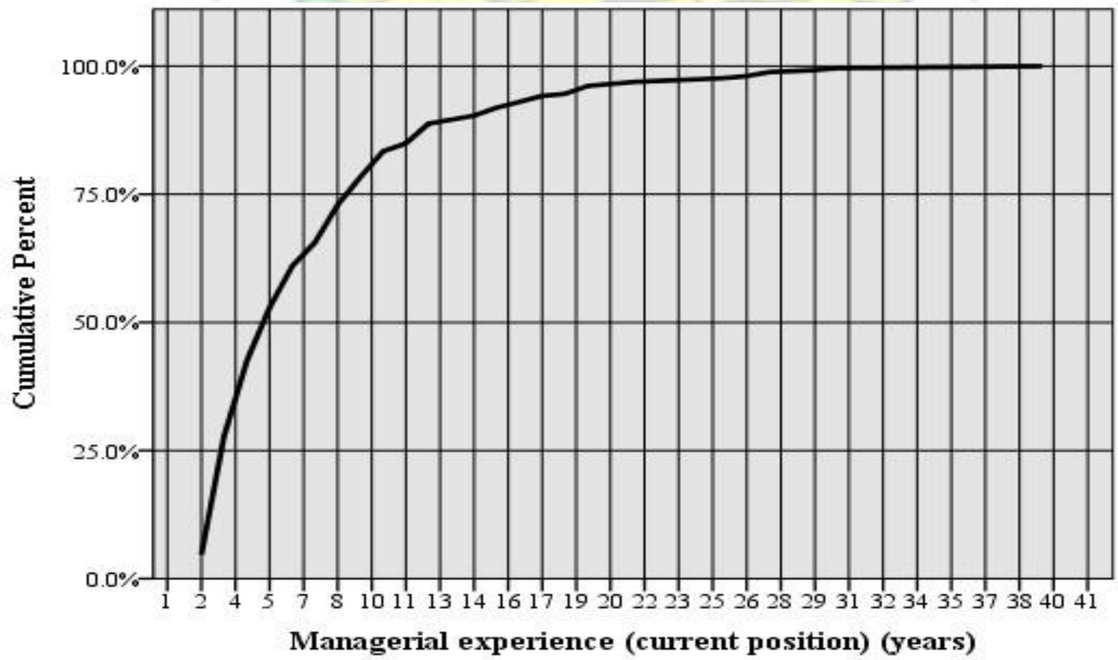


Figure 5.3: Distribution of Managerial Experience

Last but not the least, 45.6% of the informant hold top-level positions, including CEO, General Manager and Managing Director while the rest are middle level managers. As discussed in Section 4.4.6, both prior resilience (e.g., Ambulkar *et al.*, 2015) and ABV (e.g., Bouquet *et al.*, 2009) studies have drawn on key informants with such diverse positional background.

5.2.6 Informant Competence Analysis

Beyond ensuring that only managers with good organisational experience and educational background were considered as key informants for the firms, the study further examined statistically to see if indeed they were competent enough to provide data for the study. To do this, three items (adapted from Boso *et al.* [2013a]) in the questionnaire evaluated their competence level using a 7-point scale that ranged from strongly disagree (=1) to strongly agree (=7). As indicated in Section 5.2.1, all questionnaires with informants scoring an average minimum score of four were dropped (Morgan *at al.*, 2004). For the retained questionnaires, the average minimum score on the three items was 4.33. Table 5.9 shows that an average informant scored 5.79 (standard deviation = 1.032), 5.81 (standard deviation = .961), and 5.99 (standard deviation = .835) on the items relating to knowledge of the issues captured in the questionnaire, general confidence in the responses provided, and the accuracy of the responses provided in relation to their firm's situations respectively. Each of these mean scores was significantly higher than the median point on the scale (i.e., 4.00), signifying that an average informant was competent enough to provide data for the study (Morgan *et al.*, 2004).

Further analysis revealed that while these measures of informant competence correlate highly (positive), each item had a very low correlation with all the substantive variables in the study, indicating that the variations in the scores on the substantive variables in the study is significantly independent of the variations in the competence level of the informants.

Table 5.9: Results on Informant Competence Assessment

		Informant competence		
		RC1	*RC2*	*RC3*
Substantive variables	Recoverability	-.011	.130*	.114
	Disruption absorption	-.067	.078	.088
	Strategic mission rigidity	-.045	-.019	-.074
	Disruption orientation	.049	.011	.016
	Attention to threats	.120	.047	.132*
	Operational efficiency	.069	-.048	-.084
Informant competence items	RC1: The questionnaire deals with issues I am very knowledgeable about	1	.635**	.506**
	RC2: I am completely confident about my answers to the questions		1	.722**
	RC3: I am confident that my answers reflect the company's situation			1
Min		4	4	5
Max		7	7	7
Mean		5.79	5.81	5.99
Standard deviation		1.032	.961	.835
t-statistic (test value = 4.0)		27.939†	30.255†	38.388†
Variables		*items*		

Notes: *significant at 5%, **significant at 1%, †significant .01%

5.2.7 Missing Data: Controls and Treatment

Missing data is a fact of life in multivariate analysis (Hair *et al.*, 2014) and survey research. The problem with missing data in multivariate analysis is that it practically reduces the effective sample size, and substantively, it biases the results, particularly, when it is occurring non-randomly (Hair *et al.*, 2014). In this sense, knowing the pattern and the extent of missing data are both key to identifying an appropriate remedy to resort to. Indeed, missing data can lie outside the control of the researcher, and hardly can s/he have a complete knowledge of why some informants may fail to respond to certain items beforehand (Hair *et al.*, 2014). Nevertheless, a good forethought can be helpful. For example, prior research (e.g., Acquaah,

2007) and experience suggest that given the smallness and the informal nature of most firms in the research setting, requesting for objective/actual or secondary data on attention to threats as done in Durand (2003) can lead to high intentional rather than accidental missing data. Accordingly, in such circumstance, prior research (e.g., Boso *et al.*, 2013a; Adomako *et al.*, 2018; Story *et al.*, 2013; Acquaah, 2007) drawing on data from the Ghanaian context resorted to the use of primary and subjective data to measure variables of interest. Other proactive measures taken to minimise both intentional and accidental missing data was to (1) rationally plead with the informants in the cover letter to attempt to respond to each item, even for those that appear similar; (2) rely on key informants (as those with inadequate knowledge on the items in the questionnaire can be skipping them); (3) provide both monetary and non-monitory incentives; (4) categorically inform the informants to fill the questionnaire at their convenient time, and (5) give the informants enough number of days to respond to the questionnaire. It is believed that these ex ante measures worked as a review of the questionnaires received revealed few instances where certain questionnaires had missing data. Nevertheless, as a way of reducing the extent of missing data in the dataset, all questionnaires found to have substantial missing data (about 10% of the total items) were dropped (see Section 5.2.1). An analysis of the extent of missing data in the dataset using missing value analysis (MVA) in SPSS (Hair *et al.*, 2014) revealed that firm size and age had the largest missing value of 3.1% and 2.5%. All categorical items had no missing value while all other scaled items had less than 1% missing value. Accordingly, the study resorted to the use of expectation maximisation (EM[30]) algorithm (in MVA in SPSS) to estimate and replace the missing data (Tabachnick and Fidell, 2013; Hair *et al.*, 2014).

[30] The study relied on EM algorithm since it better accommodates random and non-random missing data processes, and best represents the original distribution of the values with least bias (Hair *et al.*, 2014).

5.3 MEASUREMENT MODEL ANALYSIS

This section of the chapter focuses on the statistical validation of the study's multi-item metric scales measuring attention to threats, disruption absorption, recoverability, strategic mission rigidity, disruption orientation, operational efficiency, slack resources, environment dynamism, and operational disruption. Figure 5.4 depicts the key process involved in this exercise.

5.3.1 Descriptive Analysis and Normality Assessment

Prior to conducting the descriptive analysis and the normality assessment, all negatively worded items, namely, those measuring operational efficiency, were reverse-coded. Tables 5.10 to 5.17 present the items and their descriptive results.

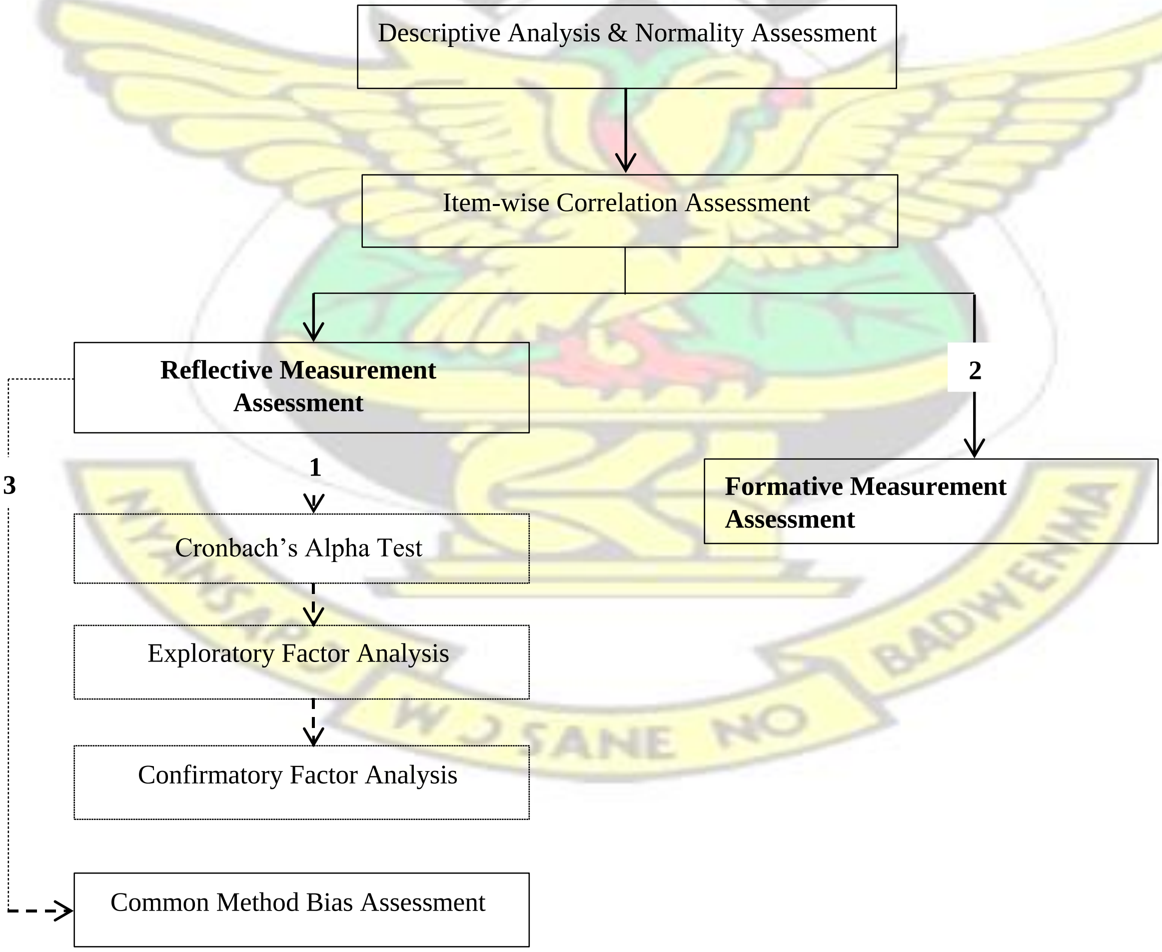


Figure 5.4: Key Steps involved in the Measurement Model Analysis

Source: Researcher's Own Construct (2019)

The results show that the scores on all items were within the range of the respective scale length used to measure them. Apart from the scale measuring strategic mission rigidity and operational disruption, it is seen that an average firm scored above the mid-point of the scales used to measure the other constructs. The mean results generally show that the substantive variables in the study (i.e., attention to threats, disruption absorption, recoverability, disruption orientation, strategic mission rigidity, and operational efficiency) sufficiently exist within the empirical setting of the study.

When inference is a goal, checking metric variables for normality is an important early step in multivariate analysis (Tabachnick and Fidell, 2013). For this reason, most multivariate analyses generally assume multivariate normality of data (Tabachnick and Fidell, 2013; Hair *et al.*, 2014). Kline (2011) discusses that multivariate normality is demonstrated when: (1) the distribution of each variable (or item) is normal, (2) the joint distribution of any pair of variables is bivariate normal, and (3) when each bivariate relationship between the variables is linear and the distribution of the residual is homoscedastic. Nevertheless, Kline (2011) and Tabachnick and Fidell (2013) observe that, in practice, it is difficult to investigate the last two conditions necessary to claim multivariate normality. And this is particularly so when a researcher is dealing with a lot of observed variables (Tabachnick and Fidell, 2013) as in the case of this study. For Kline (2011), "…multivariate nonnormality are detectable through inspection of univariate distributions" (p. 60). Accordingly, this study only evaluated the normality of the distributions of the individual observed variables. The results in Tables 5.10 to 5.17 show that the distribution of scores on each item is satisfactorily normal as both the skewness and the kurtosis indices obtained are very much within the recommended thresholds of "less than |3|" and "less than |8|" respectively (Kline, 2011). The highest skewness and kurtosis indices were -1.058 and 1.507 respectively. Per these results, the study concludes that nonnormality of the multi-scale items is not a major concern in the study.

Table 5.10: Descriptive and Normality Results on Attention to Threats

Item code	*Item[31] (Over the past 3 years, …)*	*Min*	*Max*	*Mean*	*SD*	*Skewness*	*Kurtosis*
AT1	Our company has been holding frequent board meetings to discuss and find answers to issues that threaten its operation	1	7	4.97	1.842	-.700	-.548
AT2	Individuals in managerial positions in this company have been spending a lot of time and effort on studying and coming up with responses to threats in our industry	1	7	5.06	1.631	-.721	-.225
AT3	Our company has been utilizing employees (either individuals, or teams, or units) specifically in charge of monitoring the business environment for disruptive events	1	7	5.15	1.585	-.920	.148
AT4	Our company has been engaging industry experts and business partners to discuss and find answers to threatening issues emerging in the business environment	1	7	5.14	1.668	-.909	.047

[1]SCALE: 1= "strongly disagree" to 7= "strongly agree"

Table 5.11: Descriptive and Normality Results on Recoverability

Item code	*Item[1] (Over the past 3 years, whenever our operations fail or breakdown due to a disruptive event,..)*	*Min*	*Max*	*Mean*	*SD*	*Skewness*	*Kurtosis*
RC1	It does not take long for us to restore normal operation	1	7	4.83	1.724	-.691	-.408
RC2	Our company reliably recovers to its normal operating state	1	7	5.07	1.496	-.763	.020
RC3	Our company easily recovers to its normal operating state	1	7	4.90	1.531	-.771	-.070
RC4	Our company effectively restores operations back to normal quickly	1	7	4.81	1.503	-.717	.035
RC5	We are able to resume operations within the shortest possible time	1	7	4.85	1.514	-.830	.293

[1]SCALE: 1= "strongly disagree" to 7= "strongly agree"

Table 5.12: Descriptive and Normality Results on Disruption Absorption

Item code	*Item[1] (For the past 3 years, whenever disruptive events occur…,)*	*Min*	*Max*	*Mean*	*SD*	*Skewness*	*Kurtosis*
DAC1	Our company is able to carry out its regular functions	1	7	5.36	1.427	-.998	.845

[31] SCALE: 1= "strongly disagree" to 7= "strongly agree"

DAC2	Our company grants us much time to consider a reasonable response	1	7	5.40	1.315	-.920	.608
DAC3	Our company is able to carry out its functions despite some damage done to it	1	7	5.37	1.217	-1.058	1.507
DAC4	Without much deviation, we are able to meet normal operational and market needs	1	7	5.32	1.243	-.843	.874
DAC5	Without adaptations being necessary, our company performs well over a wide variety of possible scenarios	1	7	5.25	1.269	-.960	1.120
DAC6	Our company's operations retain the same stable situation as it had before disruptions occur for a long time	1	7	5.10	1.244	-.901	1.375

Table 5.13: Descriptive and Normality Results on Strategic Mission Rigidity

Item	Item[1] Min Max	Mean code			SD	Skewness	Kurtosis
SMR1	Our company's overall mission is defined quite 3.86 narrowly	1	7		1.813	.085	-1.048
SMR2	Our company's overall mission allows little 1 7 3.90 flexibility to modify the domain of operations				1.758	.051	-1.126
SMR3	Any activity outside our overall mission is actively 1 3.91 discouraged		7		1.895	.036	-1.167
SMR4	We hardly change our strategic mission to meet 1 7 3.83 new challenges				1.810	.131	-1.089

[1]SCALE: 1= "strongly disagree" to 7= "strongly agree"

Table 5.14: Descriptive and Normality Results on Operational Efficie cy

Item code	Item[1, 2] (Over the past 3 years, …)	Min	Max	Mean	SD	Skewness	Kurtosis
OE1	The costs we incur in running our core operations has been…	1	7	3.92	1.398	.230	-.443
OE2	The volume of waste in processes that we record 1 7 has been…			4.46	1.415	.050	-.782
OE3	The volume of material waste recorded in our company has been…	1	7	4.52	1.458	-.012	-.739
OE4	Overhead costs incurred by our company has been…	1	7	4.34	1.507	.092	-.783
OE5	The volume of idle capacity/ resources our 1 7 company experiences has been…			4.70	1.520	-.147	-.744

[1]SCALE: 1= "very low" to 7= "very high", [2]Items are reverse-coded

Table 5.15: Descriptive and Normality Results on Slack Resou ces

Item	Item[1] Min Max	Mean code	SD	Skewness	Kurtosis
SLK1	Our company often has uncommitted resources that 1 7 4.39 can quickly be used to fund new strategic initiatives		1.729	-.232	-.782
SLK2	Our company usually has adequate resources 1 7 4.47 available in the short run to fund its initiatives		1.556	-.318	-.725
SLK3	We are often able to obtain resources at short 1 7 4.42 notice to support new strategic initiatives		1.577	-.288	-.734

SLK4	We often have substantial resources at the discretion of management for funding strategic initiatives	1	7	4.47	1.482	-.422	-.470
SLK5	Our company usually has reasonable amount of resources in reserve	1	7	4.54	1.530	-.326	-.594

[1]SCALE: 1= "strongly disagree" to 7= "strongly agree"

Table 5.16: Descriptive and Normality Results on Environment Dynamism

Item code	*Item[1] (Over the past 3 years, there has been irregular changes in...)*	*Min*	*Max*	*Mean*	*SD*	*Skewness*	*Kurtosis*
DYM1	The needs and preferences in our demand/customer market	1	7	4.88	1.907	-.799	-.411
DYM2	The actions of our competitors, in terms of their promotions, innovations, etc.	1	7	4.60	1.921	-.665	-.731
DYM3	Terms, conditions, and structures in our supply markets	1	7	4.84	1.644	-.906	.114
DYM4	Government policies and programmes for our industry	1	7	4.95	1.692	-.855	-.048
DYM5	Laws and regulations governing our industry	1	7	4.93	1.795	-.835	-.197
DYM6	Technological needs and advancement in our industry	1	7	5.23	1.714	-.951	.122

[1]SCALE: 1= "not at all", to 7= "to an extreme extent"

Table 5.17: Descriptive and Normality Results on Operational Disruption

Item code	*Item[1] (Unexpectedly,)*	*Min*	*Max*	*Mean*	*SD*	*Skewness*	*Kurtosis*
OD1	Some of our employees leave their posts (i.e., quit their job)	1	7	3.40	1.859	.496	-.760
OD2	Some of our suppliers fail to make deliveries	1	7	3.11	1.670	.192	-1.192
OD3	We experience vehicular breakdowns	1	7	2.87	1.577	.523	-.659
OD4	We experience service/product failure	1	6	2.72	1.517	.560	-.713
OD5	We run out of cash for running day-to-day operations	1	7	2.74	1.575	.669	-.443
OD6	We experience machine/technology downtime/ failure	1	7	3.19	1.585	.346	-.742
OD7	We experience shortage of raw materials	1	7	2.83	1.558	.471	-.794
OD8	We experience power cuts	1	7	3.33	1.797	.407	-.856
OD9	Some of our service providers fail to honour their promises	1	7	3.09	1.519	.190	-.982

[1]SCALE: 1= "strongly disagree" to 7= "strongly agree"

5.3.2 Item-wise Correlations

This section assesses within-scale-item and between-scale-item correlations. This is a necessary step in the validation of both reflective and formative measures. Unlike formative measures, one expects sufficiently high correlations between any pair of items within each scale (Diamantopoulos *et al.*, 2008). In the case of reflective measurement assessment, analysis of scale reliability as well as the use of exploratory factor analysis and confirmatory factor analysis all assume that there are sizable correlations (at least .30) between pairs of items within each scale (Hair *et al.,* 2014; Tabachnick and Fidell, 2013). Table 5.18 presents the bivariate relationships between all observed multi-scale variables in the study.

Table 5.18: Item-wise Correlations Results

	Items	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*
1	AT1	1.00																							
2	AT2	**.81**	1.00																						
3	AT3	**.72**	**.83**	1.00																					
4	AT4	**.72**	**.77**	**.75**	1.00																				
5	SMR1	-.22	-.17	-.13	-.22	1.00																			
6	SMR2	-.21	-.16	-.13	-.21	**.81**	1.00																		
7	SMR3	-.22	-.10	-.09	-.17	**.71**	**.76**	1.00																	
8	SMR4	-.22	-.13	-.12	-.20	**.84**	**.84**	**.78**	1.00																
9	SLK1	.25	.26	.21	.30	-.03	-.02	.00	.04	1.00															
10	SLK2	.27	.24	.20	.29	.03	.06	-.03	.08	**.82**	1.00														
11	SLK3	.23	.21	.16	.26	-.03	-.01	-.04	.00	**.79**	**.82**	1.00													
12	SLK4	.27	.27	.21	.32	.03	.04	-.01	.05	**.78**	**.83**	**.85**	1.00												
13	SLK5	.23	.22	.17	.29	.01	.00	-.03	.03	**.79**	**.79**	**.80**	**.84**	1.00											
14	RC1	.22	.22	.15	.18	-.02	-.03	-.07	-.02	.14	.16	.16	.15	.10	1.00										
15	RC2	.27	.26	.24	.22	-.03	-.03	-.11	-.01	.14	.15	.17	.15	.12	**.83**	1.00									
16	RC3	.27	.25	.20	.21	-.02	-.05	-.06	.00	.11	.16	.12	.13	.10	**.82**	**.81**	1.00								
17	RC4	.20	.22	.19	.16	-.02	-.04	-.03	.01	.10	.11	.10	.10	.05	**.80**	**.78**	**.83**	1.00							
18	RC5	.26	.24	.19	.20	-.05	-.03	-.06	-.03	.09	.13	.12	.14	.08	**.79**	**.80**	**.83**	**.87**	1.00						
19	DYM1	.19	.16	.11	.17	.08	.07	.07	.07	.15	.17	.14	.13	.14	.14	.08	.17	.09	.07	1.00					
20	DYM2	.33	.21	.22	.28	-.04	-.03	-.04	-.03	.21	.24	.21	.20	.19	.17	.17	.19	.09	.11	**.72**	1.00				
21	DYM3	.27	.24	.23	.28	-.09	-.08	-.02	-.07	.11	.11	.15	.14	.07	.12	.10	.13	.10	.08	**.63**	**.63**	1.00			
22	DYM4	.29	.26	.24	.30	.01	.02	-.01	.00	.16	.21	.22	.17	.20	.20	.17	.18	.18	.16	**.53**	**.55**	**.62**	1.00		
23	DYM5	.33	.27	.21	.29	-.04	.02	.02	-.03	.15	.22	.24	.21	.23	.18	.16	.18	.14	.14	**.44**	**.41**	**.55**	**.76**	1.00	
24	DYM6	.41	.34	.28	.16	-.13	-.17	-.11	-.11	.15	.17	.11	.11	.09	.15	.16	.19	.13	.10	**.50**	**.53**	**.52**	**.45**	**.39**	1.00
25	OE1	.12	.10	.07	.09	-.08	-.11	-.15	-.05	.09	.09	.04	.02	.05	.23	.23	.25	.24	.23	.04	.06	-.02	.08	.02	.00
26	OE2	-.05	-.01	-.04	-.03	-.09	-.13	-.13	-.06	-.02	-.03	-.08	-.03	-.03	.21	.24	.24	.23	.24	-.04	-.06	-.09	-.04	-.05	-.10

Table 5.18: Item-

27	OE3	-.04	-.02	-.04	-.05	-.06	-.10	-.13	-.06	-.01	.02	.01	.01	-.04	.26	.25	.23	.24	.24	-.03	-.03	-.06	-.01	-.03	-.10
28	OE4	-.04	.00	.01	-.03	-.08	-.08	-.11	-.03	.01	.03	-.03	.01	.01	.16	.17	.16	.20	.16	-.04	-.02	-.07	-.05	-.07	-.02
29	OE5	-.06	-.02	-.04	-.09	-.08	-.13	-.14	-.07	-.04	-.01	-.01	-.01	-.04	.23	.22	.25	.27	.24	-.08	-.06	-.09	-.07	-.07	-.11
30	DAC1	.26	.23	.18	.28	-.10	-.06	-.10	-.04	.10	.15	.13	.12	.11	.51	.44	.55	.49	.50	.06	.09	.05	.10	.11	.17
31	DAC2	.17	.23	.21	.23	-.03	.02	-.01	.05	.12	.12	.12	.11	.11	.31	.32	.36	.34	.35	-.01	.02	.04	.10	.07	.07
32	DAC3	.27	.24	.22	.23	-.12	-.08	-.09	-.03	.06	.13	.10	.12	.11	.44	.43	.47	.45	.47	.03	.05	.10	.14	.15	.13
33	DAC4	.29	.29	.27	.27	-.09	-.03	-.03	.01	.18	.18	.17	.15	.16	.43	.45	.49	.48	.47	.13	.15	.15	.22	.15	.16
34	DAC5	.29	.31	.24	.29	-.06	.00	-.04	-.02	.15	.17	.15	.14	.12	.42	.39	.50	.47	.47	.12	.12	.15	.18	.16	.13
35	DAC6	.17	.23	.22	.25	-.08	-.03	.00	.00	.11	.10	.09	.10	.09	.37	.39	.42	.40	.42	.08	.07	.07	.10	.07	.11
36	OD1	-.29	-.28	-.28	-.28	.11	.05	.03	.08	-.07	-.09	-.13	-.09	-.07	-.11	-.16	-.14	-.15	-.16	-.10	-.09	-.19	-.21	-.21	-.06
37	OD2	-.03	-.02	.00	-.03	.14	.07	.08	.14	.02	.07	.02	.04	.05	-.06	-.07	-.05	-.07	-.09	.21	.18	.14	.08	.05	.21

Note: Bolded values are within scale correlations

wise Correlations Results (Continued 1)

Items		*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*
38	OD3	-.06	-.09	-.06	-.07	.06	.05	.04	.06	-.03	-.02	-.03	.00	-.01	-.05	-.14	-.08	-.13	-.10	.09	.12	-.03	.02	.01	.04
39	OD4	-.07	-.10	-.11	-.13	.07	.04	.09	.09	-.03	.01	-.06	-.01	-.03	-.08	-.13	-.10	-.11	-						
.06	.03	.07	-.03	-.09	-.12	.08 40	OD5	-.02	-.10	-.06	-.10	.10	.05	-.01	.09	.01	.09	.02							
	.04	.06	.01	-.07	-.02	-.05	-.07	.01	.00	-.14	-.13	-.11	.05 41	OD6	.02	-.04	-.03	-.01	-						
.02	-.08	.04	-.05	-.06	-.06	-.06	-.01	.02	-.10	-.13	-.10	-.13	-.12	.16	.16	.09	.03	.10							
	.17 42	OD7	-.02	-.07	-.07	-.09	.17	.15	.13	.17	.05	.10	.09	.04	.09	.05	.04	.06							
	.02	.04	.17	.15	.00	.03	.00	.06 43	OD8	-.13	-.02	-.02	-.10	-.03	.05	.02	.04	-.05	-						
.10	-.06	-.04	-.02	-.11	-.12	-.12	-.13	-.13	-.06	-.07	-.08	-.06	-.03	.02 44	OD9	-.02	-.06	.00	-						
.01	.12	.05	.00	.09	-.01	.02	.00	.03	.05	.04	.02	.03	-.03	.04	.10	.11	.04	-.01	-						
.07	.12 45	DO1	.23	.26	.25	.25	-.16	-.13	-.12	-.13	.24	.24	.21	.21	.15	.16	.20	.19							
	.18	.18	.04	.00	.08	.02	.08	.15 46	DO2	.24	.28	.25	.20	-.20	-.19	-.14	-.21	.14							
	.13	.08	.08	.06	.12	.14	.14	.15	.14	.00	-.02	.02	.00	.02	.15 47	DO3	.20	.17							
	.14	.18	-.11	-.09	-.11	-.12	.11	.12	.08	.07	.12	.09	.09	.12	.12	.09	.11	.06							
	.10	.04	.09	.16 48	DO4	.34	.25	.22	.27	-.23	-.21	-.18	-.24	.12	.14	.09	.09	.08							
	.21	.22	.19	.19	.20	.09	.10	.10	.11	.18	.21														

Note: Bolded values are within scale correlations

Table 5.18: Item-wise Correlations Results (Continued 2)

Items		*25*	*26*	*27*	*28*	*29*	*30*	*31*	*32*	*33*	*34*	*35*	*36*	*37*	*38*	*39*	*40*	*41*	*42*	*43*	*44*	*45*	*46*	*47*	*48*
25	OE1	1.00																							
26	OE2	**.61**	1.00																						
27	OE3	**.56**	**.77**	1.00																					
28	OE4	**.56**	**.67**	**.67**	1.00																				
29	OE5	**.47**	**.69**	**.75**	**.67**	1.00																			
30	DAC1	.18	.13	.11	.17	.20	1.00																		
31	DAC2	.16	.18	.14	.11	.08	**.58**	1.00																	
32	DAC3	.22	.23	.23	.18	.19	**.70**	**.65**	1.00																
33	DAC4	.23	.21	.18	.21	.20	**.72**	**.60**	**.72**	1.00															

Table 5.18: Item-

34	DAC5	.19	.13	.10	.13	.13	**.69**	**.60**	**.66**	**.75**	1.00														
35	DAC6	.17	.18	.21	.22	.18	**.63**	**.55**	**.66**	**.67**	**.72**	1.00													
36	OD1	-.06	-.02	-.03	-.01	.02	-.07	-.02	-.13	-.17	-.14	-.12	1.00												
37	OD2	-.07	-.15	-.11	-.11	-.08	.01	-.01	-.06	-.05	-.06	-.12	**.35**	1.00											
38	OD3	-.05	-.11	-.09	-.07	-.07	-.03	.00	-.17	-.08	-.05	-.14	**.45**	**.35**	1.00										
39	OD4	-.06	-.22	-.16	-.14	-.18	-.04	-.13	-.07	-.13	-.16	-.19	**.28**	**.45**	**.32**	1.00									
40	OD5	.00	-.12	-.11	-.01	-.04	.08	-.04	-.01	-.01	.04	-.10	**.31**	**.33**	**.39**	**.39**	1.00								
41	OD6	-.07	-.09	-.07	-.07	-.10	-.02	.00	.02	-.10	-.12	-.11	**.24**	**.38**	**.32**	**.41**	**.28**	1.00							
42	OD7	.02	-.09	-.08	-.02	-.05	.09	.04	.01	.11	.08	-.02	**.31**	**.42**	**.46**	**.32**	**.48**	**.34**	1.00						
43	OD8	.00	-.02	.02	.05	.05	-.14	.00	-.17	-.14	-.13	-.12	**.40**	**.21**	**.26**	**.17**	**.23**	**.26**	**.17**	1.00					
44	OD9	-.04	-.13	-.13	-.14	-.13	.04	-.05	-.01	.02	-.05	-.08	**.18**	**.47**	**.33**	**.45**	**.40**	**.35**	**.48**	**.09**	1.00				
45	DO1	-.01	.06	-.02	-.07	-.02	.12	.17	.15	.13	.16	.11	-.05	-.03	.00	-.10	.01	.00	.04	.01	-.03	1.00			
46	DO2	-.02	-.01	-.07	-.10	-.01	.06	.09	.09	.14	.10	.05	-.01	-.08	.01	-.10	-.04	-.05	.03	.01	-.07	**.67**	1.00		
47	DO3	-.02	.00	-.15	-.07	-.03	.05	.10	.06	.14	.10	.02	.03	-.03	.02	-.10	.08	.02	.12	.01	.03	**.54**	**.60**	1.00	
48	DO4	-.02	.06	.03	.03	.03	.15	.09	.19	.20	.15	.15	-.04	-.01	-.09	-.05	-.02	.09	.09	-.02	.01	**.49**	**.56**	**.58**	1.00

Note: Bolded values are within scale correlations

Three findings are worth mentioning here. First, the results show high correlations between each pair of items within each reflective scale; almost all are above .50. This suggests that factorability of the scales was possible and that the scales are likely to have high internal consistency (Tabachnick and Fidell, 2013). Second, the within-scale bivariate correlations for the formative scale (i.e., measuring operational disruption) were comparatively weak (i.e., below .50), indicating that the scale items can be treated as formative (Bode *et al.*, 2011). Lastly, it is clear that the between-scale-item correlations are weak compared to the withinscale-item correlations, indicating that each scale (particularly, the reflective ones) appears to capture some unique concept (Hair *et al.*, 2014). Given these results, the ensuring sections focused on conducting relevant tests to validate the scales in the study.

5.3.3 Assessment of Reflective Scales

Discussions on the types of reliability and validity tests relevant in the study and the key statistical tools employed in conducting these tests have been presented in Sections 4.6 and 4.5.1.1 respectively. How the tests were conducted is presented in this section as follows:

5.3.3.1 Cronbach's Alpha Test

Two types of tests were used to assess the reliability of the reflective scales in the study. As discussed in Section 4.6.1, the tests include Cronbach's alpha test and composite reliability test. The results of the Cronbach's alpha test are presented in this section while those of the composite reliability test are presented as part of the outputs of the confirmatory factor analysis (see Section 5.3.3.3). As shown in Table 5.19, the Cronbach's alpha values obtained are above the minimum threshold of .70, indicating that each scale demonstrates high internal consistency (Hair *et al.*, 2014).

Table 5.19: Result of Cronbach's alpha test

Construct	*Number of items*	*Cronbach's alpha*
1. Attention to threats	4	.927
2. Strategic mission rigidity	4	.937
3. Slack resources	5	.954
4. Recoverability	5	.956
5. Environment dynamism	6	.879
6. Operational efficiency	5	.900
7. Disruption absorption	6	.920
8. Disruption orientation	4	.843

5.3.3.2 Exploratory Factor Analysis

The purpose and the justifications for the use of exploratory factor analysis (EFA) are discussed in Section 4.5.1.1.1. As a recap, the study used EFA to explore and establish initial evidence of unidimensionality of the scales. EFA also helped in the selection of items for the confirmatory factor analysis conducted in the study (Clark and Watson, 1995). Given the large number of items and the tendency to violate minimum sample size to parameter ratio (Boso *et al.*, 2013a), the study followed a two-stage approach in the analysis. The first stage involved analysing subset of items based on common theoretical themes while the second stage involved analysing together the retained items from stage one. In relation to the study's model, two item sets were analysed: (1) items measuring attention to threats and attention structures (i.e., disruption orientation, strategic mission rigidity, slack resources, and environment dynamism) and (2) items measuring the outcomes variables in the model: operational resilience (i.e., disruption absorption and recoverability) and operational efficiency.

Each type of analysis involved the use of principal component and varimax as the estimation and rotation techniques respectively. Principal component was considered as it is not only conceptually less complex, but also a psychometrically sound estimation technique. On the other hand, varimax was used as it simplifies the interpretation of components (Field, 2009). Also, for each analysis, only components with Eigenvalues of at least 1.00 were considered

(Field, 2009). Moreover, prior to conducting each analysis, the study examined whether factorability was possible. An initial evidence of factorability was established through the itemwise correlation analysis (see Section 5.4.2 or Table 5.18) (Tabachnick and Fidell, 2013). It was found that all pairwise associations between items within each scale were positive and high (i.e., r was greater than .30 in most cases) (Tabachnick and Fidell, 2013). Moreover, Bartlett's test of sphericity reached statistically significance level (see Tables 5.20 to 5.22), suggesting that factorability is possible. Again, the Kaiser–Meyer–Olkin (KMO) indices obtained in each EFA is above the recommended minimum threshold of .60 (Tabachnick and Fidell, 2013), indicating that the study's sample size is adequate for EFA (see Tables 5.20 to 5.22).

5.3.3.2.1 EFA Results on the Scales for Attention to Threats and Attention Structures

EFA was conducted on twenty-three items that were supposed to measure attention to threats and the attention structures. The analysis produced the expected five components. Together, they explained 76.410% of the variance. Inspection of the results revealed that items loading on components one, two, three, four, and five measured slack resources, environment dynamism, strategic mission rigidity, attention to threats, and disruption orientation. As shown in Table 5.20, the items loaded high (i.e., above .70) on their respective constructs and very low (i.e., below .30) on any other construct. These results generally provide initial evidence of unidimensionality and convergent validity of each scale (O'Leary-Kelly and Vokurka, 1998).

5.3.3.2.2 EFA Results on the Scales for Operational Resilience and Operational Efficiency

EFA was conducted on sixteen items supposed to measure disruption absorption, recoverability, and operational efficiency. The results obtained are shown in Table 5.21. As expected, the analysis produced three components, which together explained 76.170% of the variance. The results show that items loading on components one, two, and three measured disruption absorption, recoverability, and operational efficiency respectively. The items loaded high (i.e., above .70) on their respective constructs but weak (i.e., below .40) on other constructs that they are not supposed to measure. This finding provides initial evidence of unidimensionality and convergent validity (O'Leary-Kelly and Vokurka, 1998) of the items measuring disruption absorption, recoverability, and operational efficiency.

Table 5.20: EFA Results on the Scales for Attention to Threats and Attention Structures

	Construct				
Measures	*Slack resources*	*Environment dynamism*	*Strategic mission rigidity*	*Attention to threats*	*Disruption orientation*
AT1	.145	.213	-.153	**.824**	.153
AT2	.127	.143	-.055	**.910**	.144
AT3	.077	.122	-.033	**.899**	.120
AT4	.200	.190	-.141	**.829**	.116
SLK1	**.888**	.066	.003	.127	.097
SLK2	**.902**	.120	.046	.114	.106
SLK3	**.915**	.128	-.025	.069	.045
SLK4	**.919**	.082	.033	.144	.041
SLK5	**.909**	.082	.000	.094	.031
SMR1	.013	-.012	**.904**	-.102	-.107
SMR2	.021	.011	**.919**	-.096	-.081
SMR3	-.030	.020	**.880**	-.056	-.059
SMR4	.052	-.013	**.931**	-.078	-.112
DO1	.170	-.015	-.055	.140	**.797**
DO2	.038	-.052	-.103	.146	**.847**
DO3	.038	.076	-.029	.032	**.834**
DO4	.029	.124	-.165	.149	**.756**
DYM1	.076	**.781**	.091	.005	.047
DYM2	.150	**.754**	-.034	.125	-.031
DYM3	.021	**.827**	-.064	.117	.037
DYM4	.110	**.834**	.016	.151	-.016
DYM5	.129	**.770**	.009	.151	.053
DYM6	-.010	**.727**	-.018	.103	.063
Eigenvalue	4.291	3.719	3.418	3.251	2.759
Variance explained (%)	18.657	16.167	14.859	14.136	11.997

Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy = .853 Chi-Square = 4692.449; df = 253, p < .001

5.3.3.2.3 Full Measurement EFA Model

To obtain an initial evidence of discriminant validity the study, another EFA was conducted on all the items in Section 5.4.3.2.1 and Section 5.4.3.2.2 (O'Leary-Kelly and Vokurka, 1998). As expected, eight components were extracted. Together, they explained 76.617% of the variance. Items loading on components one through five to eight respectively measured disruption absorption, slack resources, recoverability, environment dynamism, operational efficiency, strategic mission rigidity, attention to threats, disruption orientation. Each item loaded high (i.e., above .70) on its respective component, but low (i.e., below .40) on any other component. These results indicate that each scale in the study appears to measure a unique construct (O'Leary-Kelly and Vokurka, 1998).

Table 5.21: EFA Results on the Scales for Operational Resilience and Operational Efficiency

	Construct		
Measures	*Disruption absorption*	*Recoverability*	*Operational efficiency*
RC1	.239	**.880**	.123
RC2	.226	**.874**	.132
RC3	.310	**.867**	.127
RC4	.274	**.875**	.141
RC5	.285	**.873**	.124
DAC1	**.783**	.334	.061
DAC2	**.778**	.125	.061
DAC3	**.816**	.251	.139
DAC4	**.829**	.263	.127
DAC5	**.835**	.258	.039
DAC6	**.802**	.188	.128
OE1	.126	.127	**.719**
OE2	.084	.105	**.881**
OE3	.057	.131	**.882**
OE4	.106	.032	**.842**
OE5	.060	.139	**.841**
Eigenvalue	4.313	4.243	3.631
Variance explained (%)	26.956	26.519	22.695

Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy = .913 Chi-Square = 3432.080; df = 120, p < .001

5.3.3.3 Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) is used in this study as the main statistical tool for validating the scales in the study. All items from the EFA were subjected to CFA. The same two-stage method used in the EFA is implemented in here. The study uses LISREL 8.50 as the statistical software package to conduct the analyses. Covariance matrix and maximum likelihood are used as the input and estimation method respectively (Diamantopoulos and Siguaw, 2000; Hair *et al.*, 2014).

Table 5.22: Results of the Full Measurement EFA Model

Measures	*Component*							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
AT1	.130	.144	.141	.212	-.038	-.161	**.805**	.139
AT2	.148	.126	.113	.145	.003	-.057	**.890**	.139
AT3	.131	.077	.069	.126	-.008	-.034	**.887**	.119
AT4	.179	.199	.054	.192	-.039	-.146	**.808**	.109
SLK1	.054	**.887**	.031	.068	.008	.006	.122	.095
SLK2	.072	**.900**	.054	.120	.024	.047	.101	.101
SLK3	.061	**.913**	.070	.124	-.026	-.028	.052	.037
SLK4	.047	**.917**	.064	.081	-.003	.032	.131	.037
SLK5	.063	**.908**	.011	.083	-.010	.000	.085	.030
SMR1	-.077	.014	.029	-.014	-.040	**.903**	-.091	-.108
SMR2	.005	.021	-.006	.008	-.084	**.915**	-.096	-.085
SMR3	-.003	-.030	-.049	.021	-.103	**.876**	-.053	-.056
SMR4	.027	.050	.001	-.015	-.012	**.933**	-.080	-.112
DO1	.074	.167	.099	-.019	-.017	-.056	.126	**.790**
DO2	.026	.040	.074	-.052	-.052	-.107	.144	**.842**
DO3	.043	.040	.016	.077	-.055	-.031	.032	**.833**
DO4	.087	.026	.116	.121	.025	-.166	.127	**.745**
DYM1	.016	.075	.042	**.781**	-.015	.091	.002	.041
DYM2	.004	.150	.085	**.752**	-.018	-.036	.122	-.041
DYM3	.049	.020	.020	**.827**	-.071	-.069	.107	.033
DYM4	.079	.106	.090	**.830**	-.014	.016	.130	-.023
DYM5	.055	.126	.080	**.766**	-.041	.004	.131	.046
DYM6	.054	-.013	.028	**.728**	.044	-.012	.088	.071
RC1	.244	.077	**.866**	.111	.126	-.015	.044	.063
RC2	.223	.078	**.856**	.075	.139	-.015	.121	.078
RC3	.312	.045	**.847**	.121	.133	-.002	.085	.083
RC4	.284	.016	**.861**	.066	.145	.015	.059	.094
RC5	.292	.042	**.862**	.043	.124	-.014	.092	.069
DAC1	**.784**	.060	.326	.020	.051	-.069	.077	.003
DAC2	**.773**	.058	.106	-.009	.065	.047	.092	.072
DAC3	**.814**	.030	.234	.049	.134	-.063	.087	.053
DAC4	**.815**	.086	.229	.124	.135	.004	.112	.090
DAC5	**.822**	.068	.232	.095	.042	-.002	.132	.047
DAC6	**.801**	.029	.173	.030	.126	.002	.092	.012
OE1	.110	.050	.117	.025	**.724**	-.049	.103	-.046
OE2	.097	-.048	.101	-.029	**.880**	-.050	-.052	.063
OE3	.070	-.003	.140	-.011	**.876**	-.049	-.050	-.057
OE4	.114	.008	.034	-.033	**.839**	-.029	-.005	-.064

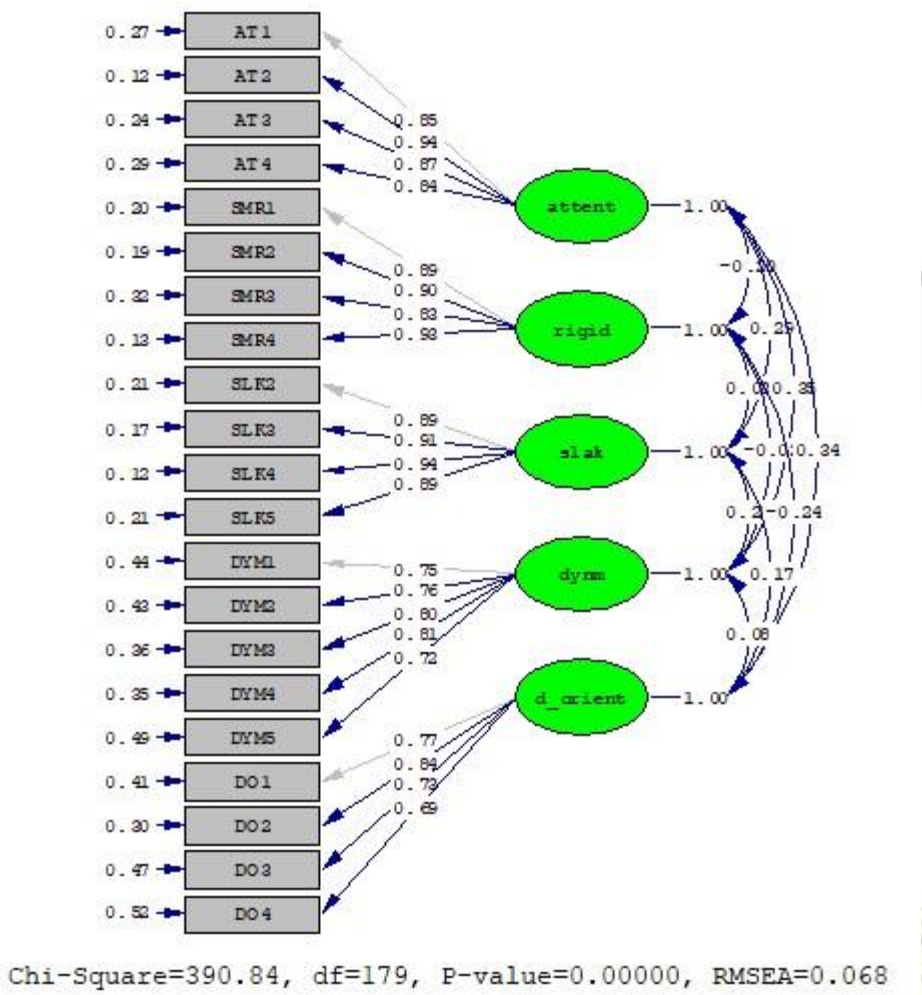
OE5	.078	-.022	.149	-.067	**.829**	-.065	-.072	.004
Eigenvalue	4.417	4.311	4.172	3.929	3.647	3.426	3.198	2.780
Variance explained (%)	11.327	11.055	10.697	10.075	9.352	8.784	8.199	7.128

Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy = .863
Chi-Square = 8351.626; df = 741, p < .001

Note: Component one through five to eight represent disruption absorption, slack resources, recoverability, environment dynamism, operational efficiency, strategic mission rigidity, attention to threats, disruption orientation, respectively.

5.3.3.3.1 CFA Results on the Scales measuring Attention to Threats and Attention Structures

Based on the results obtained in Section 5.4.3.2.1, a five-factor CFA model was estimated. An examination of the modification indices (Hair *et al.*, 2014; Diamantopoulos and Siguaw, 2000) revealed that the error terms of items SLK5 and DYM6 cross-loaded highly with the error terms of some of the other items. Accordingly, SLK5 and DYM6 dropped. The revised model provided a good fit to data: chi-square (χ^2) = 390.84, degree of freedom (DF) = 179, normed chi-square (χ^2/DF) = 2.183, square error of approximation (RMSEA) = .068, nonnormed fit index (NNFI) = .936, comparative fit index (CFI) = .946, standardised root mean square residual (SRMR) = .049 (Bagozzi and Yi, 2012; Hair *et al.*, 2014).



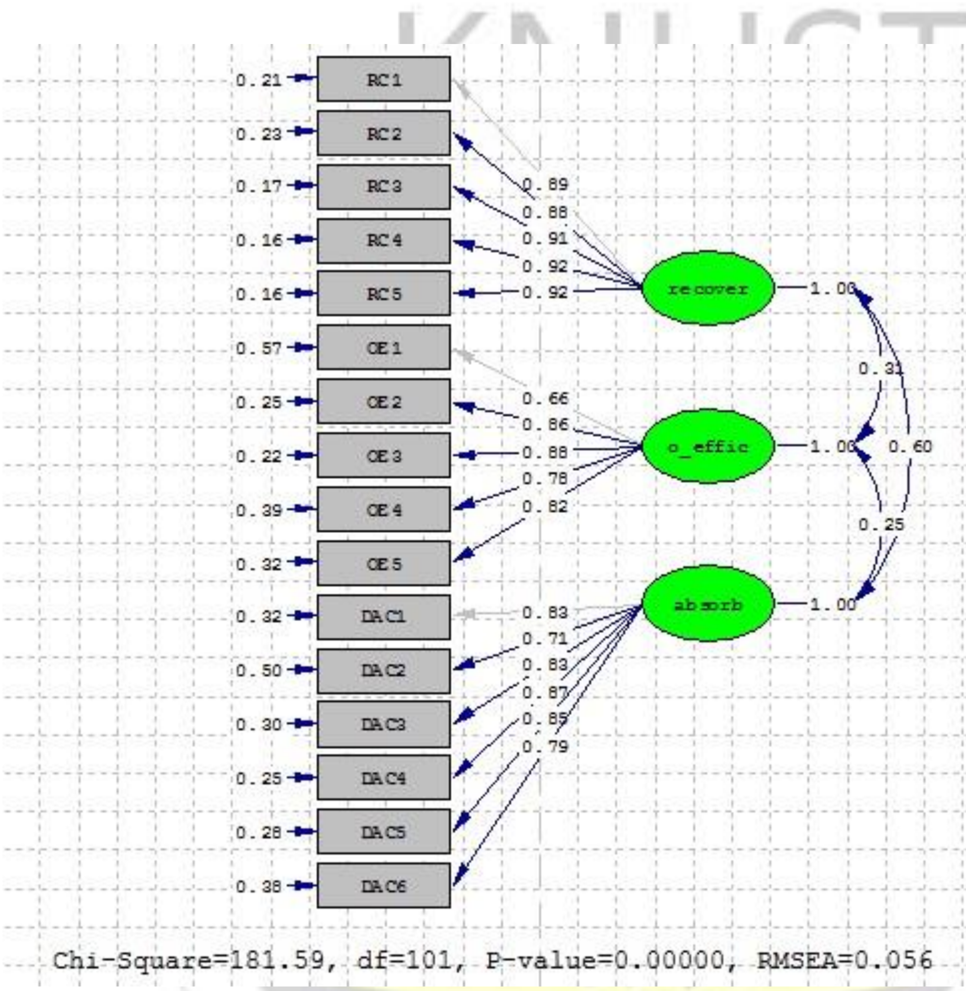
Note: Latent variables with labels attent, rigid, slak, dynm, and d_orient represent attention to threats, strategic mission rigidity, slack resources, environment dynamism, and disruption orientation respectively.

Figure 5.5: CFA Results for the Scales measuring Attention to Threats and Attention Structures

Figure 5.5 shows that each item loads positive and high (i.e., above .60) on its specified latent variable. The t-value associated with each loading is statistically significant at 1%. These results demonstrate that the scales measuring attention to threats, slack resources, environment dynamism, strategic mission rigidity, and disruption orientation exhibit convergence validity and unidimensionality (Hair *et al.*, 2014; O'Leary-Kelly and Vokurka, 1998).

5.3.3.3.2 CFA Results on the Scales for Operational Resilience and Operational Efficiency

The scales measuring operational resilience and operational efficiency were subjected to CFA and were found to provide a good fit to data: $\chi^2 = 181.59$, DF = 101, χ^2/DF = 1.798, RMSEA = .056, NNFI = .971, CFI = .975, SRMR = .035.



Note: Latent variables with labels recover, absorb, and o_effic represent recoverability, disruption absorption, and operational efficiency respectively.

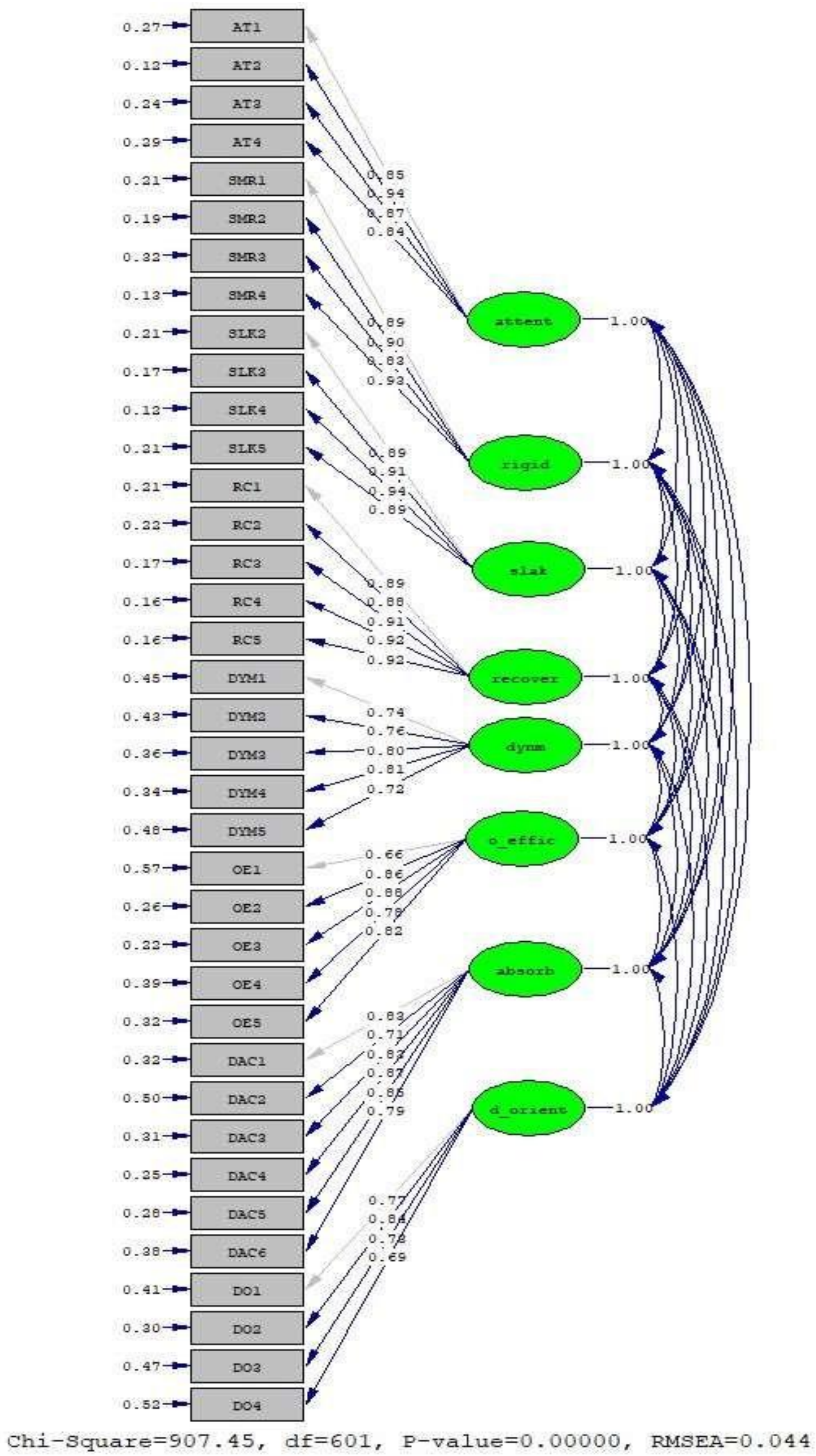
Figure 5.6: CFA Results for the Scales for Operational Resilience and Operational Efficiency

As shown in Figure 5.6, each item loads positive and high (i.e., above .60) on its specified latent variable. Also, their associated t-values are statistically significant at 1%. These results suggest that the scales measuring operational resilience and operational efficiency demonstrate adequate unidimensionality and convergent validity (Hair *et al.*, 2014; O'Leary-Kelly and Vokurka, 1998).

5.3.3.3.3 Full CFA Model and Main Validity and Reliability Results

To assess how well each scale performs (in terms of reliability, unidimensionality, convergent validity, and discriminant validity), the retained items in Sections 5.4.3.3.1 and 5.4.3.3.2 were combined and subjected to further CFA (Boso *et al.,* 2013a). As shown in Figure 5.7, the eightfactor CFA model provided a good fit to data: $\chi^2 = 907.45$, DF = 601, χ^2 /DF = 1.510, RMSEA = .044, NNFI = .948, CFI = .953, SRMR = .042.

All items from the subset CFAs were retained. Each item loads positive and high (i.e., above .60) on its theoretical construct. Also, the t-values associated with the item loadings are statistically significant at 1%. Again, the average variance extracted (AVE) values for each scale is above the minimum threshold of .50 (Hair *et al.,* 2014), indicating that each scale's unique variance is greater than 50% (see Table 5.26). These results provide enough evidence that each reflective scale in the study is unidimensional and demonstrates good convergence validity (Hair *et al.,* 2014; O'Leary-Kelly and Vokurka, 1998). As shown in Table 5.24, each scale's composite reliability and Cronbach's alpha scores are above the minimum threshold of .60 and .70 respectively, indicating that the scales demonstrate good internal consistency (Hair *et al.,* 2014; Bagozzi and Yi, 2012). Hair *et al.* (2014) assert that a stricter test of discriminant validity is to compare the AVE values of each scale with the shared variances (or squared correlations) between any pair of scales.



Note: Latent variables with labels attent, rigid, slak, dynm, d_orient, recover, absorb, and o_effic represent attention to threats, strategic mission rigidity, slack resources, environment dynamism, disruption orientation, recoverability and disruption absorption, and operational efficiency.

Figure 5.7: Full CFA Model Results

The results of this test are reported in Table 2.25. It is seen that all AVE values are far greater than any of the shared variances. The lowest AVE value is .578 while the highest shared variance is .361. This finding indicates that the study's scales demonstrate good discriminant validity (Hair *et al.*, 2014).

Last but not the least, nomological validity of the scales was assessed by analysing the causal links from attention to threats to operational efficiency[32] (as shown in Figure 5.8). This was done by, first, examining the correlations between variables in the casual paths (Hair *et al.*, 2014). The results obtained: r = .342 for "attention to threats ↔ disruption absorption", r = .276 for "attention to threats ↔ recoverability", r = -.026 for "attention to threats ↔ operational efficiency", r = .251 for "disruption absorption ↔ operational efficiency", and r = .305 for "recoverability ↔ operational efficiency" indicate sufficient and significant associations between variables in the hypothesised causal paths.

Table 5.23: Summary of Fit Indices for the CFA Models

CFA Models	χ^2	*DF*	χ^2/DF	*RMSEA*	*NNFI*	*CFI*	*SRMR*
Measurement set 1	390.84	179	2.183	.068	.936	.946	.049
Measurement set 2	143.33	87	1.647	.050	.976	.980	.033
Measurement set 3	907.45	601	1.510	.044	.948	.953	.042

Notes:

1. Measurement set 1: Attention and attention structures (including attention to threats, disruption orientation, strategic mission rigidity, slack resources, and environment dynamism)
2. Measurement set 2: Outcome variables: disruption absorption, recoverability, and operational efficiency
3. Measurement set 3: Full measurement model (all measures retained in measurement set 1 and set 2 were analysed simultaneously).

For robust assessment, the proposed nomological net of relationships (Figure 5.7) was estimated simultaneously[33] (Steenkamp and Trijp, 1991) in LISREL 8.5. The model showed good fit to

[32] The analysis was limited to the main effect paths of the research model as nomological validity focuses attention on the extent to which scales theoretically relate to other scale(s) in a predictable way (O'Leary-Kelly and Vokurka, 1998; Hair *et al.*, 2014).

[33] The association between disruption absorption and recoverability was set to freely correlate. This is consistent with the study's theoretical arguments in Section 2.3.5.4 of Chapter 2 as well as prior research finding (BrandonJones *et al.*, 2014) and that of the present study (see Table 5.28).

data: χ^2 = 264.85, DF = 164, χ^2 /DF = 1.615, RMSEA = .049, NNFI = .970, CFI = .974, SRMR = .036. These results suggest that the hypothesised causal links from attention to threats, via operational resilience, to operational efficiency are nomologically valid (Steenkamp and Trijp, 1991).

Table 2.24: Full Measurement CFA Model Results

Construct/Measures (Composite reliability; Average variance extracted; Cronbach alpha)	Loading	T-value[a]
Attention to threats (CR = .930, AVE = .769, CA = .927)		
AT1	.853	Fixed
AT2	.936	20.84
AT3	.873	18.48
AT4	.844	17.41
Strategic mission rigidity (CR = .938, AVE = .791, CA = .937)		
SMR1	.892	Fixed
SMR2	.902	21.85
SMR3	.827	18.16
SMR4	.933	23.51
Slack resources (CR = .949, AVE = .823, CA = .948)		
SLK2	.890	Fixed
SLK3	.911	32.54
SLK4	.937	24.07
SLK5	.889	21.27
Recoverability (CR = .957, AVE = .815, CA = .956)		
RC1	.888	Fixed
RC2	.881	20.86
RC3	.913	22.73
RC4	.917	22.93
RC5	.915	22.83
Environment dynamism (CR = .877, AVE = .587, CA = .873)		
DYM1	.743	Fixed
DYM2	.756	11.73
DYM3	.799	12.41
DYM4	.811	12.58
DYM5	.719	11.15
Operational efficiency (CR = .901, AVE = .648, CA = .900)		
OE1	.655	Fixed
OE2	.862	11.73
OE3	.882	11.91
OE4	.782	10.87
OE5	.824	11.34
Disruption absorption (CR = .921, AVE = .662, CA = .920)		
DAC1	.826	Fixed
DAC2	.709	12.73
DAC3	.833	15.97
DAC4	.867	16.98
DAC5	.848	16.41
DAC6	.790	14.76

Disruption orientation (CR = .845, AVE = .578, CA = .843)		
DO1	.771	Fixed
DO2	.838	12.77
DO3	.731	11.36
DO4	.694	10.76

Note: [a]t-values ≥ 2.56 are significant at 1%

Also, the parameter estimates obtained as shown in Figure 5.9a and Figure 5.9b are largely consistent with the correlation results. The results show that the paths from attention to threats to both disruption absorption (β = .34, t = 5.17) and recoverability (β = .28, t = 4.26) are positive and statistically significant as hypothesised. Attention to threats had significant negative relationship with operational efficiency (β = -.15, t = -2.11). Lastly, it was found that both the paths from disruption absorption (β = .15, t = 1.70) and recoverability (β = .26, t = 3.06) to operational efficiency were positive and significant as hypothesised in the study. Table 5.25: Results of Discriminant Validity Test

	Construct	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1	Attention to threats	**.769**	.040	.086	.076	.123	.001	.117	.116
2	Strategic mission rigidity	-.200	**.791**	.001	.001	.000	.012	.003	.057
3	Slack resources	.293	.025	**.823**	.023	.062	.000	.029	.029
4	Recoverability	.276	-.038	.150	**.815**	.040	.093	.361	.047
5	Environment dynamism	.351	-.015	.249	.200	**.587**	.004	.032	.006
6	Operational efficiency	-.026	-.109	-.012	.305	-.065	**.648**	.063	.002
7	Disruption absorption	.342	-.051	.171	.601	.178	.251	**.662**	.032
8	Disruption orientation	.341	-.238	.170	.216	.080	-.040	.178	**.578**

Notes:
1. Values below and above the principal diagonal are correlations and shared variances respectively.
2. Values on the principal diagonal are average variance extracted.
3. The correlation coefficients are based on full scale information (i.e., the output of the CFA).

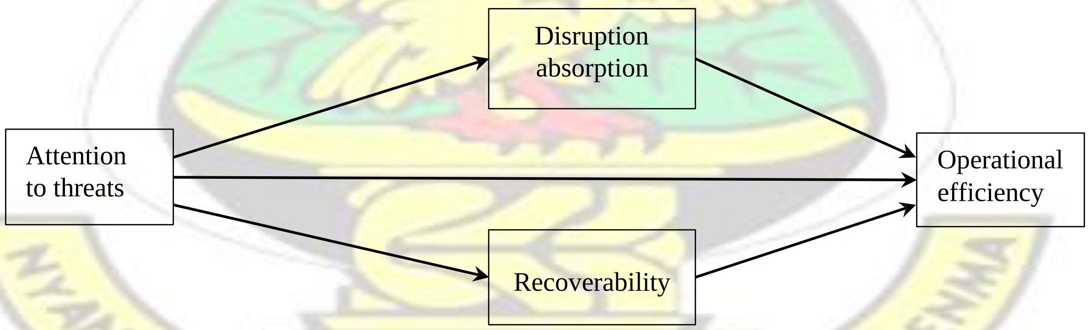
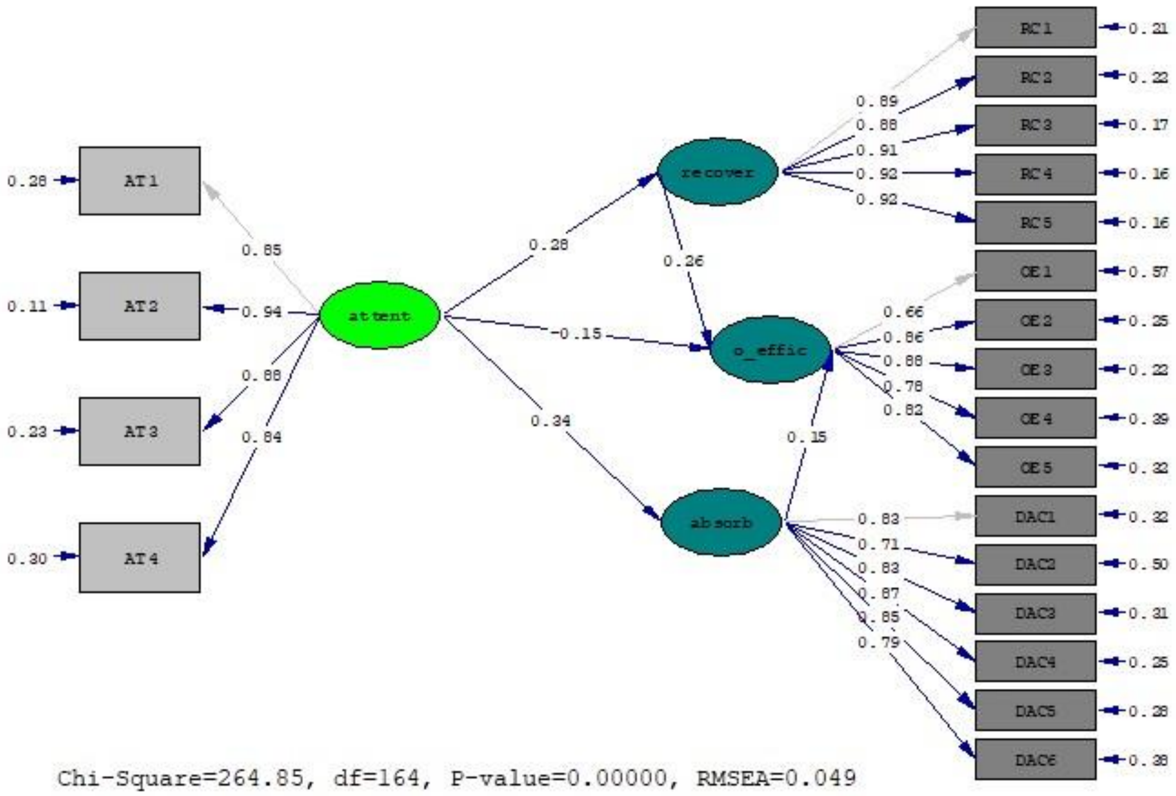


Figure 5.8: Proposed Nomological Net for Attention to Threats

5.3.4 Assessment of the Formative Scale

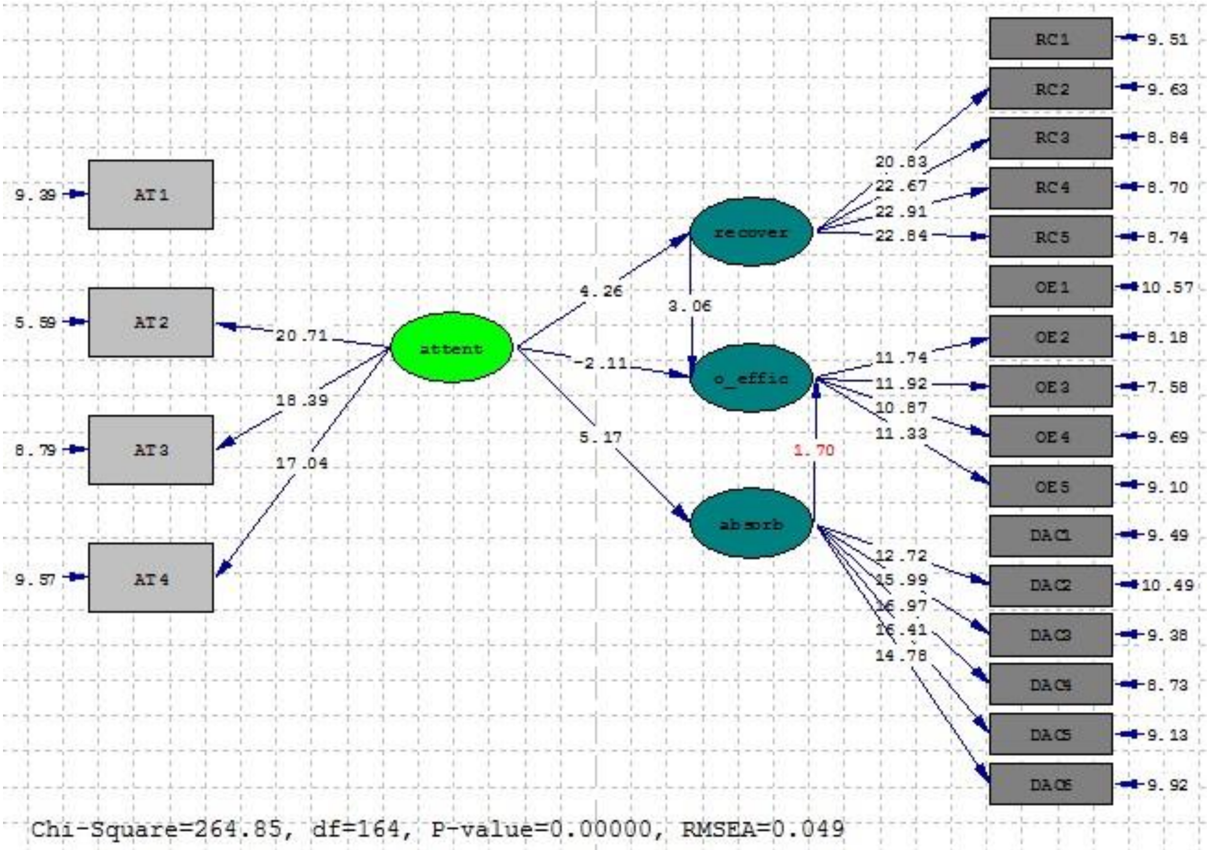
The study proposed the items measuring operational disruption (see Table 5.26) to be formative, and accordingly followed prior research (e.g., Bode *et al.*, 2011; Wilden *et al.* 2013) to create an index for operational disruption, which was accordingly used as a control variable. The index was created as the unweighted linear sum of the proposed items (Diamantopoulos and Siguaw, 2006; Bode *et al.*, 2011). Prior to creating this index, the study followed Jarvis *et al.* (2003) criteria to establish if a formative index for operational disruption was appropriate.



Note: Latent variables with labels attent, recover, absorb, and o_effic represent attention to threats, recoverability, disruption absorption, and operational efficiency respectively.

Figure 5.9a: Estimated Nomological Net for Attention to Threats (Parameter Estimates)

First, operational disruption was measured with items representing events that have the tendency to disrupt the smooth flow of operations. Thus, the items are the defining characteristic of the operational disruption construct and changes in them cause changes in the construct (Bollen and Lennox, 1991; Jarvis *et al.*, 2003). Second, since the items represent different disruptive events, they are not interchangeable or necessarily share same/similar theoretical content, and dropping any of them can alter the conceptual domain of the construct (Jarvis *et al.*, 2003). This implies that all the proposed items should be used in the creation of the index.



Note: Latent variables with labels attent, recover, absorb, and o_effic represent attention to threats, recoverability, disruption absorption, and operational efficiency respectively.

Figure 5.9b: Estimated Nomological Net for Attention to Threats (t-values)

Third, the items do not have to necessarily correlate with each other (Jarvis *et al.*, 2003). Accordingly, unlike reflective scale, the issue of internal consistency, and accordingly unidimensionality and convergent validity, is immaterial to the construction of a formative index (Bollen and Lennox, 1991). Given that the nature and the pattern of occurrence of any of the items (i.e., disruptive events) may be different, one does not necessarily expect them to correlate highly. Generally, the results shown in Table 5.26 indicate the firms that score high on any of the items score high on any other (and vice versa). Nevertheless, the strength of associations between any pair of the items was below .50.

Table 5.26: Assessment of the Formative Scale for Operational Disruption

Items	Unexpectedly…,	OD1	OD2	OD3	OD4	OD5	OD6	OD7	OD8	OD9	VIF
OD1	some of our employees leave their posts (i.e. quit their job)	1									1.493
OD2	some of our suppliers fail to make deliveries	.345	1								1.587
OD3	we experience vehicular breakdowns	.453	.347	1							1.548
OD4	we experience service/product failure	.282	.451	.317	1						1.542
OD5	we run out of cash for running day-to-day operations	.311	.330	.390	.389	1					1.512
OD6	we experience machine/technology downtime/ failure	.243	.382	.321	.408	.276	1				1.381
OD7	we experience shortage of raw materials	.307	.424	.456	.319	.484	.344	1			1.698
OD8	we experience power cuts	.400	.207	.261	.170	.232	.257	.172	1		1.252
OD9	some of our service providers fail to honour their promises	.182	.465	.327	.448	.395	.349	.478	.089	1	1.627

Note: VIF = variance inflation factor

A further test of the extent of collinearity among the items using variance inflation factor score (VIF) (Bode *et al.*, 2011) revealed a highest VIF score of 1.698. These results indicate that multicollinearity does not sufficiently describe the proposed items (Diamantopoulos and Winklhofer, 2001; Hair *et al.*, 2014), and thus will not pose problem for the creation of an index for the operational disruption construct. The validity of this construct was assessed by examining its relations with the outcome variable: operational efficiency (Diamantopoulos and Siguaw, 2006). As shown in Table 5.28, it was found that operational disruption significantly correlates with operational efficiency negatively, which is consistent with the study's argument in Section 4.4.7.1.2. This finding offers support for nomological validity of the scale for operational disruption.

5.3.5 Statistical Assessment of Common Method Bias

A key concern in the use of cross-sectional survey data provided by single informant[34] is common method bias (CMB) (Podsakoff *et al.*, 2012; Podsakoff *et al.*, 2003). Accordingly, necessary procedural measures were followed to minimise the chances of increasing its presence in the data (see Section 4.4.10). While Sections 4.4.10 and 4.6.3 respectively indicate that the study's proposed model and the method utilised to estimate it raise little concern about common method bias, it was necessary to empirically examine the extent to which CMB describes the data. To do this, the study followed Cote and Buckley's (1987) recommendation as implemented to Boso *et al.* (2013a) to estimate and compare three competing models: method-only model (Model 1), trait-only model (Model 2), and method and trait model (Model 3). Mode 1 assumes that a single latent variable accounts for the variances in the reflective scales. Model 2 assumes that the variances in the reflective scales are explained by their

[34] It should be noted that although the data were collected from single informants, the analyses in Sections 5.2.2 and 5.2.6 reveal that their position and competence level are not related to any of the substantive scales in the study.

respective latent variables. Lastly, Model 3 assumes that the variances in the reflective scales are explained by their respective latent variables and an additional common latent variable. Model 1, which was estimated by allowing all the reflective items to load on a single latent variable, provided poor fit data: χ^2 = 9349.32 702, DF = 702, χ^2/DF = 13.318, RMSEA = .219, NNFI = .222, CFI = .232, SRMR = .190. Model 2, which was estimated by allowing each item to load on its respective reflective latent variable, provided good fit to data: χ^2 = 1041.23, DF = 674, χ^2/DF = 1.545, RMSEA = .046, NNFI = .945, CFI = .950, SRMR = .042. These results indicate that the proposed eight-factor CFA was significantly better than the alternate onefactor CFA model, indicating that a single latent factor does not account for the variances in the reflective scales. Model 3 involved including a common latent factor linking all the items in Model 2. The results obtained show that this model provides equally good fit to data: χ^2 = 921.109, DF = 627, χ^2/DF = 1.469, RMSEA = .039, NNFI = .957, CFI = .964, SRMR = .040 (Bagozzi and Yi, 2012; Hair *et al.*, 2014). While the fit indices of Model 3 are better than those of Model 2, the differences appear non-substantial, indicating that CMB does not adequately describe the data. Accordingly, it was concluded that CMB is not major issue in the study (Boso *et al.*, 2013a).

5.4 STRUCTURAL MODEL ANALYSIS AND EVALUATION OF HYPOTHESES

This section analyses the research model and evaluates the hypotheses. The model is analysed using three-stage least squares (3SLS) estimator. Section 4.5.1.2 discusses the justifications for the use of 3SLS estimator in the study. The hypothesised paths (i.e., directional hypotheses) and the non-hypothesised paths are evaluated at t-value $\geq$ 1.645 (5% significance level, 1tailed) and at t-value $\geq$ 1.96 (5% significance level, 2-tailed) respectively (Kothari, 2004).

5.4.1 Variables in the Structural Model Analysis

Table 5.27 presents the variables involved in the structural model analysis. In relation to H1, the dependent variables were disruption absorption and recoverability while the predictor variable was attention to threats. The links from attention to threats to both disruption absorption and recoverability are hypothesised to be moderated by strategic mission rigidity and disruption orientation (H2 and H3 respectively). In testing these hypotheses, the study controlled for the potential effects of firm age, firm size, firm industry (service =1, manufacturing = 0) and slack resources on disruption absorption and recoverability. In stage 1 of 3SLS estimator, the study regressed attention to threats on disruption orientation, strategic mission rigidity, slack resources, firm size, and environment dynamism to obtain residual values of attention to threats which was used as an indicator for attention to threats to estimate the paths relating to H1 and also, H2 and H3.

Table 5.27: Variables and their Structural Specifications in the Study

Dependent variable	*Independent variable*	*Control/Instrumental variable*
Disruption absorption	• Attention to threats (ATT) • Strategic mission rigidity (SMR) • Disruption orientation (DO) • ATT × SMR • ATT × DO	• Slack resources • Firm size • Firm age • Firm industry
Recoverability	• Attention to threats (ATT) • Strategic mission rigidity (SMR) • Disruption orientation (DO) • ATT × SMR • ATT × DO	• Slack resources • Firm size • Firm age • Firm industry
Operational efficiency	• Disruption absorption • Recoverability • Attention to threats	• Slack resources • Firm size • Firm age • Firm industry • Operational disruption
Attention to threats[1]		• Environment dynamism • Disruption orientation • Strategic mission rigidity • Slack resources • Firm size

Notes: [1]Considered in Stage 1 of 3SLS regression analysis

Next, regarding to H4, the study assessed the effects of recoverability and disruption absorption on operational efficiency by controlling for the potential effect of attention to threats on operational efficiency. The other variables included as controls in the model of operational efficiency are slack resources, firm size, firm age, firm industry, and operational disruption.

5.4.2 Key Descriptive Statistics and Correlation Results

Table 5.28 presents the descriptive statistics and the correlation results. The focal variables of interest in this study are attention to threats, operational resilience (disruption absorption and recoverability), and operational efficiency. Accordingly, this section highlights the mean scores of these variables and their correlations with the other variables in the study.

5.4.2.1 Attention to Threats

The results in Table 5.28 show that an average firm scores slightly above moderate level on the attention to threats scale (given mean = 5.08, standard deviation = 1.526), indicating that a typical firm in the study's sample, to some extent, emphasises attention to threats. Nonetheless, further analysis revealed that the mean score on attention to threats among small firms (mean = 4.76, standard deviation = 1.651, n = 165) is significantly lower than that of medium/large firms (mean = 5.64, standard deviation = 1.074, n = 94), given t = -4.649, $p < .001$. As the correlation results indicates, firm size correlates positively with attention to threats, given r = .340, $p < .01$. The correlation results also show that not only may heterogeneity in firm size be an important factor that may explain the variations in attention to threats, but also variations in other contextual/situational factors (i.e., attention structures) such as strategic mission rigidity, disruption orientation, slack resources, and environment dynamism.

Table 5.28: Descriptive Statistics and Correlation Results

	Variables	1	2	3	4	5	6	7	8	9	10	11	12
1	Attention to threats	1											
2	Strategic mission rigidity	-.204**	1										
3	Disruption orientation	.310**	-.210**	1									
4	Disruption absorption	.317**	-.052	.164**	1								
5	Recoverability	.260**	-.043	.203**	.556**	1							
6	Operational efficiency	-.012	-.119	-.030	.239**	.287**	1						
7	Slack resources	.284**	.013	.162**	.160*	.146*	-.001	1					
8	Environment dynamism	.330**	-.005	.090	.143*	.186**	-.050	.238**	1				
9	Operational disruption	-.143*	.107	-.016	-.104	-.119	-.124*	-.008	.013	1			
10	Firm size (log)	.340**	.027	.142*	.233**	.266**	-.086	.256**	.223**	-.062	1		
11	Firm age (log)	.118	-.008	.023	.087	.140*	-.028	.003	-.010	-.067	.554**	1	
12	Industry (service =1)	-.067	-.081	-.022	-.012	-.065	.114	-.078	-.084	-.061	-.107	-.059	1
	Min	1	1	1	1	1	1	1	1	9	1.79	1.10	0
	Max	7	7	7	7	7	7	7	7	56	6.07	4.09	1
	Mean	5.08	3.88	5.43	5.30	4.89	4.39	4.47	4.84	27.27	3.09	2.55	.73
	Standard deviation	1.526	1.668	1.008	1.088	1.434	1.234	1.430	1.463	9.327	1.013	.639	.445
	Skewness	-.872	.115	-1.693	-1.348	-.863	-.020	-.471	-.977	.433	.744	-.034	-1.041
	Kurtosis	-.129	-1.193	4.183	2.210	-.057	-.728	-.698	.016	-.221	-.151	-.347	-.924

Notes: Correlation coefficients are based on composite scales. $^{*}p < .05$ (2-tailed test), $^{**}p < .01$ (2-tailed test).

Specifically, the correlation results indicate that firms scoring low on strategic mission rigidity (r = -.204, $p < .01$) and high on disruption orientation (r = .310, $p < .01$), have more slack resources (r = .284, $p < .01$), and experience more environment dynamism (r = .330, $p < .01$) score high on the attention to threats scale. Also, the results show that attention to threats correlates positively with both components of operational resilience: disruption absorption (r = .317, $p < .01$) and recoverability (r = .260, $p < .01$); and negatively with operational disruption (r = -.143, $p < .05$). Further results show that attention to threats does not correlate with either firm age (r = .118, $p > .05$) or industry type (r = -.067, $p > .05$) or operational efficiency (r = .012, $p > .05$).

5.4.2.2 Operational Resilience

The mean results indicate that an average firm in the study is somehow operationally resilient, given mean scores of 5.30 (standard deviation = 1.088) and 4.89 (standard deviation = 1.434) on the scales measuring disruption absorption and recoverability. A t-test conducted reveals that recoverability level is significantly lower than disruption absorption level among the firms, given a mean difference of -.41 (t-value = -5.329, $p < .01$). Also, the correlation results indicate that firms that score high on disruption absorption also score significantly high on recoverability. In fact, the size of the correlation coefficient (r = .556, $p < .01$) for the relationship between these components of operational resilience is largely consistent with those in prior research (Brandon-Jones *et al.* 2014), lending support for the study's arguments in Section 2.4.2.

Of particular interest, the study finds that small firms are significantly less operationally resilient, compared to medium/large firms, given that small firms (n = 164) score 5.15 (standard deviation = 1.219) and medium/large firms (n = 95) score 5.56 (standard deviation =

.743) on the scale measuring disruption absorption (t = -2.970, p < .01) respectively, and also that small firms (n = 164) score 4.62 (standard deviation = 1.484) and medium/large firms (n = 95) score

5.37 (standard deviation = .962) on the scale measuring recoverability (t = -4.130, p < .01).

Table 5. 29: Correlation between Attention to Threats and Operational Resilience across Firm Size

Firm size	Variables	Attention to threats	Disruption absorption	Recoverability
Small (n = 164)	Attention to threats	1		
	Disruption absorption	.248**	1	
	Recoverability	.197*	.538**	1
Medium & large (n =94)	Attention to threat	1		
	Disruption absorption	.434**	1	
	Recoverability	.237*	.526**	1

Notes: The correlation coefficients are based on composite scales. *p < .05 (2-tailed test), **p < .01 (2-tailed test).

Nonetheless, as shown in Table 5.29, additional results indicate that while both attention to threats and operational resilience are significantly high among medium/large firms, compared to small firms, the correlation between attention to threats and operational resilience are positive and significant in the case of both medium/large firms and small firms. Yet, it is seen the size of the correlation coefficients are smaller in the case of the smaller firms. These results generally indicate that medium/large firms as well as small firms can be operationally resilient by increasing attention to threats.

Regarding the moderator variables, it was found that disruption orientation correlates positively and significantly with both disruption absorption (r = .164, p < .01) and recoverability (r =

.203, p < .01), lending further support for Ambulkar *et al.* (2015) arguments and finding. However, strategic mission rigidity did not relate to either disruption absorption (r = -.052, p

> .05) or recoverability (r = -.043, p > .05). Also, slack resources was found to correlate positively with both disruption absorption (r = .160, p < .05) and recovery capability (r = .140, p < .05), lending support for the argument that the more resources firms have, the more likely they are to be resilient (Hohenstein *et al.*, 2015; Lampel *et al.*, 2014; Lai *et al.*, 2016; Meyer, 1982). Firm age correlated (positively) with recoverability (r = .140, p < .05) but not with disruption absorption (r = .087, p > .05). Firm industry had no association with either disruption absorption (r = -.012, p > .05) or recoverability (r = -.065, p > .05).

5.4.2.3 Operational Efficiency

The descriptive results that an average firm in the study sample is moderately operationally efficient, given a mean score of 4.39 (standard deviation = 1.234). Operational efficiency was found to correlate with disruption absorption (r = .239, p < .01), recoverability (r = .287, p < .01), and disruption orientation (r = -.124, p < .05) but not the other control variables, including slack resources (r = -.086, p > .05), firm size (r = -.001, p > .05), firm age (r = -.028, p > .05), and firm industry (r = .114, p > .05).

5.4.3 Assessment of General Assumptions

This section assesses key assumptions (including, normality, linearity, homoscedasticity, independence of residuals, and outliers) underlying the use of multivariate data analysis tools such as regression analysis/3SLE. The results presented in Section 5.3.1 show that the distributions of data on all multi-scale items in the study are satisfactorily normal. Also, as shown in Table 5.28, the distributions of data on the composite scales are satisfactorily normal, given a highest skewness index of |1.693| and a highest kurtosis index of |4.183| (Kline, 2011). Firm size and firm age departed from normality and were accordingly normalised via natural logarithm transformation (Hair *et al.*, 2014). Besides, as shown in Figures 5.10a and 5.10b, the distributions of the residuals of the dependent variables in the main analyses do not depart much from normality. The correlation results in Table 5.28 and the collinearity statistics in Table 5.30 indicate that multicollinearity is not a concern in the study as the correlation between any pair of independent variables was below .70 and the highest variance inflation factor was

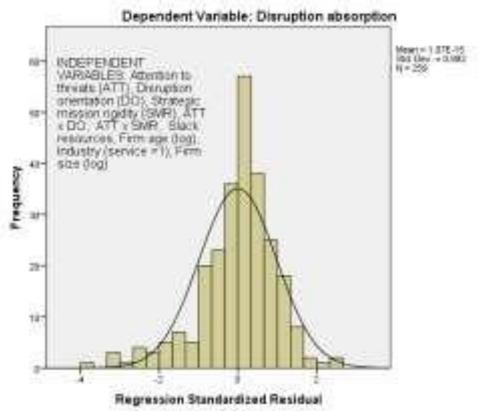
1.866 (Hair *et al.*, 2014). The linearity of the variables in the casual paths of interest were checked using correlation analysis and scatterplots (see Figure 5.10c).

Table 5.30: Collinearity Statistics[1]

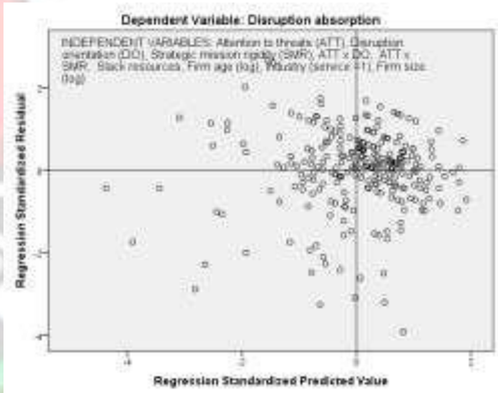
Independent variable	*Tolerance*	*Variance inflation factor (VIF)*
Attention to threats	.627	1.595
Strategic mission rigidity	.884	1.131
Disruption orientation	.849	1.178
ATT x SMR*	.797	1.255
ATT x DO*	.815	1.227
Disruption absorption	.596	1.677
Recoverability	.636	1.573
Slack resources	.825	1.212
Environment dynamism	.817	1.224
Operational disruption	.944	1.059
Firm size (log)	.536	1.866
Firm age (log)	.648	1.543
Industry (service =1)	.955	1.047

[1]Dependent variable: Operational Efficiency. *See Section 5.44 for how it was created.

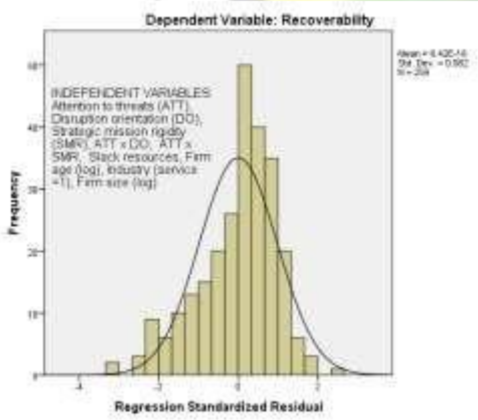
The correlation results discussed in Section 5.4.2.1 and 5.4.2.2 indicate that the relationships between the variables in the nomological net of attention to threats are linear. Moreover, the scatterplots of residuals and predicted values shown in Figures 5.10a and 5.10b indicate that the assumptions of homoscedasticity, independence of residuals, outliers, were largely not violated in the study. It is clear that the residuals were roughly rectangularly distributed, with most of them concentrated in the centre (Pallant, 2007).



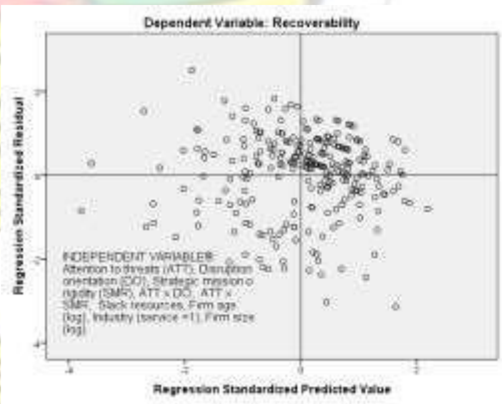
Histogram of the Residuals of Disruption Absorption



Scatterplots of Residuals and Predicted values of Disruption Absorption

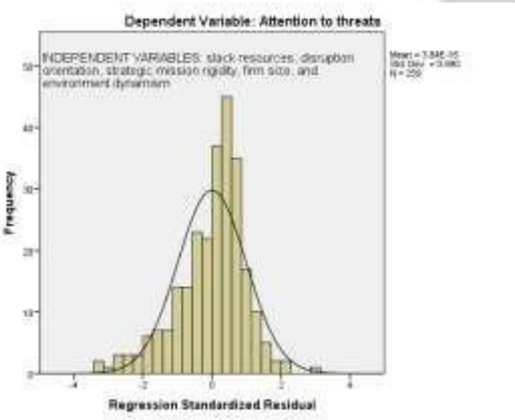


Histogram of the Residuals of Recoverability

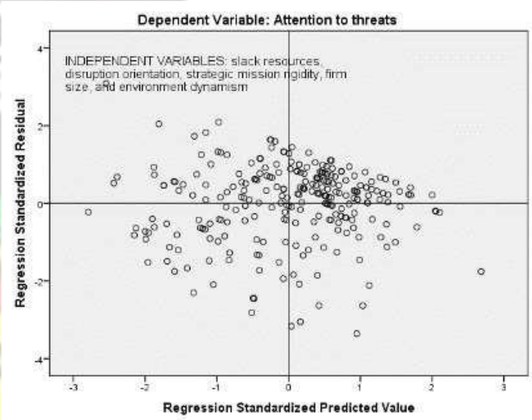


Scatterplots of the Residuals and the Predicted values of Recoverability

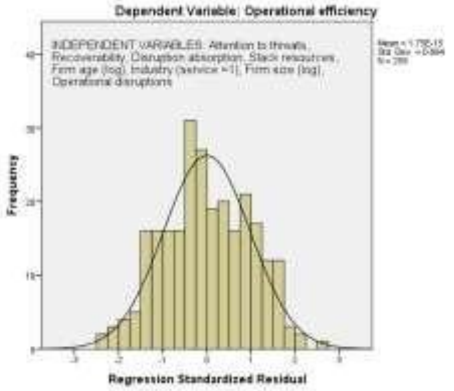
Figure 5.10b: Results on the Assessment of Relevant Multivariate Assumptions: Histogram and Scatter Plot of Residuals



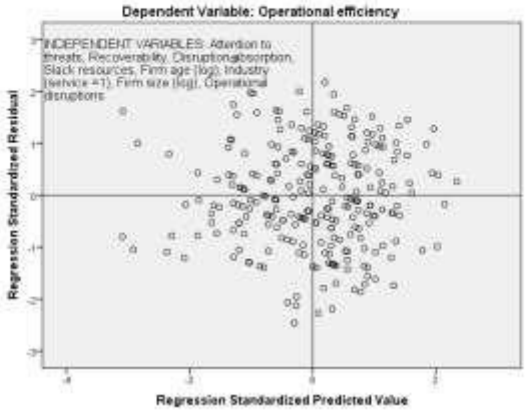
Histogram of the Residuals of Attention to Threats



Scatterplots of the Residuals and the Predicted values of Attention to Threats

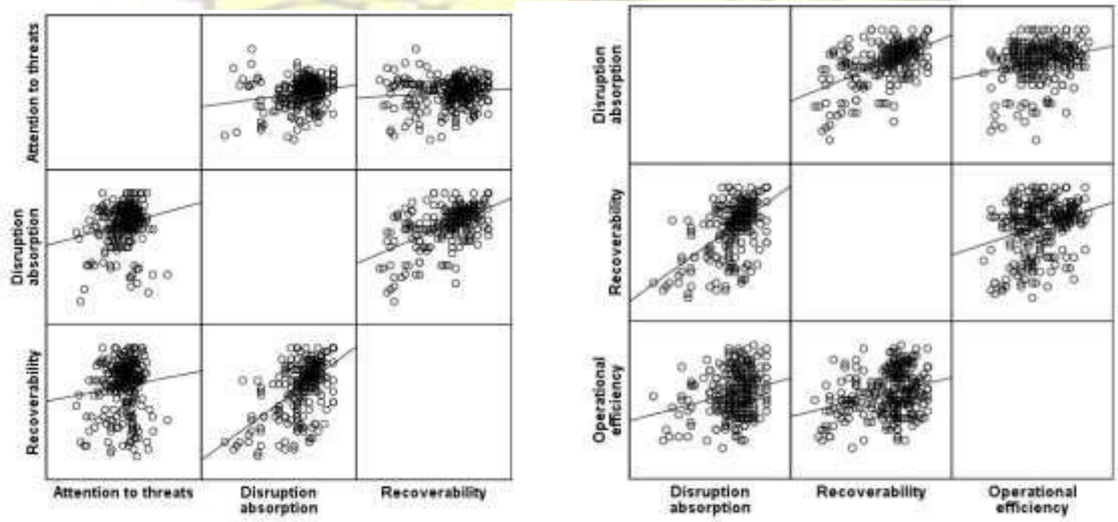


Histogram of the Residuals of Operational Efficiency



Scatterplots of the Residuals and the Predicted values of Operational Efficiency

Figure 5.10b: Results on the Assessment of Relevant Multivariate Assumptions: Histogram and Scatter Plot of Residuals (Continued)

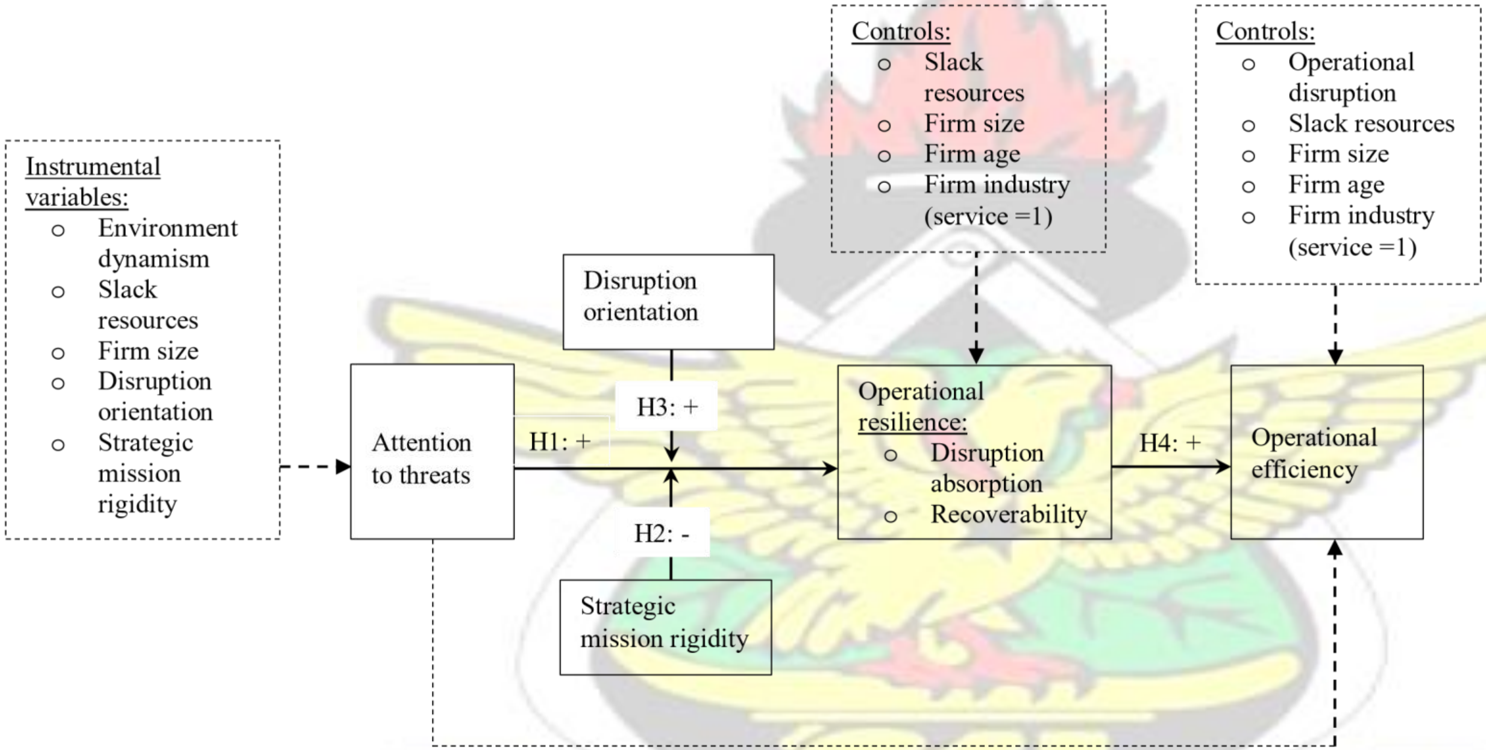


Scatterplots of the Variables in the Casual Paths

Figure 5.10c: Results on the Assessment of Relevant Multivariate Assumptions: Linearity

5.4.4 Three-Stage Least Squares Estimator: Assumptions and Results

As argued in Section 4.4.7.1.3, attention to threats is an endogenous variable. Thus, proper model specification should control for the effects of relevant attention structures on attention to threats. As discussed in Section 4.4.7.1.3, attention to threats can be influenced by environment dynamism, slack resources, firm size, strategic mission rigidity, and disruption orientation. Thus, these factors were utilised as instrumental variables to correct for the potential endogeneity problem in the research model using three-stage least squares estimator (Zaefarian *et al.*, 2017; Bascle, 2008) as implemented in prior research (Poppo *et al.*, 2016; Luo *et al.*, 2007; Menguc *et al.*, 2014). Figure 5.11 represents the model that was estimated using 3SLS estimator while Figure 5.12 gives the model specifications. Table 5.32 reports the results of Stage 1 model while Table 5.33 and Table 5.34 report the results of Stage 2 and Stage 3 models.



Notes: Paths to Attention to threats are estimated in Stage 1 model. Solid lines are estimated in Stage 2 and Stage 3 models. H1 and H4 are evaluated in Stage 2 model. H2 & H3 were evaluated in Stage 3 model.

Figure 5.11: The Structural Model Estimated using Three-stage Least Squares Estimator

Stage 1 (Eqn 1) $ATT = \beta_0 + \beta_1 ED + \beta_2 SR + \beta_3 FS + \beta_4 SMR + \beta_5 DO + e$; *to obtain* $ATT_{residual} = ATT - ATT_{predicted}$.

Stage 2 (Eqn 2a, b & c) ………………………………………………………………………used to test ***H1*** *and* ***H4***

$DA = \beta_0 + \beta_1 SR + \beta_2 FS + \beta_3 SMR + \beta_4 DO + \beta_5 FI + \beta_6 FA + \beta_7 ATT_{residual} + e.$

$R = \beta_0 + \beta_1 SR + \beta_2 FS + \beta_3 SMR + \beta_4 DO + \beta_5 FI + \beta_6 FA + \beta_7 ATT_{residual} + e.$ $OE =$

$\beta_0 + \beta_1 FI + \beta_2 FA + \beta_3 FS + \beta_4 SR + \beta_5 OD + \beta_6 ATT_{residual} + \beta_7 DA + \beta_8 R + e.$

Stage 3 (Eqn 3a&b) ………………………………………………………………………used to test ***H2*** *and* ***H3***

$DA = \beta_0 + \beta \times DO) + e._1 SR + \beta_2 FS + \beta_3 SMR + \beta_4 DO + \beta_5 FI + \beta_6 FA + \beta_7 ATT_{residual} + \beta_8 (ATT_{residual} \times SMR) + \beta_9 (ATT$

$_{residual}$

$_{residual 0} + \beta_1 \times DO) + e.SR + \beta_2 FS + \beta_3 SMR + \beta_4 DO + \beta_5 FI + \beta_6 FA + \beta_7 ATT_{residual} + \beta_8 (ATT_{residual} \times SMR) + \beta_9 (ATT \quad R = \beta$

Where DA = disruption absorption, R = recoverability, ED = environment dynamism, SR = slack resources, FS = firm size, FA = firm age, FI = firm industry (service =1, manufacturing =0), $ATT_{residual}$ = attention to threats residual, SMR = strategic mission rigidity, DO = disruption orientation, OD =

operational disruption, OE = operational efficiencyto threats residual and strategic mission rigidity, ATT , $ATT_{residualresidual}$×DO = interaction between attention to ×SMR = interaction between attention

threats residual and disruption orientation, β

$_0$ = *constants*, $\beta_{1\text{-}9}$ = *regression coefficients*, e = error terms

Figure 5.12: The Three-stage Least Squares Estimator Model Specifications

The validity of instrumental variables (IVs) is contingent upon two fundamental conditions: *exogeneity* and *relevance* (Zaefarian *et al.*, 2017). The exogeneity (or orthogonality) condition suggests that the IVs and the error term of the structural model are uncorrelated (Bascle, 2008). This condition is typically assessed using the Hansen's J-statistic, the Basmann statistic, and the difference-in-Sargan statistic (Bascle, 2008). Exogeneity condition tests require that there are more IVs than the endogenous explanatory variables (EEVs) and assume that at least one of the IVs is exogenous (Bascle, 2008). This study has one EEV and five IVs, meeting the former requirement of exogeneity test. Among the five IVs in this study, firm size and environment dynamism can be argued as exogenous IVs, meeting the latter requirement of exogeneity test. Attention to threats is unlikely to influence firm size or environment dynamism. The exogeneity tests[35] results (in Table 5.31) show that firm size and environment dynamism can be regarded as exogenous given that the null hypothesis is not rejected at the 5% level. All tests show that the exogeneity of the instruments is respected in the study. Table 5.31: Instrument Exogeneity Test Results

Exogeneity test	Dependent variable	
	Disruption Absorption	Recoverability
Sagarn statistics	2.162	3.108
Chi-sq(d.f.) *p*-value	.706	.540
Basmann statistics	2.130	3.073
Chi-sq(d.f.) *p*-value	.712	.546
Hansen-*J* statistics	2.253	2.803
Chi-sq(d.f.) *p*-value	.689	.591
Difference-in-Sargan statistic (*instruments tested: firm size, environment dynamism*)	1.344	1.344
Chi-sq(d.f.) *p*-value	.511	.511

On the other hand, the relevance condition has to do with the extent of fit or correlation between the IVs and the EEV. Relevant instruments are ones that correlate strongly with the EEV (Bascle, 2008). The stage 1 *F-statistics* developed by Stock and colleagues provides the most robust and conservative test of instrument relevance (Bascle, 2008). With one EEV (i.e., attention to threats) and five IVs (i.e., environment dynamism, slack resources, firm size, strategic mission rigidity, disruption orientation) in this study, the stage 1 *F-statistics* should be greater than 10.58 in order for the IVs to be regarded as relevant (Stock et al., 2002). The stage 1 results from the study (see Table 5.32) indicate that the IVs significantly explains 28.9% variance in attention to threats, given F (253) = 20.602, p < .001; indicating that they meet the

[35] The study uses STATA (version 15.0) and follows procedures discussed in Bascle (2008) to conduct these tests. To have an overidentified model while avoiding duplicate variables, the control variables, and the moderating

relevance condition. The results indicate that environment dynamism (β = .226, t = 4.083, p < .01), slack resources (β = .142, t = 2.516, p < .05), firm size (β = .230, t = 4.102, p < .01), strategic mission rigidity (β = -.169, t = -3.119, p < .01), and disruption orientation (β = .199, t

variables in the models of the dependent variables (disruption absorption and recoverability) were not included as predictors in these tests.

= 3.587, p < .01) are all significantly related attention to threats. Consistent with the theological arguments advanced in Section 4.4.7.1.3, these results support the use of 3SLS estimator to correct for potential endogeneity (Poppo *et al.,* 2016) of attention to threats. Accordingly, the study obtained and used the residual values of attention to threats that is free from the influence of environment dynamism, slack resources, firm size, strategic mission rigidity, and disruption orientation as an indicator for attention to threats.

Table 5.32: Stage 1 Regression and Instrument Relevance Results[1]

Independent variables	Standardised β (t-value)	VIF
Firm size	.230(4.102) ***	1.116
Slack resources	.142(2.516) **	1.129
Environment dynamism	.226(4.083) ***	1.094
Strategic mission rigidity	-.169(-3.119) ***	1.051
Disruption orientation	.199(3.587) ***	1.092
R^2	28.9%	
F	20.602***	
DF	253	

[1]Endogenous explanatory variable = attention to threats. **p < .05, ***p < .01.

In Stage 2, attention to threats $_{\text{residual}}$ was used as an indicator for attention to threats to test H1. It was additionally included as a control variable while testing for H4. First, disruption absorption and recoverability were regressed on attention to threats $_{\text{residual}}$, the main effect of the moderators (i.e., strategic mission rigidity and disruption orientation), and the control variables (i.e., slack resources, firm size, firm age, firm industry). Stage 2 model significantly accounted for 12.1% (*F* [251] = 4.922, p < .001) and 11.4% (*F* [251] = 4.636, p < .001) variance in disruption absorption and recoverability respectively. The main effects of the variables (attention to threats $_{residual}$, strategic mission rigidity, and disruption orientation) of interest alone significantly accounted for 5.4% (F [251] = 5.174, p < .01) and 3.6% (F [251] = 3.403, p < .05) variance in disruption absorption and recoverability respectively. The results shown in Table 5.33 indicate that the attention to threats $_{residual}$ has positive effects on disruption absorption (β = .198, t = 3.348, p < .01) and recoverability (β = .104, t = 1.754, p < .05), lending support for the H1 which stated that a*ttention to threats is positively related to operational resilience*. About the main effects of the moderators, the results show that while strategic mission rigidity does not have significant effect on either disruption absorption (β = -.023, t = -.408, p > .05) or recoverability (β = -.019, t = -.306, p > .05), disruption orientation has positive significant effect on recoverability (β = .123, t = 2.046, p < .05) and does not have significant effect on disruption absorption (β = .113 t = 1.832, p > .05). Second, operational efficiency was regressed on disruption absorption and recoverability and the control variables (i.e., attention to threats $_{residual}$, operational disruption, slack resources, firm size, firm age, firm industry). The results in Table 5.34 (see Model 1) show that attention to threats does not have direct effect on operational efficiency (β = -.008, t = -.125, p > .05). Further results (see Model 2) indicate that both disruption absorption (β = .143, t = 1.980, p < .05) and recoverability (β = .259, t = 3.614, p < .01) positively affect operational efficiency, lending support for H4 which stated that *operational resilience is positively related to operational efficiency*.

Stage 3 tested the moderating effects of strategic mission rigidity (SMR) and disruption orientation (DO) on the attention to threats $_{residual}$-operational resilience (disruption absorption and recoverability) link. To deal with multicollinearity issues resulting from use of product terms, the variables were orthogonalised using mean-centring approach (Little *et al.,* 2007). As shown in Table 5.33, the highest variance inflation factor was 1.639, indicating that multicollinearity was not an issue. Stage 3 model significantly accounted for 13.1% (F [249]

= 21.787, $p < .001$) and 7.6% (F [249] = 11.761, $p < .001$) additional variance in disruption absorption and recoverability. The results show that strategic mission rigidity negatively moderates the relationship between attention to threats and disruption absorption ($\beta = -.229$, $t = -3.897$, $p < .01$) and the relationship between attention to threats and recoverability ($\beta = .236$, $t = -3.861$, $p < .01$). These results lend support for H2, which argued that *the positive effect of attention to threats on operational resilience is strengthened at lower levels of strategic mission rigidity*. Again, the results show that disruption orientation positively moderates the relationship between attention to threats and disruption absorption ($\beta = .240$, $t = 4.098$, $p < .01$) and the relationship between attention to threats and recoverability ($\beta = .110$, $t = 1.801$, $p < .05$), lending support for H3 which stated that *the positive effect of attention to threats on operational resilience is strengthened at higher levels of disruption orientation.*

Table 5.33: Results for H1, H2, and H3

Independent variables:	Hypothesis	Standardised estimates (t-values) Disruption absorption Model 1	Model 2	Model 3	Recoverability Model 1	Model 2	Model 3	VIF	Conclusion
Covariates									
Firm industry (service =1)		.019(.305)	.021(.355)	-.018(-.325)	-.033(-.543)	-.032(-.526)	-.057(-.990)	1.035	
Firm age		-.040(-.547)	-.030(-.420)	-.054(-.802)	.005(.074)	.016(.221)	-.011(-.162)	1.513	
Firm size		.231(3.012)	.214(2.834)	.259(3.684)	.239(3.134)	.216(2.854)	.249(3.412)	1.639	
Slack resources		.102(1.605)	.089(1.418)	.095(1.626)	.083(1.304)	.063(1.007)	.078(1.288)	1.141	
Main effects									
Attention to threats (ATT)	H1: +		.198(3.348)	.200(3.534)		.104(1.754)	.085(1.444)	1.069	Supported
Strategic mission rigidity (SMR)			-.033(-.547)	-.023(-.408)		-.019(-.306)	-.018(-.306)	1.068	
Disruption orientation (DO)			.113(1.832)	.077(1.338)		.157(2.520)	.123(2.046)	1.112	
Interaction effects									
ATT × SMR	H2: -			-.229(-3.897)			-.236(-3.861)	1.146	Supported
ATT × DO	H3: +			.240(4.098)			.110(1.801)	1.142	Supported
R_2		6.6%	12.1%	25.2%	7.8%	11.4%	19.1%		
ΔR^2			5.4%	13.1%		3.6%	7.6%		
F of R^2		4.511^{**}	4.922^{***}	9.304^{***}	5.408^{***}	4.636^{***}	6.529^{***}		
F of ΔR^2			5.174^{**}	21.787^{***}		3.403^{*}	11.761^{***}		
DF		254	251	249	254	251	249		

Notes:

1. Model 2 tests H1. Model 3 tests H2 & H3.
2. Hypothesised paths are evaluated at t-value ≥ 1.645 (i.e., 5% significance level, 1-tailed test).

3. Non-hypothesised paths are evaluated at t-value ≥ 1.960 (i.e., 5% significance level, 2-tailed test).
4. *Model is significant at 5%, **Model is significant at 1%, ***Model is significant at .1%.

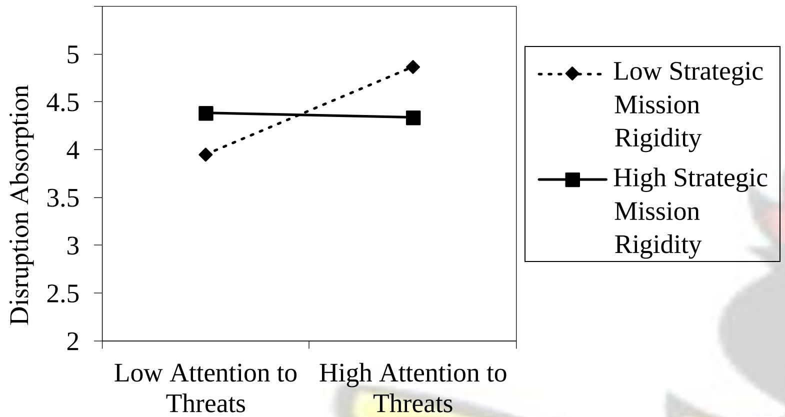
Figure 5.13 displays the results relating to the interaction effects (H2 & H3) while Figure 5.14 provides a summary of the findings relating to H1, H2, H3 and H4. Overall, the results in Table 5.33 (relating to the R^2 and the beta values) show that the independent variables of interest in the study (relating to H1, H2, and H3) better predict disruption absorption than recoverability.

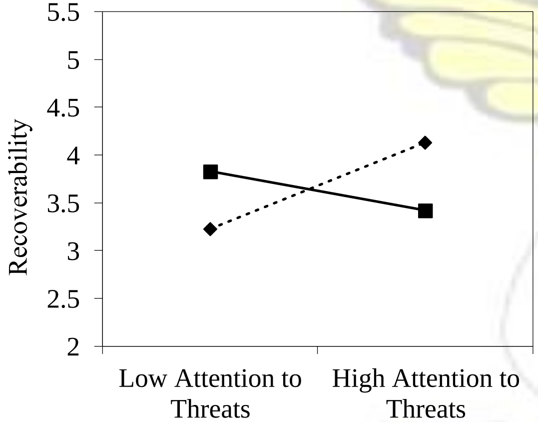
Table 5.34: Results for H4

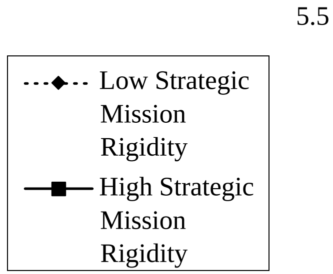
Independent variables:	Hypothesis	Standardised estimates (t-values) Model 1	Model 2	VIF	Conclusion
Control Paths					
Industry (service =1)		.099(1.588)	.106(1.796)	1.024	
Firm size		.028(.373)	.033(.462)	1.492	
Firm age		-.107(-1.364)	-.199(-2.636)	1.677	
Slack resources		.033(.506)	-.003(-.052)	1.119	
Operational disruption		-.123(-1.965)	-.089(-1.503)	1.039	
Attention to threats		-.008(-.125)	-.059(-.975)	1.059	
Hypothesised paths					
Disruption absorption Recoverability	H4		.143(1.980) .259(3.614)	1.525 1.504	Supported
R^2		3.5%	14.7%		
ΔR^2			11.3%		
F of R^2		1.518	5.404***		
F of ΔR^2			16.502***		
DF		252	250		

Notes:

1. Model 2 tests H4.
2. Hypothesised paths are evaluated at t-value ≥ 1.645 (i.e., 5% significance level, 1-tailed test).
3. Non-hypothesised paths are evaluated at t-value ≥ 1.960 (i.e., 5% significance level, 2-tailed test).
4. ***Model is significant at .1%.


Disruption Absorption
5
4.5
4
3.5
3
2.5
2
Low Attention to Threats
High Attention to Threats
Low Strategic Mission Rigidity
High Strategic Mission Rigidity


Recoverability
5.5
5
4.5
4
3.5
3
2.5
2
Low Attention to Threats
High Attention to Threats


5.5
Low Strategic Mission Rigidity
High Strategic Mission Rigidity

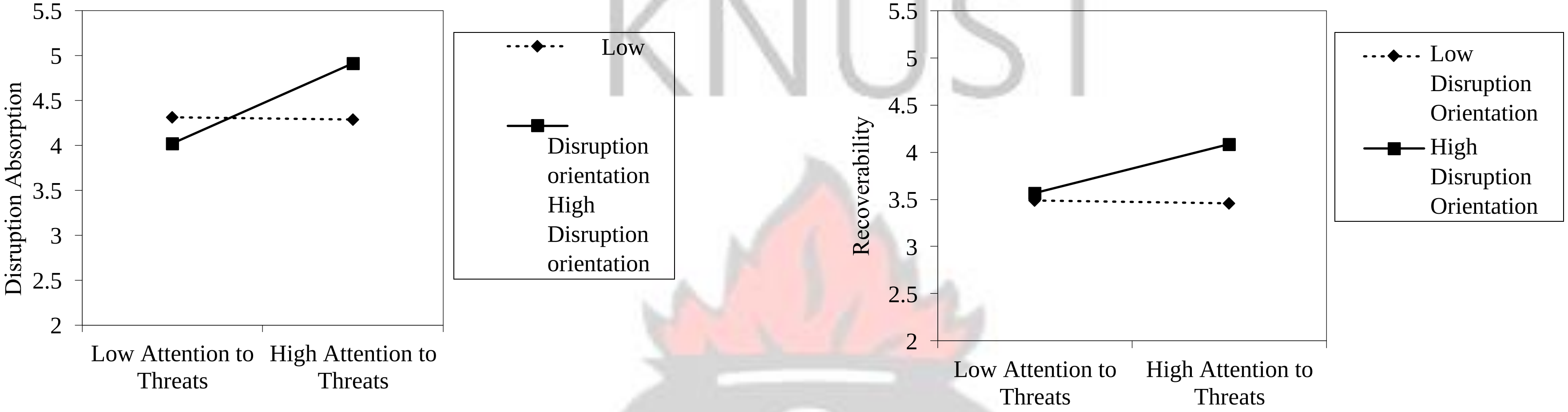
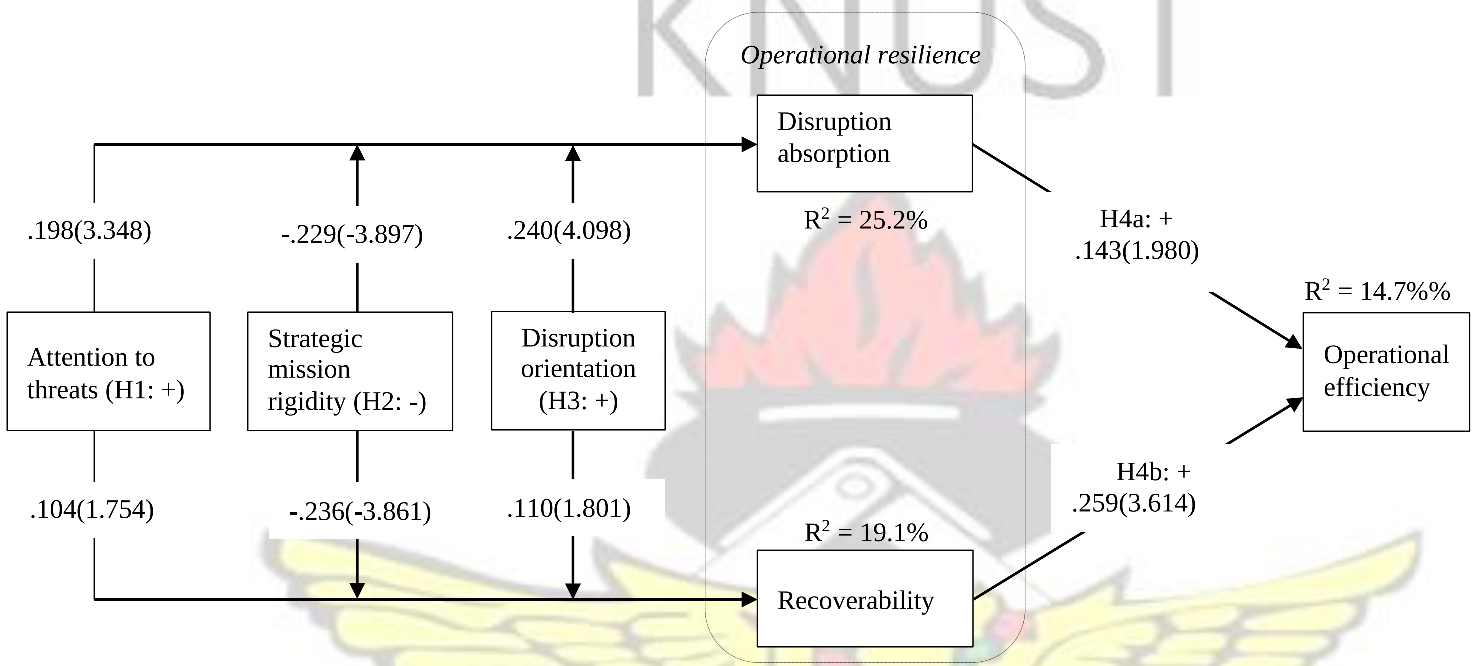


Figure 5.13: Surface of the Moderating Effects of Strategic Mission Rigidity and Disruption Orientation



Notes: Values presented in the figure are standardised estimates (t-values) (extracted from Tables 5.33 and 5.34). R^2 values include covariates and main effects of the moderators.

Figure 5.14: Summary of Main Findings and Hypothesis Evaluation

5.5 POST HOC ANALYSES

Three post hoc analyses were conducted in this study. The first focused on exploring if the research model is firm size-dependent while the second explored if attention to threats indirectly relates to operational efficiency through operational resilience, and whether this relationship is moderated by strategic mission rigidity and disruption orientation. The third explored if attention to threats has curvilinear relationships with operational resilience and operational efficiency.

5.5.1 Is the Research Model Firm Size-Dependent?

The study argues and finds that attention to threats positively relates to operational resilience (particularly, the disruption absorption dimension), and that the strength of this relationship is conditioned by differing levels of strategic mission rigidity and disruption orientation. Also, the consistent with the study's argument, it was found that operational resilience positively relates to operational efficiency. It must, however, be noted that the sample used to test the research model comprises firms that share different demographic characteristics, including size (small, medium, and large), industry type (service and manufacturing) and age. Among these three demographic variables, the results indicate that firm size relates positively to both attention to threats (β = .230, t = 4.102, p < .01) and operational resilience (disruption absorption [β = .231, t = 3.012, p < .01] and recoverability [β = .239, t = 3.134, p < .01]). These findings in fact suggest that large firms place more emphasis on attention to threats and are more operationally resilient. While firm size was controlled in all the analyses, it is still necessary to explore further whether the conclusions of the study relating to H1, H2, H3, and

H4 may change by focusing only on small firms or medium & large firms[36]. To do this, the research model was tested with the small firm sample data (n = 164) and also with the medium & large firm sample data (n = 95) using 3SLS estimator as described in Section 5.4.4 (or see Figure 5.11). However, this time, in Stage 1, the variables that attention to threats was regressed on excluded firm size. Among the small firms, results (see Table 5.35) relating to strategic mission rigidity, disruption orientation, slack resources, and environment dynamism obtained are similar to those obtained using the full dataset. Also, except for disruption orientation, similar results were found among the medium & large firms. It was found that the most important predictor of attention to threats among both groups of firms is environment dynamism.

Table 5.35. Standardised estimates of Stage 1 regression analyses (Small firms versus Medium & Large firms)[1]

	Small firms only (n = 164)		Medium & Large firms only (n = 95)	
Independent variables	β (t-value)	VIF	β (t-value)	VIF
Strategic mission rigidity	-.181(-2.547) *	1.078	-.163(-1.732)	1.015
Disruption orientation	.270(3.759) **	1.094	-.106(-1.097)	1.062
Slack resources	.185(2.594) **	1.079	.162(1.660)	1.083
Environment dynamism	.208(2.945) **	1.062	.391(4.128) ***	1.025
R^2	24.6%		22.2%	
F	13.064***		6.339***	
DF	160		89	

[1]Endogenous explanatory variable = attention to threats. *p < .05, **p < .01, ***p < .001.

The results of Stage 2 and Stage 3 models are shown in Tables 5.36, 5.37, and 5.38. Regarding H1, H2, and H3, the results show that the signs of the coefficient for the hypothesised paths remained unchanged in the case of small firms and medium & large firms. Specifically, the results show that in the context of small firms, attention to threats positively relates to disruption absorption ($\beta = .155$, $t = 2.021$, $p < .05$), but not recoverability ($\beta = .066$, $t = .860$, p

[36] The analysis could not be conducted separately with data from medium firms (n = 71) and large firms (n =23) as the sample were too small relative to the number of independent variables in the models to detect significant effects.

> .05). Thus, for H1, partial support was found. In the case of the medium & large firms, the results show that attention to threats positively relates to both disruption orientation (β = .428, t = 4.211, p < .01) and recoverability (β = .254, t = 2.318, p < .05), lending for support for H1.

Also, in the case of the small firms, the results indicate that strategic mission rigidity negatively moderates the relationship between attention to threats and disruption absorption (β = -.262, t = -3.383, p < .01), and also the relationship between attention to threats and recoverability (β = -.245, t = -3.030, p < .01). These results indicate that even in the context of small firms, the positive relationship between attention to threats and operational resilience (both disruption absorption and recoverability) is strengthened for firms that score low on strategic mission rigidity, relative to those that score high on strategic mission rigidity. This finding lends support for H2. Among the medium & large firms, however, strategic mission rigidity was found to moderate the relationship between attention to threats and recoverability (β = .284 t = -2.617, p < .01) negatively, but not the relationship between attention to threats and disruption absorption (β = -.073, t = -.692, p > .05), lending partial support for H2. Also, in the case of small firms, the results show that disruption orientation positively moderates the relationship between attention to threats and disruption absorption (β = .212, t = 2.756, p < .01), but not the relationship between attention to threats and recoverability (β = .065, t = .816, p > .05), lending partial support for H3. Among the medium & large firms, however, the results show that disruption orientation positively moderate relationships between attention to threats and both disruption absorption (β = .362, t = 3.390, p < .01) and recoverability (β = .312, t = 2.825, p < .01), lending support for H3.

Table 5.36

: Results for H1, H2, and H3 using Small Firm Sample Only (n = 164)

		Standardised estimates (t-values)							
		Disruption absorption			Recoverability				
Independent variables:	Hypothesis	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	VIF	Conclusion
Covariates									
Firm industry (service =1)		.024(.311)	.029(.370)	.000(.003)	-.007(-.089)	-.010(-.133)	-.025(-.328)	1.026	
Slack resources		.148(1.881)	.129(1.652)	.146(1.979)	.133(1.683)	.111(1.418)	.133(1.735)	1.064	
Firm age(log)		.011(.133)	.016(.201)	-.019(-.256)	.069(.874)	.075(.963)	.040(.523)	1.054	
Main effects									
Attention to threats (ATT)	H1: +		.155(2.021)	.163(2.165)		.066(.860)	.044(.563)	1.108	Partially supported
Strategic mission rigidity (SMR)			.016(.198)	-.001(-.008)		-.031(-.384)	-.064(-.796)	1.147	
Disruption orientation (DO)			.174(2.174)	.145(1.891)		.196(2.440)	.158(1.984)	1.146	
Interaction effects									
ATT × SMR	H2: -			-.262(-3.383)			-.245(-3.030)	1.180	Supported
ATT × DO	H3: +			.212(2.756)			.065(.816)	1.158	Partially supported
R_2		2.2%	7.6%	20.5%	2.0%	6.8%	13.4%		
ΔR^2			5.5%	12.9%		4.8%	6.6%		
F of R^2		1.194	2.180^{*}	5.042^{***}	1.110	1.916	3.006^{**}		
F of ΔR^2			3.119^{*}	12.662^{***}		2.688^{*}	5.918^{***}		
DF		161	158	156	161	158	156		

Notes:

1. Model 2 tests H1. Model 3 tests H2 & H3.
2. Hypothesised paths are evaluated at t-value ≥ 1.645 (i.e., 5% significance level, 1-tailed test).
3. Non-hypothesised paths are evaluated at t-value ≥ 1.960 (i.e., 5% significance level, 2-tailed test).
4. *Model is significant at 5%, **Model is significant at 1%, ***Model is significant at .1%.

Table 5.37

: Results for H1, H2, and H3 using Medium & Large Firm Sample Only (n = 95)

		Standardised estimates (t-values)						VIF	Conclusion
		Disruption absorption			Recoverability				
Independent variables:	Hypothesis	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3		
Covariates									
Firm industry (service =1)		.022(.205)	-.033(-.333)	-.092(-1.006)	-.041(-.386)	-.055(-.520)	-.115(-1.211)	1.096	
Slack resources		.083(.792)	.116(1.176)	.094(1.028)	.037(.352)	.057(.534)	.048(.506)	1.079	
Firm age(log)		-.016(-.149)	-.048(-.489)	-.051(-.561)	-.126(-1.192)	-.136(-1.295)	-.154(-1.657)	1.051	
Main effects									
Attention to threats (ATT)	H1: +		.428(4.211)	.368(3.849)		.254(2.318)	.159(1.610)	1.184	Supported
Strategic mission rigidity (SMR)			-.194(-1.984)	-.190(-1.977)		-.008(-.072)	.061(.616)	1.198	
Disruption orientation (DO)			-.008(-.078)	-.156(-1.517)		.040(.357)	-.109(-1.025)	1.375	
Interaction effects									
ATT × SMR	H2: -			-.073(-.692)			-.284(-2.617)	1.428	Partially supported
ATT × DO	H3: +			.362(3.390)			.312(2.825)	1.477	Supported

Table 5.38

R^2	.8%	21.0%	34.4%	2.1%	8.0%	29.7%
ΔR^2		20.3%	13.4%		5.8%	21.8%
F of R^2	.228	3.865**	5.576***	.656	1.258	4.498***
F of ΔR^2		7.453***	8.666***		1.842	13.162***
DF	90	87	85	90	87	85

Notes:

1. Model 2 tests H1. Model 3 tests H2 & H3.
2. Hypothesised paths are evaluated at t-value ≥ 1.645 (i.e., 5% significance level, 1-tailed test).
3. Non-hypothesised paths are evaluated at t-value ≥ 1.960 (i.e., 5% significance level, 2-tailed test).
4. *Model is significant at 5%, **Model is significant at 1%, ***Model is significant at .1%.

: Results for H4 across Small and Medium & Large Firm Samples

Independent variables:	Hypothesis	Standardised estimates (t-values)					
		Small Firms (n = 164)			Medium & Large Firms (n = 95)		
Covariates		Model 1	Model 2	Conclusion	Model 1	Model 2	Conclusion
Industry (service =1)		.049(.623)	.044(.630)		.160(1.510)	.157(1.455)	
Firm age		.056(.713)	.033(.468)		.081(.779)	.075(.706)	

Table 5.39

Slack resources		.122(1.551)	.052(.731)		-.177(-1.725)	-.182(-1.746)	
Operational disruption		-.126(-1.593)	-.074(-1.041)		-.062(-.588)	-.065(-.605)	
Attention to threats		-.026(-.325)	-.069(-.973)		.068(.656)	.052(.453)	
Hypothesised path							
Disruption absorption	H4: +		.144(1.715)	Supported		.073(.567)	Not supported
Recoverability			.375(4.516)			-.060(-.490)	
R^2		3.5%	24.3%		9.2%	9.6%	
ΔR^2			20.9%			.4%	
F of R^2		1.137	7.204***		1.781	1.304	
F of ΔR^2			21.635***			.191	
DF		159	157		88	86	

Notes:

1. Dependent variable: Operational efficiency
2. Model 2 tests H4.
3. Hypothesised paths are evaluated at t-value ≥ 1.645 (i.e., 5% significance level, 1-tailed test).
4. Non-hypothesised paths are evaluated at t-value ≥ 1.960 (i.e., 5% significance level, 2-tailed test).
5. ***Model is significant at .1%.

Moreover, among the small firms, the results (see Table 5.38) show that disruption absorption (β = .144, t = 1.715, p < .05) and recoverability (β = .375, t = 4.516, p < .01) positively relate to operational efficiency, lending support for H4. In the case of the medium & large firms, no support was found for H4, given the following results: disruption absorption → operational efficiency: β = .073, t = .567, p > .05; and recoverability → operational efficiency: β = -.060, t = -.490, p > .05.

In sum, these results relating to H1, H2, H3 appears invariant across small firms and medium & large firms, strengthening the study's arguments for these hypotheses. However, the results for H4 varies significantly between small firms and medium & large firms. Specifically, unlike the context of small firms, no statistical support was found for H4 in the context of medium & large firms.

5.5.2 The Path from Attention to Threats to Operational Efficiency

This study mainly focused on developing and testing a model about the antecedent and performance outcome of operational resilience. In so doing, the study proposed attention to threats and operational efficiency as antecedent and outcome of operational resilience respectively. Nonetheless, as part of the post-hoc analysis, the study explored whether the antecedent variable affects the outcome variable. This analysis was necessary as it has been recognised that resilience-building requires resource investment (Li *et al.*, 2017) and that may have implication on operational inefficiency (van der Vegt *et al.*, 2015; World Economic Forum Report, 2013). Attention to threats constitutes resource investment in non-revenue generating activity, and thus has implication on operational inefficiency. In fact, the SEM results (see Figures 5.9a and 5.9b) on the nomological net for attention to threats appear to lend support for the assertion that resilience building initiatives tend to be associated with operational inefficiency, given β = -.15, t = -2.11, p < .05. Nonetheless, a more interesting finding from the SEM results is that operational resilience appears to positively mediate the relationship between attention to threats and operational efficiency. It is seen that the paths from attention to threats to both disruption absorption (β = .34, t = 5.17, p < .01) and recoverability (β = .28, t = 4.36, p < .01) are positive and statistically significant (as suggested by H1). Also, the paths from disruption absorption (β = .15, t = 1.70, p > .05) and recoverability (β = .26, t = 3.06, p < .01) to operational efficiency are positive as suggested by H4. It must, however, be noted that the estimation of the nomological net for the attention to threats model did not include any controls or IVs.

Besides, as argued by Rucker *et al.* (2011), an appropriate way to evaluate mediation model is to test the significance of the indirect effect, rather than assessing the significance of the bivariate relationships in the indirect effect path. Accordingly, to conclude on how attention to threats affects operational efficiency via operational resilience, the study used Hayes' PROCESS (in SPSS, model number 4) to test the indirect effect paths, while controlling for the potential effects of operational disruption, slack resources, firm size, firm age, and firm industry on operational efficiency. Also, to address the issue of endogeneity relating to attention to threats, Stage 1 model in Figure 5.12 was estimated to obtain a residual (as an indicator) for attention to threats that is free from the influence of slack resources, environment dynamism, strategic mission rigidity, firm size, and disruption orientation. The results on the paths from attention to threats to the mediators (disruption absorption and recoverability) and the outcome (operational efficiency) and the paths from the mediators to the outcome have been reported in Tables 5.33 and 5.34[37]. As shown in Table 5.34 (Model 2), after correcting for endogeneity of attention to threats and also, including relevant controls in the paths to operational efficiency, the results obtained show that attention to threats is not related directly

[37] The results relating to the paths from attention to threats to the mediators (disruption absorption and recoverability) remain unchanged even when no controls are included in the models of the mediators.

to operational efficiency (β = -.008, t = -.125, p > .05). The indirect effect results presented in Table 5.39 indicate that only disruption absorption positively mediates the attention to threats–operational efficiency relationship (given that the confidence interval for the indirect effect does not include zero). The total indirect effect was not statistically significant.

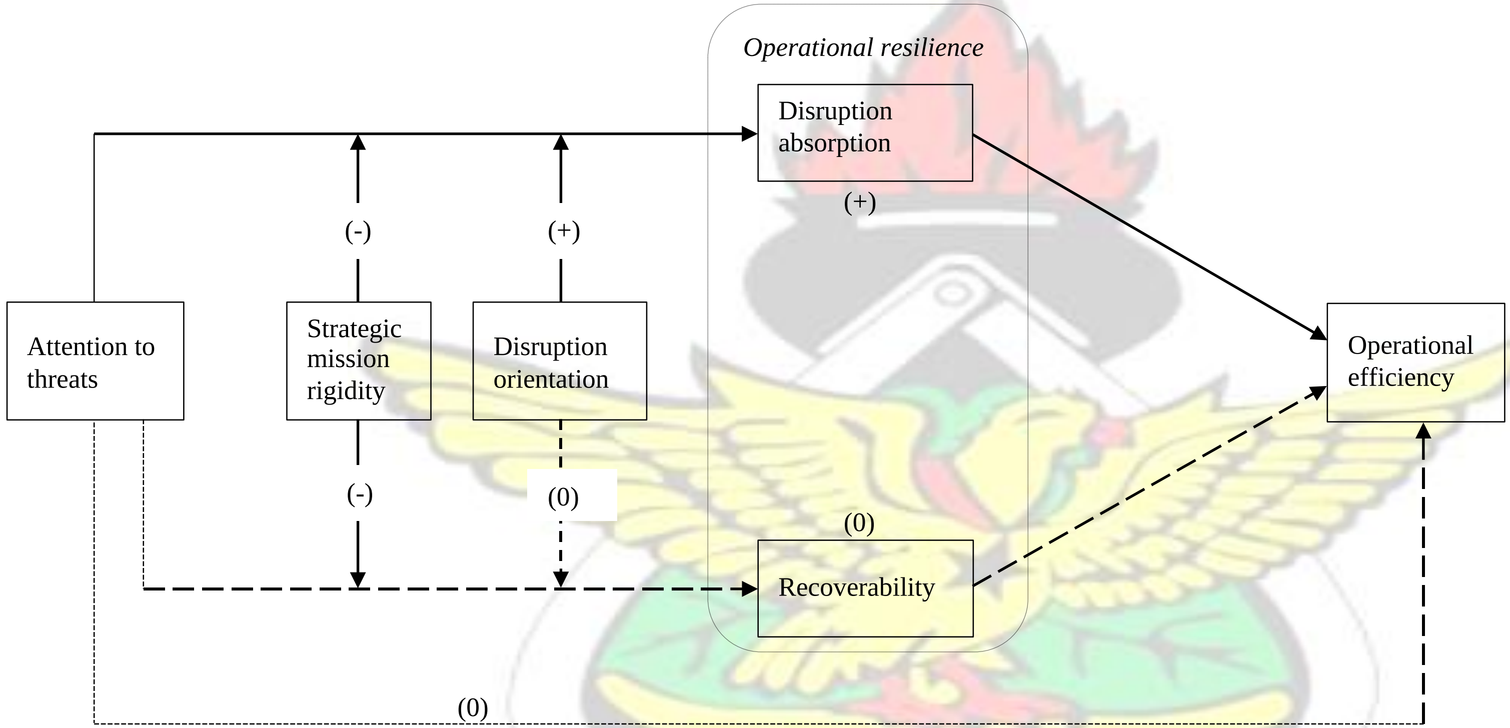
A further analysis was conducted to determine whether the indirect effect of attention to threats on operational efficiency via operational resilience is moderated by strategic mission rigidity and disruption orientation. This analysis was also conducted using Hayes' PROCESS (in SPSS, model number 9). The procedure used to test the mediation effect as described above was utilised. The results obtained as shown in Table 5.40 indicate that strategic mission rigidity significantly weakens the positive indirect effect of attention to threats on operational efficiency via both disruption absorption and recoverability. Disruption orientation was only found to moderate (positive) the indirect effect of attention to threats on operational efficiency via disruption absorption. Figure 5.15 summaries the results relating to this post hoc analysis.

Table 5.39: Test of Indirect Effect of Attention to Threats (X) on Operational Efficiency (Y)

Effect of X on Y via…	*Effect*	*Boot SE*	*Boot LLCI*	*Boot ULCI*
Disruption absorption	.0271	.0182	.0016	.0774
Recoverability	.0260	.0201	-.0084	.0719
Total	.0532	.0305	-.0001	.1177

Table 5.40: Test of Conditional Indirect Effect of Attention to Threats (X) on Operational Efficiency (Y)

Moderator	*Effect of X on Y via…*	*Index of partial moderated mediation*	*Boot SE*	*Boot LLCI*	*Boot ULCI*
Strategic mission rigidity	Disruption absorption	-.0161	.0100	-.0422	-.0016
	Recoverability	-.0309	.0137	-.0655	-.0094
Disruption orientation	Disruption absorption	.0267	.0159	.0023	.0681
	Recoverability	.0185	.0139	-.0055	.0507



Notes: Solid lines indicate significant indirect and conditional indirect effect paths. Dotted lines indicate insignificant indirect, direct, and conditional indirect effect paths.

Figure 5.15: Summary of Results for the Path from Attention to Threats to Operational Efficiency

5.5.3 Form of Relationships between Attention to Threats and its Outcomes: Beyond Linearity

The form of relationship between attention allocation variables and their suggested outcomes may be quite complex. While some studies (Clercq and Zhou, 2014; Yadav *et al.,* 2007) suggest linear effects of attentional focus variables, others (e.g., Bouquet et al. 2009; Jääskeläinen *et al.,* 2006) suggest curvilinear effects (specifically, inverted *U*-shaped). In Levinthal and Rerup's (2006) view, the association between any particular attention practice "…particular outcomes, particularly more-or-less favorable performance outcomes, cannot be presupposed but must be derived through analysis and empirical observation" (p. 510). The analyses conducted so far have assumed that attention to threats has linear implications on operational resilience and operational efficiency. To raise further deliberation on the dominant "more-isbetter" perspective on resilience-building effort, while not forgetting a possible "less-is-better" perspective (van der Vegt *et al.*, 2015), this section explores whether different levels of attention to threats are associated differently with operational resilience and operational efficiency.

Some prior studies (e.g., Laursen and Salter, 2006; Bouquet *et al.*, 2009; Jääskeläinen *et al.*, 2006) show that extreme level of attentional focus has negative implications. But why might some firms place extreme emphasises on attention to threats? In part, the answer to this question is that firms may be unaware about placing extreme emphasis on attention to threats as what is

'optimum' level in this sense is invisible and constantly shifting (depending on the comparative priority of other factors) (Bouquet *et al.,* 2009). Other things being equal, two related reasons may suffice for why firms may stretch emphasis on attention to threats too far. First, for fear of the impacts and costs of disruptions, management may be tempted to put disruption mentality before competition logic (Fujimoto, 2011). In such situations, one can expect

management to place extreme emphasis on attention to threats. Second, past economic benefits reaped from increased emphasis on attention to threats can boost management confidence to go the extra mile (Bouquet *et al.*, 2009).

The potential curvilinear implications of attention to threats were explored by estimating the effects of the product of ATT $_{residual}$[38] (as obtained in Stage 1 in Figure 5.12) on disruption absorption, recoverability, and operational efficiency. The model specifications are summarised in Figure 5.16. The results (see Table 5.41) indicate that attention to threats has significant inverted *U*-shaped relationships with both disruption absorption and recoverability, but significant *U*-shaped relationship with operational efficiency.

Model 1…………………………………………….....control effect models

$$DA = \beta_0 + \beta_1 FI + \beta_2 FA + \beta_3 FS + \beta_4 SR + \beta_5 SMR + \beta_6 DO + \beta_7 ATT_{residual} + e.$$

$$R = \beta_0 + \beta_1 FI + \beta_2 FA + \beta_3 FS + \beta_4 SR + \beta_5 SMR + \beta_6 DO + \beta_7 ATT_{residual} + e.$$

$$OE = \beta_0 + \beta_1 FI + \beta_2 FA + \beta_3 FS + \beta_4 SR + \beta_5 OD + \beta_6 ATT_{residual} + \beta_7 DA + \beta_8 R + e.$$

Model 2…………………………………………….curvilinear effect models

$$DA = \beta_0 + \beta_1 FI + \beta_2 FA + \beta_3 FS + \beta_4 SR + \beta_5 SMR + \beta_6 DO + \beta_7 ATT_{residual} + \beta_8 (ATT_{residual} \times ATT_{residual}) + e.$$

$$R = \beta_0 + \beta_1 FI + \beta_2 FA + \beta_3 FS + \beta_4 SR + \beta_5 SMR + \beta_6 DO + \beta_7 ATT_{residual} + \beta_8 (ATT_{residual} \times ATT_{residual}) + e.$$

$$OE = \beta_0 + \beta_1 FI + \beta_2 FA + \beta_3 FS + \beta_4 SR + \beta_5 OD + \beta_6 ATT_{residual} + \beta_7 DA + \beta_8 R + \beta_9 (ATT_{residual}^2) + e.$$

Where DA = disruption absorption, R = recoverability, ED = environment dynamism, SR = slack resources, FS = firm size, FA = firm age, FI = firm industry (service =1, manufacturing =0), ATT $_{residual}$ = attention to threats residual, SMR = strategic mission rigidity, DO = disruption orientation, OD = operational disruption, OE = operational efficiency, ATT $_{residual}^2$ = squared term of attention to threats residual, β_0 = *constants,* β_{1-9} = *regression coefficients,* e = error terms

Figure 5.16: Model Specifications regarding the Curvilinear Effects of Attention to Threats

[38] Residual centring approach was used to obtain a pure interaction term.

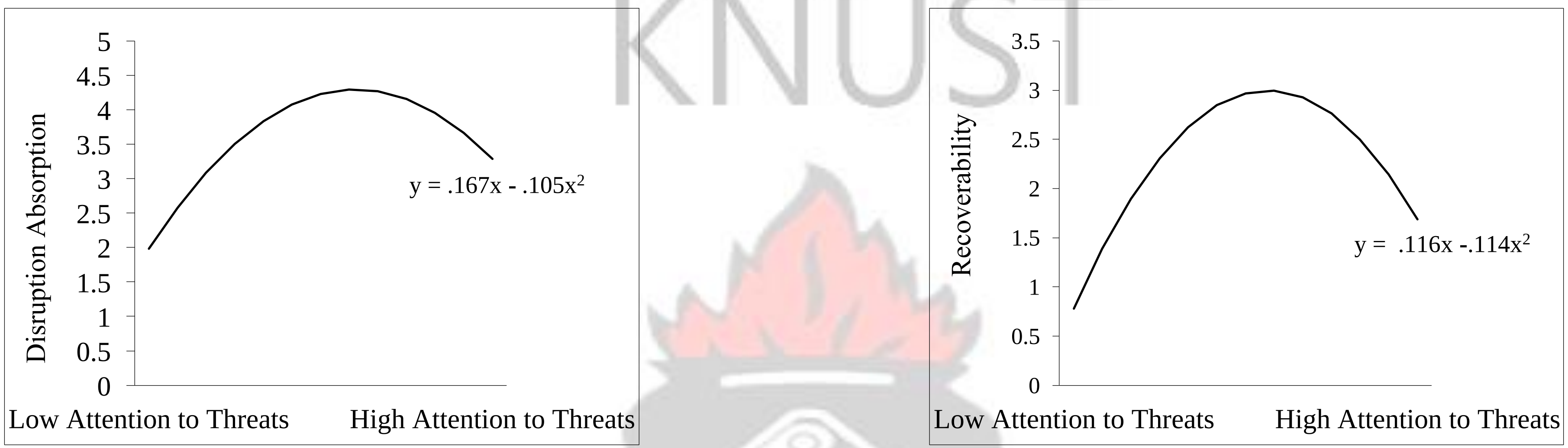
Table 5.41: Curvilinear Effects of Attention to Threats on Operational Resilience and Operational Efficiency

Independent variables	Standardised estimates (t-values)						VIF
	Disruption absorption		Recoverability		Operational efficiency		
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	
Covariates							
Industry (service =1)	.021(.355)	.007(.125)	-.032(-.526)	-.043(-.733)	.106(1.796)	.112(1.922)	1.026
Firm size (log)	-.030(-.420)	-.027(-.381)	.016(.221)	.019(.269)	.033(.462)	.029(.417)	1.492
Firm age (log)	.214(2.834)	.177(2.413)	.216(2.854)	.186(2.492)	-.199(-2.636)	-.185(-2.472)	1.686
Slack resources	.089(1.418)	.069(1.126)	.063(1.007)	.047(.753)	-.003(-.052)	.007(.113)	1.124
Operational disruption					-.089(-1.503)	-.101(-1.708)	1.045
Strategic mission rigidity	-.033(-.547)	-.063(-1.068)	-.019(-.306)	-.044(-.723)			1.075
Disruption orientation	.113(1.832)	.087(1.437)	.157(2.520)	.134(2.197)			1.107
Attention to threats (ATT)	.198(3.348)	.198(3.455)	.104(1.754)	.104(1.788)	-.059(-.975)	-.068(-1.147)	1.064
Disruption absorption					.143(1.980)	.175(2.422)	1.573
Recoverability					.259(3.614)	.277(3.888)	1.519
ATT^2		-.250(-4.240)		-.207(-3.449)		.159(2.578)	1.136

R_2	12.1%	18.0%	11.4%	15.5%	14.7%	17.0%
ΔR^2		5.9%		4.0%		2.2%
F of R^2	4.922^{***}	6.845^{***}	4.636^{***}	5.720^{***}	5.404^{***}	5.651^{***}
F of ΔR^2		17.978^{***}		11.897^{**}		6.646^{*}
DF	251	250	251	250	250	249

Notes:

1. All paths are evaluated at t-value ≥ 1.96 (i.e., 5% significance level, 2-tailed test).
2. *Model significant at 5%, **Model significant at 1%, ***Model significant at .1%.



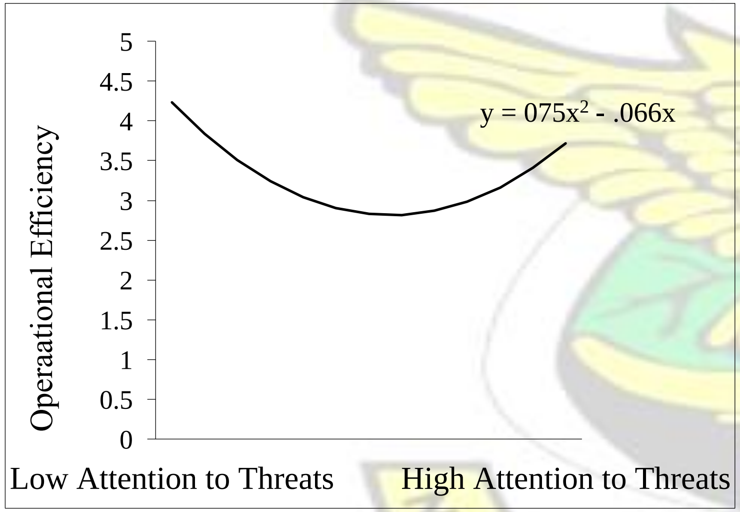


Figure 5.17: Surface of the Curvilinear Effects of Attention to Threats

5.6 CHAPTER SUMMARY

This chapter focused on testing and evaluating the research model and hypotheses developed in Chapter 3. The chapter began by exploring the data to ensure that they are appropriate for testing the proposed model. Next, the chapter validated the multi-item scales used to capture the constructs. In addition, relevant assumptions relating to the use of multivariate data analysis techniques were evaluated.

The research model suggests that attention to threats positively relates to operational resilience (disruption absorption and recoverability) (H1), and that the relationship between these variables is negatively moderated by strategic mission rigidity (H2) and positively moderated by disruption orientation (H3). Also, the model suggests that operational resilience positively relates to operational efficiency (H4). The results obtained using 3SLS estimator show that attention to threats relates positively and significantly with both disruption absorption and recoverability dimensions of operational resilience. Also, the results indicate that the positive relationships between attention to threats and both dimensions of operational resilience are significantly weakened by strategic mission rigidity, but significantly strengthened by disruption orientation. Moreover, the results show that operational resilience positively relates to operational efficiency. These findings are consistent with the study's hypotheses (H1, H2, H3, and H4).

Notwithstanding these findings, three additional analyses were conducted to explore for further insights. The first focused on finding out if the research model fits within the contexts of small firms only and medium & large firms only. The results obtained were largely consistent with H1, H2, and H3 but not H4. The second explored the direct, indirect, and the conditional indirect paths from attention to threats to operational efficiency. First, the results show that attention to threats is not directly related to operational efficiency. Second, the results show that only disruption absorption positively and significantly mediates the relationship between attention to threats and operational efficiency. Third, it was found that strategic mission rigidity significantly weakens the positive indirect effect of attention to threats on operational efficiency via both disruption absorption and recoverability. It was additionally found that disruption orientation significantly strengthens the positive indirect effect of attention to threats on operational efficiency via disruption absorption, but not recoverability. The third analysis explored whether attention to threats is curvilinearly related to operational resilience and operational efficiency. The results obtained indicate that attention to threats has inverted *U*shaped relationships with both disruption absorption and recoverability but *U*-shaped relationship with operational efficiency. Discussion relating to these findings are presented in the next chapter.

CHAPTER SIX

DISCUSSION AND CONCLUSION

6.1 INTRODUCTION

This chapter discusses the theoretical and managerial implications of findings from the study. In addition, it discusses the theoretical and methodological limitations of the study and avenues for further research. Lastly, it presents the conclusion of the study. The chapter is organised as follows: main discussion and theoretical implications, further discussion and theoretical implications, implications for practice, limitations and directions for further research, and conclusion.

6.2 MAIN DISCUSSION AND THEORETICAL IMPLICATIONS

Advancing the frontiers of knowledge of drivers and outcomes of operational resilience is important for building resilient societies as societal welfare depends on the sustenance of business operations (van der Vegt *et al.,* 2015; Buyl *et al.,* 2017). This research is a novel attempt to integrate important bodies of literature to develop the operational resilience construct and investigate its attention-based drivers and operational efficiency consequence. The study conceptualises operational resilience as a di-dimensional construct, formed by the disruption absorption and recoverability elements of resilience. Again, the study introduces the ABV into the resilience literature to understand the role of organisational attention in driving resilience. It proposes the notion of attention to threats as an antecedent of operational resilience and further examines the moderating roles of two attention structures: strategic mission rigidity and disruption orientation; in the attention to threats-operational resilience link. Moreover, the study investigates operational efficiency as an outcome of operational resilience. In doing so, it draws on the RBV to explain why superior performance outcomes may be associated with high levels of operational resilience. Key findings from the study are discussed in the subsequent sections.

6.2.1 Conceptual Domain of Operational Resilience

The study first develops and analyses the conceptual domain of operational resilience. Unlike prior research (Birkie *et al.*, 2017), this study follows Davidson *et al.* (2016) to propose that operational resilience is, and can be analysed as, a concept distinct from its potential drivers. The core theoretical components of resilience are many (Davidson *et al.*, 2016). However, the study suggests that at the operations level of the firm, the components that apply include disruption absorption and recoverability. This proposition is grounded in the systems theory, Holling's (1973) and Meyer's (1982) seminal studies, the original dictionary view of resilience (Brandon-Jones *et al.*, 2014; van der Vegt *et al.*, 2015), the idea that firms have stability and continuity motives (Bode *et al.*, 2011) regarding their operations at any point in time, and relevant cases. Integrating insights from these bodies of literature, the study defines operational resilience as the ability of a firm's operations to absorb and recover from disruptions (van der Vegt *et al.*, 2015; Buyl *et al.*, 2017).

Disruption absorption is defined as the ability of the firm to maintain the structure and normal functioning of operations in the face of disruptions while recoverability is defined as the ability of the firm to restore operations to a prior normal level after being disrupted. These components of operational resilience are argued as distinct organisational capabilities that preserve how the firm makes a living in the present in the face of disruptions. Further, the study suggests that these capabilities exist independent of each other and that neither of them constitutes operational capability nor dynamic capability. It is argued that neither disruption absorption nor recoverability is used to perform or alter primary activities that earn the firm a living; rather, they enable firms to manage disruptions in ways that do not modify their current domain of operations.

Again, it is suggested that notwithstanding their theoretically independent nature, these components of operational resilience can correlate positively as they may be underpinned by same resource-base (Blackhurst *et al.,* 2011) or driven by same resilience-building strategies (e.g., attention to threats as argued in the study). Consistent with these propositions, the study finds that the scales tapping into disruption absorption and recoverability demonstrate discriminant validity, although they are positively related, and that the scale tapping into attention to threats correlates positively with those of disruption absorption and recoverability. These findings corroborate Brandon-Jones *et al.*'s (2014) arguments and findings that supply chain resilience (i.e., recoverability) is unique and different from supply chain robustness (i.e., disruption absorption), although both are driven by supply chain visibility.

6.2.2 Attention-Based Drivers of Operational Resilience

Second, the study examines attention to threats, strategic mission rigidity, and disruption orientation as attention-based drivers of operational resilience. Attention to threats is proposed as an attentional focus construct while strategic mission rigidity and disruption orientation are conceptualised as attention structures that moderate the effect of attention to threats. Findings relating to this research objective are discussed as follows:

6.2.2.1 Attention to Threats and Operational Resilience

Drawing on the ABV, study develops the hypothesis (H1) that attention to threats positively relates to operational resilience (in terms of disruption absorption and recoverability). The results from the study support H1. This finding collaborates the arguments that attention to threats improves visibility and forecast accuracy (Durand, 2003), disruption-specific knowledge capacity, and ability to detect weak cues that signal potential disruptions (Rerup,

2009; McMullen *et al.*, 2009); allowing firms to respond swiftly and effectively to disruptions (Brandon-Jones *et al.*, 2014). The finding from the study lends further support to the report that Nokia's operations was more resilient (compared to that of Ericsson) when faced with supplierrelated disruption as it was more prepared and was able to notice the problem earlier (Latour,
2001). Again, the finding is consistent with the view that investment in disruption-preparedness (in general) is critical to the ability to absorb and recover from disruptions (Sheffi and Rice, 2005; Pettit *et al.*, 2013).

Despite the results indicating that attention to threats positively relates to both components of operational resilience, it was found that the attention to threats-recoverability link was weak. This finding implies that investing in disruption-preparedness may be more effective in cushioning operations in the face of disruptions (i.e., contributing to disruption absorption). However, when operational failure occurs, preparedness may matter less. Attention to threats helps in the development of scenarios regarding the impacts of disruptions and how to initiate and perform remedial actions. However, whether such prior developed remedial actions will be appropriate or resorted to in events of disruptions, are different questions altogether. Due to fear of escalated consequences of disruptions, operational failure will normally require timebound responses that may not follow pre-developed response procedures. Thus, the study speculates that in such a situation, fire-fighting or improvisation strategy could be resorted to. In this case, the contribution of attention to threats to recoverability can be trivial.

Moreover, a post hoc analysis shows that there is a limit to the operational resilience benefit of attention to threats: extreme levels of attention to threats are associated with low levels of both disruption absorption and recoverability, a finding that is quite counterintuitive but the disruption-preparedness literature sheds little light on. However, it is consistent with prior ABV-studies (e.g., Laursen and Salter, 2006; Bouquet *et al.,* 2009; Jääskeläinen *et al.,* 2006) that find that organisational/managerial attentional focus variables tend to have invented *U*shaped effects. A possible explanation is that there are general limits to firms' information processing abilities (Bouquet *et al.*, 2009) and extreme levels of attention can lead to information overload, which may make firms less effective in processing information from the business environment and responding appropriately to disruptions. Besides, extreme emphasis on attention to threats may make firms lose sight of opportunities (e.g., developing new business processes/business models and purchasing a new technology) that can minimise their exposure to disruptions and sensitivity to the impacts of disruptions. Thus, while increases in attention to threats will lead to increases in operational resilience, beyond a certain limit, further increases in attention to threats may reduce operational resilience.

That attention to threats constitutes disruption-preparedness makes the findings discussed above interesting and useful for rethinking about the conceptualisation of disruptionpreparedness as a theoretical component of resilience (Ponomarov and Holcomb, 2009; Chowdhury and Quaddus, 2016:2017; Macdonald and Corsi, 2013; Kamalahmadi and Parast, 2016). Indeed, the assumption that disruption-preparedness is a component of resilience has led to less scholarly effort in examining how it is related to the core components of the concept (including disruption absorption, recoverability, adaptability, and transformability [Davidson *et al.*, 2016]). From the ABV-standpoint, it is challenging to assume that firms scoring high on investment in disruption-preparedness strategies are more resilient to disruptions. While disruption-preparedness may be a formative indicator of the core components of resilience, findings from the study suggest that basing on it to make inferences about the contributions of resilience (i.e., in terms of its core theoretical components) to business performance outcomes as done in prior research (Li *et al.,* 2017; Birkie *et al.,* 2017) can be quite problematic. This assertion is consistent with the school of thought that argues that while disruption-preparedness is important, engaging in it does not necessarily make a firm resilient as resilience can only be determined when a system is exposed to disruptions (Sutcliffe and Vogus, 2007; Weick *et al.*, 1999; Davidson *et al.*, 2016).

6.2.2.2 Moderating Effects of Strategic Mission Rigidity and Disruption Orientation

In line with the contingency theory (Donaldson, 2006), the study posits that strategic mission rigidity (H2) and disruption orientation (H3) respectively moderate the relationship between attention to threats and operational resilience negatively and positively. Results from the study indicate that at high levels of strategic mission rigidity, the positive relationships between attention to threats and both disruption absorption and recoverability become weaker, lending support for H2. This finding largely corroborates those reported in Atuahene-Gima *et al.* (2005) and Li *et al.* (2008). In their study of the effect of proactive market orientation, Atuahene-Gima *et al.* (2005) find that strategic mission rigidity weakens the positive effect of proactive market orientation on new product program performance while Li *et al.* (2008) find that the positive effect of proactive market orientation on incremental innovation becomes negative among firms scoring high on strategic mission rigidity. Attention to threats, due to its information search and processing nature, enhances the firm's intrusiveness and visibility in the business environment and responses to disruptions. However, strategic mission rigidity restricts external information search and interpretations as well as learning (Li *et al.*, 2008; Atuahene-Gima *et al.*, 2005), limiting the advantages of attention to threats.

On the other hand, the results show that the positive effects of attention to threats on disruption absorption and recoverability amplify among disruption-oriented firms, lending support for H3 and strengthening prior evidence that disruption orientation interacts with other organisational circumstances such as risk management infrastructure to drive firm resilience (Ambulkar *et al.*, 2015). The stronger disruption orientation, the more a firm attaches importance to issues that can threaten its stability (Bode *et al.*, 2011). Thus, for disruption-oriented firms, interest and commitment to attention to threats can be sustained so as to benefit from it. Besides, disruptionoriented firms are pre-disposed to learning about disruptions (Bode *et al.*, 2011), allowing them to develop stronger disruption-specific knowledge capacity to complement attention to threats.

The findings relating to H2 and H3 generally reinforce prior ABV-research findings (Ambos and Birkinshaw, 2010; Bouquet *et al.*, 2009; Clercq and Zhou, 2014; Laursen and Salter, 2006; Titus and Anderson, 2016; Jääskeläinen *et al.*, 2006) which suggest that attentional focus can be more or less beneficial under certain circumstances. The findings also strengthen the position of the contingency theory that lack of fit between strategy (e.g., attention to threats) and organisational factors will produce less benefit (Donaldson, 2006; Van de Ven *et al.*, 2013; Flynn *et al.*, 2010). Again, the findings are consistent with prior resilience research (BrandonJones *et al.*, 2014; Buyl *et al.*, 2017; Ambulkar *et al.*, 2015) that find that the effectiveness of antecedents of resilience may be contingent upon relevant internal and external organisational circumstances. A key theoretical implication of the findings relating to H2 and H3 is that while attention to threats is relevant, its potency to enhance operational resilience amplifies when it is congruent with the prevailing organisational circumstances.

6.2.3 Operational Resilience and Operational Efficiency

Consistent with the RBV, the study argues that operational resilience positively relates to operational efficiency (H4). Results from the study support H4, strengthening the RBV argument that resilience is an important organisational capability (Brandon-Jones *et al.,* 2014) and a source of competitive advantage (Kwak *et al.,* 2018). Prior research indicates that disruptions cause inefficiency (Ivanov *et al.,* 2014; Hendricks and Singhal, 2005). Meanwhile, it is also recognised that building operational resilience comes at a cost (van der Vegt *et al.*, 2015). Nonetheless, it can be argued that the cost of inability to absorb or recover quickly from disruptions may be greater and even difficult to quantify.

The study additionally finds that, unlike recoverability, disruption absorption has weak association with operational efficiency. This finding can be expected as disruption absorption is largely built through proactive resilience-building strategies such as buffers/redundancies, and thus be associated more with inefficiency (van der Van *et al.,* 2015; Sheffi and Rice, 2005). This finding is important as it clarifies how different components of operational resilience relate differently to operational efficiency. While Sheffi and Rice (2005) discuss how different resilience-building strategies (redundancy versus flexibility) are associated differently with (in)efficiencies, they do not clarify whether different resilience-building strategies contribute differently to different components of resilience, and for that matter, different levels of operational efficiency. The implication of the finding from the study is that, in as much as different resilience-building strategies may be associated with different levels of (in)efficiencies, there is the need to recognise resilience as a multifaceted concept (Davidson *et al.,* 2016), with different components of it having the potential to contribute differently to operational efficiency, and perhaps other performance outcomes.

In sum, the study demonstrates the benefits of conceptualising and analysing operational resilience as a multifaceted construct, comprising disruption absorption and recoverability. Based on this, the study shows that conclusions about the operational resilience-operational efficiency relationship can be erroneous when operational resilience is assumed to be, and operationalised as, a unidimensional construct. It is perceived in this study that the contention about the operational resilience-operational efficiency relationship might have resulted from prior discussions overlooking the different facets of operational resilience. The conceptualisation of operational resilience in the study allows one to better understand the details of operational resilience-operational efficiency relationship at the dimensional levels of operational resilience. Insights at this level of particularity could hardly be gained without the approach taken in this study.

6.3 FURTHER DISCUSSION AND THEORETICAL IMPLICATIONS

Additional findings from the study are discussed as follows:

6.3.1 Is the Research Model Firm Size-Dependent?

Results from the study indicate that small firms, compared to medium & large firms, score significantly low on both attention to threats and operational resilience, suggesting that the proposed research model may be moderated by firm size. Additional results, however, indicate the relationship between attention to threats and operational resilience and the moderating effects of strategic mission rigidity and disruption orientation in this relationship as posited in the study are largely invariant across small and medium & large firms. This finding strengthens the arguments relating to H1, H2, and H3. Even though the initial results support the argument that small firms are less resilient (compared to large firms) because they have little resources to invest in resilience-building strategies (Lai *et al.,* 2016; Pal *et al.*, 2014), the latter results clarify that some small firms can be more operationally resilient as they might score differently on factors such as attention to threats, strategic mission rigidity, and disruption orientation. This latter finding is revealing and important as it draws resilience scholars' attention to the need to not assume small firms to be homogeneous as doing so can impede effort to understand the drivers of resilience among these firms. That said, results from study direct further research to investigate why and when operational resilience may differ in the context of small firms.

On the other hand, further results suggest that the relationship between operational resilience and operational efficiency (H4) is moderated by firm size. Specifically, it is found that operational resilience positively relates to operational efficiency only in the context of small firms. A plausible explanation for this finding is the efficiency trade-off associated with increasing resilience. Operational resilience can mitigate costs associated with disruptions. However, this efficiency benefit can be eroded when the cost of building operational resilience is extreme. Small firms have limited resources and thus may invest little resources in building operational resilience. As found in this study, while small firms score significantly low on operational resilience, they also place significantly less emphasise on attention to threats. This suggests that for small firms, operational inefficiency resulting from investment in resiliencebuilding could be lower. Medium & large firms are more resilient as they place high emphasis on attention to threats. This can, however, reduce the potential net efficiency benefit operational resilience. Thus, it can be expected that the relationship between operational resilience and operational efficiency will be more positive among small firms.

6.3.2 The Path from Attention to Threats and Operational Efficiency

As part of the further analysis, study explored how attention to threats is related to operational efficiency. This was in response to the inefficiency concerns raised regarding resiliencebuilding strategies (Sheffi and Rice, 2005; van der Vegt *et al.*, 2015; World Economic

Forum Report, 2013) for which attention to threats is no exception. Results from the study indicate that attention to threats has no direct or linear association with operational efficiency. Additional analyses, however, produced the following insights:

6.3.2.1 Form of Relation between Attention to Threats and Operational Efficiency

The study finds that attention to threats has *U*-shaped relationship with operational efficiency. This means that increasing attention to threats will be associated with operational inefficiency to some point, above which further increases will be associated with operational efficiency.

While it is generally believed that resilience is of strategic importance (Kwak *et al.,* 2018; Linnenluecke, 2015), some scholars (Sheffi and Rice, 2005; van der Vegt *et al.,* 2015) and practitioners (World Economic Forum Report, 2013) have contended that the approach to attaining it is often associated with inefficiency. Experts, on the other hand, have opined that resilience and efficiency can co-exist (World Economic Forum Report, 2013). While these are important thoughts, none points to why different levels of investment in resilience-building strategies may be associated with differing levels of operational (in)efficiency, thus making the study's finding rather interesting. Indeed, the extant literature provides little explanation to why such finding is possible. It is true that attention to threats involves extra resources and costs (e.g., management time and costs of personnel and technology for monitoring and studying the business environment). Whereas some of these costs may be fixed, part will be written off each year as operational expenses (or overheads). Also, low levels of attention to threats can be very costly. It is generally agreed that disruptions bring about rippling and severe costs consequences (Craighead *et al.*, 2007; Tang, 2006; Kim *et al.*, 2015; Mohan and Bakshi, 2017; Brandon-Jones *et al.*, 2014; Christopher and Rutherford, 2004). Thus, it is possible that at low levels of attention to threats, which produces low levels of operational resilience, the economic sacrifices made by the firm may outweigh the efficiency gains. Again, increasing attention to threats helps minimise uncertainty and avoid disruptions and their concomitant costs. Firms that are proactive in anticipating and preparing for disruptions can minimise inefficiencies associated with disruptions (Latour, 2001; Li *et al.*, 2017). As open systems, firms face environment uncertainty (Bode *et al.*, 2011) which can make them operationally inefficient (Wong *et al.*, 2011). Relying on contingencies to reduce uncertainty can be costly, particularly when the firm is not guided by reliable information. In as much as low levels of contingencies can be costly (e.g., it can lead to stock-outs, service/product unavailability, idle workforce, back-ordering, lost sales, and losing customers and future sales) so is high levels of contingencies (e.g., excess stocking comes with unnecessary warehousing and stock management costs and capital lock-up (Koumanakos, 2008; Cannon, 2008). To minimise overall operational costs, decision about the level of contingency to keep should be based on accurate information about the conditions in the business environment. Having reliable information allows firms to maintain appropriate levels of contingencies, allowing them to avoid unnecessary operational costs associated with either too high or too low levels of contingencies. Dealing with uncertainty requires firms to invest time, effort, and finance in scanning, studying the business environment, discussing emerging issues, and responding appropriately. Thus, it is possible that the cost reductions accruing from being able to minimise uncertainty and frequency of exposure to disruptions as a result of increasing attention to threats will be greater than the corresponding economic sacrifices (Dahlman, 2008).

6.3.2.2 Mediating Effect of Operational Resilience

Furthermore, the study finds that disruption absorption significantly mediates the attention to threats-operational efficiency relationship. This implies that the question of whether investment in resilience-building strategies (such as attention to threats) is associated with (in)operational efficiency can better be answered by considering relevant intervention forces as this helps minimise competing explanations (Rindfleisch *et al.*, 2008). Per the results from the study, it can be speculated that attention to threats alone may insufficient in driving operational efficiency. In other words, when firms are not operationally-resilient, increasing attention to threats should not be expected to just translate into higher levels of operational efficiency. As indicated in the previous section, attention to threats can be costly. However, most of its efficiency gains can be realised through operational resilience. This is because operational resilience allows firms to minimise increases in costs associated with disruptions.

Nonetheless, the RBV contends that strategic investment helps organisations to build relevant capabilities (Makadok, 2001) such as operational resilience (Blackhurst *et al.*, 2011). As explained in Section of 3.2.2.3.2, operational resilience is valuable, inimitable, and nonsubstitutable and thus differences in the extent to which firms possess it can result in differences in relevant performance outcomes. The study argues in Section 3.3.4 that disruption absorption allows firms to avoid costs associated with disruptions while recoverability helps firms to minimise increases in costs associated with disruptions. Consistent with these arguments, the results from the study show that both disruption absorption and recoverability are positively related to operational efficiency. Accordingly, it can be expected that operational resilience would mediate the relationship between attention to threats and operational efficiency. The implication of the results from the study is that conclusions about the relationship between investment in resilience-building and (in)efficiency that fail to factor in the intervention force of operational resilience can be misleading.

6.3.2.3 Conditional Process Effects in the Attention to Threats-Operational Efficiency Link

Again, the study finds that there may be contingencies in the indirect association between attention to threats and operational efficiency as discussed in Section 6.3.2.2. Results indicate that in a low strategic mission rigidity context, attention to threats has positive and significant indirect relationship, via both disruption absorption and recoverability, with operational efficiency. There can be efficiency gains associated with focusing resources on current domain of operations (as opposed to investment in exploration and external information search and processing) and engaging in repeated pattern of activities, due to experience. Yet, such efficiency paradigm does not only make firms vulnerable to disruptions (Christopher and Rutherford, 2003) but also break down in disruption situations (Ivanov *et al.*, 2014; Hendricks and Singhal, 2005). This makes operations less resilient to disruptions, in which case the cost consequences tend to be greater (Tang, 2006; Hendricks and Singhal, 2005; Latour, 2001).

Also, the study finds that in a high disruption orientation context, the positive indirect relationship between attention to threats and operational efficiency via disruption absorption strengthens. Disruption-oriented firms are more effective in reconfiguring resources, making them more resilient to disruptions (Ambulkar *et al.*, 2015). This can add up to the efficiency advantages of attention to threats realised through operational resilience.

These findings further strengthen the value of a contingency approach to explaining the consequences of attention to threats as discussed in Section 6.2.2.2. The implication of these findings is that more accurate conclusions about the relationship between investment in resilience-building and operational efficiency can be reached when relevant conditionalprocess factors are accounted for.

6.3.3 Attention Structures and Attention to Threats

By recognising that attention to threats is an endogenous construct and thus raises endogeneity concern, the study resorted to the use of three-stage least squares estimator (Zaefarian *et al.*, 2017). However, the use of three-stage least squares estimator produced some interesting results that are worth highlighting. Consistent with the ABV's (Ocasio, 1997) core principles, the study argues that attention to threats may be affected by environment dynamism, slack resources, firm size, strategic mission rigidity, and disruption orientation (see Section 4.4.7.1.3). The stage 1 model results lend support for the arguments that environment dynamism, slack resources, firm size, and disruption orientation positively relate to attention to threats and that strategic mission rigidity negatively relates to attention to threats. The study finds that, together, these factors (environment dynamism, slack resources, firm size, and disruption orientation) significantly account for a quarter of the variance in attention to threats, making them important antecedents of attention to threats.

The positive association between environment dynamism and attention to threats is consistent with the argument that since environment dynamism represents a key source of uncertainty and disruptions (Dess and Beard, 1984; Joshi and Campbell, 2003; Boso *et al.*, 2013a), and thus warrants investment in strategic responses such as information search, new technology, and innovation (Li and Atuahene-Gima, 2001; Story e*t al.*, 2015), it will drive firms that experience greater levels of it to emphasise attention to threats.

Also, that slack resources relates positively with attention to threats strengthens the ABV's position that organisational input resource is a relevant attention structure (Ocasio, 1997). This finding is important for aligning the ABV with the RBV to explain resilience. Slack resources are necessary for conceiving and implementing resilience-building strategies (such as information search and processing). As the study finds, attention to threats is likely to be low among firms that lack slack resources, supporting the argument that slack resources frees organisational attention (Ren and Cuo, 2011). Indeed, the study additionally finds that attention to threats in turn relates positively to operational resilience.

Further, the results strengthen the view that firms that are prevention-focused have greater tendency to emphasise attention to threats (McMullen *et al.*, 2009). Disruption-oriented firms are prevention focused and that motivates them to proactively engage in activities that allow them to safeguard their stability (Bode *et al.*, 2011). Again, the negative relationship between strategic mission rigidity and attention to threats corroborate the view that firms that score high on strategic mission rigidity are driven by efficiency motives and place less emphasis on external information search (Atuahene-Gima *et al.*, 2005; Li *et al.*, 2008). Such firms may be unwilling to emphasise attention to threats as they engage in corporate belt-tightening rituals.

Moreover, the positive relationship between firm size and attention to threats is in line with the assertion that large firms, due to possession of more financial resources, are able to invest in resilience-building strategies in their effort to be resilient (Lai *et al.*, 2016; Pal *et al.*, 2014). Indeed, large firms are more complex in structure and scope of operations which increases their exposure and sensitivity to disruptions (Revilla and Jesus, 2017). Thus, it can be expected that they will increase attention to threats.

The above findings substantiate the ABV's proposition that what issues and answers organisational decision-makers focus attention on, and what they do, is contingent upon the particular situation they are located in (Ocasio, 1997). That organisational attention is limited (Ambos and Birkinshaw, 2010) means firms cannot and will not attend to all issues and answers equally. This, however, leads to attention selection (Ocasio, 1997). The situation firms find themselves will thus govern and regulate the evaluation, legitimisation, and prioritisation of issues and answers, and accordingly attention selection and focus (Titus and Anderson, 2016; Ocasio, 1997). The main import of the study's findings is that while resilience is generally believed to be a strategic capability (Kwak *et al.*, 2018), firms, as long as they encounter different situations, can be expected to place varying levels of emphasis on investment in resilience-building strategies. As the study finds, environment dynamism, slack resources, firm size, and disruption orientation uniquely and significantly matters in disciplining firms in the extent of emphasis they place on attention to threats. This finding is important as it opens new avenues for research on the broader strategic topic of why and when firms channel resources into resilience-building. More importantly, the study shows that one should not assume that the strategic value of resilience as overly projected in the extant literature (van der Vegt *et al.,* 2015) alone would be enough motivation for firms to invest in strategies that may contribute to their resilience. Accounting for differences in situations characterising such resource allocation decision matter in our quest to understand why resilience-building effort, and accordingly resilience, differ among firms.

6.3.5 Other Controls in the Model of Operational Resilience

Results from the study indicate that the positive effects of slack resources on disruption absorption and recoverability are not statistically significant. Meanwhile, the resilience literature (Tognazzo *et al.,* 2016; Sheffi and Rice, 2005; Meyer, 1982) suggests that slack resources is a key driver of resilience. While the study does not find significant positive effect of slack resources on operational resilience, the argument that slack resources is a key driver of resilience may be difficult to refute. Slack resources can enhance resilience in important two ways: *reactive* and *proactive*. Reactively, in event of disruptions, firms with more slack resources can be effective at weathering or recovering from impact since it facilitates improvisation (Adomako *et al.*, 2018a). Beyond this, however, since disruption-preparedness often requires substantial resource investment (Li *et al.,* 2017), firms with more slack resources can better prepare, allowing them to effectively respond to disruptions. Thus, the contribution of slack resources to resilience may be channelled via investment in disruption-preparedness. Consistent with this argument, the study finds that firms with more slack resources score high on attention to threats. Also, it is found that attention to threats positively relates to operational resilience. Thus, it is possible that slack resources may enhance operational resilience via attention to threats. That slack resources has no significant direct relationship with operational resilience in this study is quite interesting. Having slack resources may not just translate into resilience. More importantly, if it is not channelled into resilience-building strategies, its contribution to resilience can be insufficient.

Using firm age as a proxy for business experience (i.e., accumulated knowledge of the context in which a firm operates), the study expected that older firms will be more operationally resilient than younger firms. While the correlation analysis reveals that firm age relates positively with both disruption absorption (was not significant though) and recoverability (was significant), the regression analysis (which controlled for other factors) indicates that firm age does not relate to any of them. The implication of this finding, assuming firm age is a good proxy for business experience, is that per the variables considered in the analysis, firm age is a less important determinant of operational resilience. Moreover, it can be that the relationship between firm age and operational resilience is not direct as the study expected. It is also possible that the advantage of firm age will be realised when it is levered on in conjunction with other resources at the firm's disposal or other resilience-building strategies.

The study argues that, compared to manufacturing firms, service firms will be more operationally-resilient. Results, however, indicate that operational resilience does not differ between these firm categories. This means that operating in any of these industries may not offer a natural advantage for being operationally-resilient. It is true that industry differences may present different forms of disruptions that firms would have to deal with. Yet, this in itself may not just make firms more or less resilient. Resilience needs to be built into operations

(Christopher and Peck, 2003) or firms need to have appropriate resources to draw on in event of disruptions in order to be resilient (Blackhurst *et al.*, 2011).

6.3.6 Operational Disruption and Operational Efficiency

In estimating the effect of operational resilience on operational efficiency, the study controlled for the potential influence of attention to threats, firm industry, firm size, firm age, slack resources, and operational disruption. The results indicate that among these six variables, only operational disruption significantly affects operational efficiency. The effect of operational disruption was negative, and thus consistent with the argument (Craighead *et al.*, 2007; Tang, 2006; Kim *et al.*, 2015; Mohan and Bakshi, 2017; Brandon-Jones *et al.*, 2014; Christopher and Rutherford, 2004) and prior research finding (Hendricks and Singhal, 2005) that disruptions have negative effect on operational efficiency. Among other things, inefficiencies resulting from disruptions include delays/idle capacity and overhead expenses in restoring operations. After introducing operational resilience in the model, the effect of operational disruption became statistically insignificant, justifying why operational resilience is of strategic essence, in that, it shows that in the absence of operational resilience, increases in operational-related disruptions make firms inefficient.

6.4 IMPLICATIONS FOR PRACTICE

Operational resilience is an important organisational capability and managers must understand its conceptual domain to allow them to devise appropriate strategies to develop it. This study suggests that operational resilience comprises two distinct theoretical components: disruption absorption and recoverability; each of which is relevant and may require different approaches for building it. For example, investing in proactive strategies such as redundancies/buffers and attention to threats will increase disruption absorption while investing in reactive strategies such as flexibility would boost recoverability.

Another lesson from the study for managers is that the (in)efficiency implications of possessing each component of operational resilience are different. Inefficiency associated with building disruption absorption is greater than that of recoverability, thus its efficiency benefit can be lower as the study finds. Resources channelled into building disruption absorption, unlike recoverability, are difficult to redeploy in other strategic activities in the firm. Nevertheless, disruption absorption can help firms avoid inefficiency associated with disruptions altogether. Related to the cost of building resilience argument, the study finds that unlike medium & large firms, small firms are likely to benefit more, in terms of operational efficiency, from operational resilience, as these firms are more resource constrained and invest low in resiliencebuilding strategies. What managers should note in relation to these findings is that there is efficiency trade-off in possessing operational resilience and optimising the efficiency benefit of operational resilience requires a balancing act. Operational resilience can mitigate costs associated with disruptions. Yet, it may be costly building greater levels of it. In this sense, managers should critically consider if the situations they find themselves in warrant a certain level of operational resilience that ought to be built. It is reasonable for managers to build low levels of disruption absorption when faced with low levels of disruptions so as to optimise the efficiency gains associated with operational resilience.

Again, the study shows that managers should only consider attention to threats as a potential driver of operational resilience. As the findings indicate, there is a limit to the operational resilience benefit of increasing attention to threats. It was found that, while increases in attention to threats brings about corresponding increases in operational resilience, beyond a certain limit, further increases in attention to threats is associated with lower levels of operational resilience. Decision-makers should be aware that this is likely as increases in attention to threats results in information overload, burdening the firm's limited information processing capacity, and accordingly its ability to effectively learn about, and respond to, disruptions. Besides, extreme emphasis on attention to threats can make decision-makers lose sight of opportunities that, when exploited, can in the first place minimise their firms' exposure to disruptions, and also, sensitivity to the impacts of disruptions. Thus, management have to be mindful of the level of emphasis they place on attention to threats. In fact, it is not by chance that some firms may go the extra mile when it comes to investment in resilience-building. Evidence from the study indicates that firms that experience more environment dynamism, have more slack resources, are large in size, are disruption-oriented, and have less rigid strategic mission are more likely to increase attention to threats. This means that the level of emphasis firms place on attention to threats is situation specific, and thus management should critically consider whether the situation they find themselves in necessitates the need for increasing attention to threats. Undoubtedly, it can be difficult to know whether extreme emphasis is placed on attention to threats or not as "what is extreme" is invisible and continually shifting. Yet, managers having knowledge of critical triggers of extreme emphasis on attention to threats can make more informed decisions. For example, extreme fear of the impacts and costs of disruptions and being carried away by prior benefits gained from increasing attention to threats may lead to an extreme emphasis on attention to threats. In view of these issues, and in tandem with the findings from the study, management are encouraged to allow their decisions on the level of attention to threats to be guided by a comprehensive analysis of the present situation that their firms face. This is imperative as disruptionpreparedness logic alone is likely to be insufficient for driving overall organisational success.

Moreover, the study finds that reaping greater benefits (including operational resilience and operational efficiency) from attention to threats requires creating an organisational environment (such as having a flexible strategic mission and being disruption-oriented) that is compatible with, and will boost the effectiveness of, investment in resilience-building strategies. Results indicate firms in the research setting can improve operational resilience by emphasising attention to threats. However, firms generally have limited information processing abilities and attention to threats comes with its own challenges such as information overload. The study shows that the operational resilience consequences these challenges pose become more salient among firms having a well-defined and yet narrowly focused mission statement and competitive strategies, and discouraging any activity outside their current domain of operation (i.e., having rigid strategic mission), but less salient among firms that are conscious of, show concern about, are serious about, and recognise the opportunity to learn from disruptions (i.e., disruption-oriented). It is true that strategic mission is an important factor that guides a firm’s moves and resource allocation decisions, and thus it is likely that the nature of it can have significant implication on attention to threats as well as its (attention to threats) potential benefits. As the study finds, a rigid strategic mission does not only restrain attention to threats, but also weakens the latter’s contribution to operational resilience, and accordingly operational efficiency. Again, although firms would naturally not entertain disruptions and might want to invest resources in preparing for them, there should be a motivation, particularly an inherent one like disruption orientation. The study finds that disruption orientation fosters attention to threats to drive operational resilience.

The study’s examination of the contingency effects of strategic mission rigidity and disruption orientation suggests that firms should match attention to threats with appropriate organisational circumstances in order to benefit more from increasing attention to threats. Decision-makers in the research setting whose firms have a rigid strategic mission and or are less disruptionoriented have major roles to play in their quest to lever on attention to threats to boost their firms' operational resilience. Such roles include facilitating the development of strategic mission flexibility and promoting disruption-orientation at all levels within the firm. A flexible strategic mission would make the firm open and look beyond how it currently makes a living. This comes with increases in exploration behaviour, external information search, learning, and experimentation, useful for boosting the firm's information search and processing capacities to foster attention to threats. Relatedly, decision-makers who promote awareness of, and concerns about, disruptions and value the opportunity to learn from disruptions will be motivated to invest in resilience-building strategies. Besides, they are likely to sustain their interest and commitment to such endeavour. Importantly, promoting disruption orientation allows the firm to acquire relevant knowledge about disruptions which in turn can complement attention to threats to enhance operational resilience.

6.5 LIMITATIONS AND ADDITIONAL AVENUES FOR FURTHER RESEARCH

As in every research, this study has limitations that set the grounds for future research. Below are discussions of the key limitations in the study and directions for future research.

6.5.1 Attention to Threats

Though the scale used to tap into attention to threats is consistent with previous research (e.g., Bouquet *et al.*, 2008) approaches for measuring attentional focus, it may be limited as it was also informed by insight from interviews with managers. In fact, scholars (e.g., Ocasio, 2011; Surroca *et al.*, 2016; Eggers and Kaplan, 2009) agree that the measurement of the notion of attention is difficult. As Surroca *et al.* (2016) and Ocasio (2011) find, varied approaches have been utilised to measure attention. Thus, beyond the subjective measures suggested in this study, it is encouraged that future studies consider other approaches through which the notion of attention to threats can be measured. For example, analysis of minutes and other company documents for the frequency at which disruptions facing firms were mentioned and discussed can be a good proxy (Surroca *et al.*, 2016; Ocasio, 2011; Eggers and Kaplan, 2009). Again, consistent with Durand (2003), future studies can rely on expenditure on disruptions-specific information search and/ or information processing (e.g., discussions) as a proxy.

6.4.2 Attention Structures and Attention to Threats

There can be heterogeneity in attention to threats among firms as firm (in)attention to particular issues/answers are influenced by the peculiarities of the situations they face (Ocasio, 1997). Consistent with this proposition, the study finds that environment dynamisms, slack resources, firm size, disruption orientation, and strategic mission rigidity uniquely contribute to explaining heterogeneity in attention to threats. Given that attention to threats is an important antecedent of operational resilience, and accordingly operational efficiency as the study finds, it will be a worthy course for future studies to explore for additional determinants of attention to threats.

6.5.3 Firm-level View of Resilience

Consistent with Davidson *et al.* (2016), this study acknowledges that the core conceptual components of the resilience concept are several: disruption absorption (or persistence/ resistance/robustness/system identity retention), recoverability (or restoration/ return to previous state), adaptability, and transformability. Nevertheless, the study argues that only the disruption absorption and recoverability components are relevant in the conceptualisation of operational resilience. This means that the other core components of resilience that can be studied at the firm-level include adaptability and transformability. Even though a portion of the broad resilience literature discusses the adaptability and transformability components of resilience, empirical research on them is scarce. It should be noted that operationalising adaptability and transformability (either at the firm level or supply chain level) can be difficult since adaptation and transformation can occur intendedly or unintendedly or in response to disruptions or not (Folke *et al.*, 2010; Davidson *et al.*, 2016). One way to overcome this measurement challenge in future research is to tie the scales for tapping into these capabilities to (specific) unintended and unplanned events that undermine the structure and normal functioning of the firm. The study contends that these components of resilience better illuminate the dynamic capability nature of resilience as perceived by some scholars (e.g. Mandal 2016:2017; Chowdhury and Quaddus, 2017; Li *et al.*, 2017; Eltantawy, 2016; Ponomarov and Holcomb, 2009). Future research can additionally investigate how attention to threats relates to these components of resilience at the firm-level.

Few prior studies (Buyl *et al,*. 2017; DesJardine *et al.,* 2017) that focused on single disruptions and studied resilience at the firm level used secondary data (e.g., financial performance/stock price indicators) to measure disruption absorption and recoverability. However, unlike these studies, the present research, following the vast majority of the emerged studies (see Tables 2.9 and 2.11), did not focus on any specific disruption, in which case the use of secondary data to measure disruption absorption recoverability, particularly at the operations level, can be challenging. Notwithstanding, the researcher believes that when a single disruption becomes the subject of interest, secondary data can be used to measure disruption absorption and recoverability. For example, it is reported that Toyota was able to resume production at twentynine plants just three to four days after the Kobe earthquake of 1995 (Fujimoto, 2011). This case clearly reflects the notion of recoverability. In this sense, number of days/hours taken to restore operations just after recovery action was initiated can be used to measure recoverability (cf. Buyl *et al.*, 2017; DesJardine *et al.*, 2017). Also, a drop in operational output (e.g., average number of products produced per hour/day or number of customers served per hour/day) just after a disruption occurs and just before recovery action is initiated can be used to measure disruption absorption (cf. Buyl *et al.*, 2017; DesJardine *et al.*, 2017). Thus, future research focusing on single disruptions and interested in operational resilience should endeavour to use secondary data, if can be obtained, to objectively measure the construct. Even when such data are not archived by the firm, interviews with operations managers can produce them.

6.5.4 Performance Outcomes of Attention to Threats and Operational Resilience

The present study examines operational efficiency as an outcome of operational resilience. The decision for singling out and focusing on operational efficiency is justifiable as (1) the debate in the literature (van der Vegt *et al.*, 2015; World Economic Forum Report, 2013) on whether being resilient is good or bad has centred on the inefficiencies associated with how it is built, and (2) there is scarce empirical evidence guiding this debate (see Tables 2.9 and 2.11). Organisational performance is a multi-faceted concept. Thus, debates and conclusions about whether resilience vis-à-vis how it built is good or bad cannot be limited to the resilience-efficiency nexus. In fact, profitability, which is the 'bottom-line' is not solely determined by cost/efficiency performance. Accordingly, further research on operational resilience and attention to threats should consider other organisational performance outcomes. Already, many other performance outcomes have been studied (see Table 2.10). However, these performance outcomes were not studied in relation to operational resilience or attention to threats. Beyond the regular economic performance outcomes, focusing on non-economic performance outcomes such as organisational/employee wellbeing will an interesting line of enquiry. Job demands will increase with operational disruption. Also, major and prolong disruptions can lead to layoffs/redundant workers, and accordingly dissatisfaction. But do these presuppose that organisational wellbeing is greater in organisations that are operationally-resilient to disruptions? If not, how and when does operational resilience drive organisational wellbeing?

6.5.5 Contingencies in the Attention to Threats-Operational Resilience Link

Contingency theory is central to the ABV (Titus and Anderson, 2016). Context factors influence attentional focus (Ocasio, 1997) and its effectiveness in driving organisational outcomes (Titus and Anderson, 2016; Ambos and Birkinshaw, 2010). Several studies (e.g., Ambos and Birkinshaw, 2010; Bouquet *et al*. 2009; Clercq and Zhou, 2014; Jääskeläinen *et al.,* 2006; Titus and Anderson, 2016; Laursen and Salter, 2006) show that both internal and external environment factors can moderate the effects of attentional focus constructs. However, in an attempt to develop a robust but a parsimonious model, the study carefully selected and investigated only two firm-level variables (disruption orientation and strategic mission rigidity) as moderators in the attention to threats-operational resilience link. Results from the study indicate that the attention to threats-operational resilience link may depend on relevant organisational contingencies. Potentially relevant external environment contingencies include environment dynamism, environment complexity, environment munificence, and competitive intensity. Slack resources, firm size/internal complexity, entrepreneurial/strategic orientation, and organisational structure can also serve as relevant internal environment contingencies.

6.5.6 Context and Data

Testing the research model with data from Ghana advances the limited knowledge on the resilience of firms in African/developing economies (see Tables 2.9 and 2.11). While the findings are limited to firms within the empirical setting, the researcher contends that the study's conceptual model may be applicable and relevant to other settings. In fact, most of the data for the study came of SMEs. Accordingly, for the purpose of cross-validation, testing the model in the other settings would be a fruitful avenue for further research.

The study relied on cross-sectional survey data. This is consistent with the vast resilience-based studies that focus on no specific disruption (see Tables 2.9 and 2.11). A well-designed crosssectional survey is adequate for explanatory research (Malhotra and Grover, 1998; Rindfleisch *et al.,* 2008). Also, theoretically-grounded models that incorporate relevant moderators and controls (Rindfleisch *et al.*, 2008; Antonakis *et al.*, 2012) and are tested on cross-sectional survey data using three-stage least squares estimator (Podsakoff *et al.*, 2012) can enhance casual inferences. Nonetheless, it does not rule out the possibility that the benefits of attention to threats, for example, may take time to materialise. Addressing this limitation will require future studies to rely on longitudinal survey data.

For good reasons (see Section 4.4.2), all substantive variables in the study were measured using psychometric scales, resulting in 'subjective' data. Again, the data were collected from single key informants using questionnaires. In fact, the data collection choices made in the study are consistent with prior resilience-based research (see Tables 2.9 and 2.11). While several procedural (see Section 4.4.10) and statistical (see Section 4.6.3) measures were followed to minimise and check common method bias in the data, it is hard to rule it out from the study. To effectively address common method bias concerns, future studies focusing on large organisations should rely on multiple informants to obtain data (Podsakoff *et al.*, 2012). In addition, primary and secondary sources should be used to obtain data on different variables in the research model (Podsakoff *et al.*, 2012). Section 6.5.2 discusses how future studies can 'objectively' measure both attention to threats and operational resilience. Moreover, reliance on longitudinal data can prove useful (Podsakoff *et al.*, 2012).

6.6 CONCLUSION

The study provides a novel perspective to developing knowledge of resilience at the operations level of the firm, in terms of its conceptual domain, drivers, and consequences. Specifically, it develops and analyses the notion of operational resilience, and further examines three attentionbased variables (i.e., attention to threats, strategic mission rigidity, and disruption orientation) as drivers of operational resilience, and how operational resilience affects operational efficiency. The study shows that attention to threats, uniquely, and in interaction with strategic mission rigidity and disruption orientation, drive operational resilience. Any, the study shows that operational resilience is likely to drive operational efficiency, particularly in the context of small firms. As discussed in this chapter, findings from the study provide rich insight for further studies and have valuable implications for practice. It is hoped that discussions on the limitations of the study and the suggested directions for further research will stimulate and guide future research to improve and extend the conceptual model developed in the study.

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APPENDIX 1: QUESTIONNAIRE

COVER LETTER

KNUST School of Business

Office of the Dean

COLLEGE OF HUMANITIES AND SOCIAL SCIENCES

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI

University Post Office, Kumasi-Ghana West Africa

Telephone: +233 3220 60962 **Email**: dean.ksb@knust.edu.gh **Website**: www.business.knust.edu

A survey on organizational resilience in Ghana

Dear Respondent,

Thank you for considering to participate in this study which seeks to investigate issues that confront the successful operation of businesses in Ghana. As hoped for, the study's findings and discussions will shape learning and also, managerial understanding on strategies that contribute to organizational survival and performance.

The study is undertaken by a team of researchers from KNUST. We can assure you that your responses will be treated in the strictest confidence, with the results collected being anonymised and used for statistical and academic purposes only. Please, you are responding to this survey as someone who holds **a senior/managerial position** (preferably, CEO, or general manager, or managing manager, or middle-level manager such as operations manager, etc.) in your company.

The questionnaire has specific instructions to follow and scales to use. Please reflect on your personal experience in your company and its business environment to respond to the statements in the questionnaire. Although some statements appear quite similar, each is different – hence, **kindly do well to respond to each**. The questionnaire will take about 25 minutes to complete and we think it will be more appropriate if you respond to it at your convenient time. All questions and concerns about the study can be directed to Mr Dominic Essuman (Tel.: +233 560 271 219), a member of the research team.

As a token of appreciation for participating in the study, you will receive a summary report of the key findings and recommendations from the study. You also have a chance to win GH₵500 for your favourite charity (e.g. church choir, school association, etc.). **Please provide your email address here (in case you are interested in these packages):**

____

Once again, we are most grateful that you take the time to participate in this study. Yours sincerely,

Prof Nathaniel Boso

Project Advisor and Dean of KNUST School of Business, Kumasi
Email: Nboso@knust.edu.gh

Please, indicate your consent for participation here	☐ ***I agree***	☐ ***I disagree***

EXTRACT OF THE QUESTIONNAIRE

>> Based on the respective scales provided, kindly circle a number that best represents your opinion on each statement

*SCALE: **1= "strongly disagree"** to **7= "strongly agree"*** ***Over the past 3 years, …***	***Strongly disagree***						***Strongly agree***
our company has been holding frequent board meetings to discuss and find answers to issues that threaten its operation	1	2	3	4	5	6	7
individuals in managerial positions in this company have been spending a lot of time and effort on studying and coming up with responses to threats in our industry	1	2	3	4	5	6	7
our company has been utilizing employees (either individuals, or teams, or units) specifically in charge of monitoring the business environment for disruptive events	1	2	3	4	5	6	7
our company has been engaging industry experts and business partners to discuss and find answers to threatening issues emerging in the business environment	1	2	3	4	5	6	7

*SCALE: **1= "strongly disagree"** to **7= "strongly agree"***	***Strongly disagree***						***Strongly agree***
Our company's overall mission is defined quite narrowly	1	2	3	4	5	6	7
Our company's overall mission allows little flexibility to modify the domain of operations	1	2	3	4	5	6	7
Any activity outside our overall mission is actively discouraged	1	2	3	4	5	6	7
We hardly change our strategic mission to meet new challenges	1	2	3	4	5	6	7

*SCALE: **1= "strongly disagree"** to **7= "strongly agree"***	***Strongly disagree***						***Strongly agree***
Our company often has uncommitted resources that can quickly be used to fund new strategic initiatives	1	2	3	4	5	6	7
Our company usually has adequate resources available in the short run to fund its initiatives	1	2	3	4	5	6	7
We are often able to obtain resources at short notice to support new strategic initiatives	1	2	3	4	5	6	7
We often have substantial resources at the discretion of management for funding strategic initiatives	1	2	3	4	5	6	7
Our company usually has reasonable amount of resources in reserve	1	2	3	4	5	6	7

*SCALE: **1= "not at all"**, to **7= "to an extreme extent"*** ***Over the past 3 years, there has been irregular changes in...***	***Not at all***						***To an extreme extent***
the needs and preferences in our demand/customer market	1	2	3	4	5	6	7
the actions of our competitors, in terms of their promotions, innovations, etc.	1	2	3	4	5	6	7
terms, conditions, and structures in our supply markets	1	2	3	4	5	6	7
government policies and programmes for our industry	1	2	3	4	5	6	7
laws and regulations governing our industry	1	2	3	4	5	6	7
technological needs and advancement in our industry	1	2	3	4	5	6	7

SCALE: *1= "very low"* to *7= "very high" Over the past 3 years, …*	***Very low***						***Very high***
the costs we incur in running our core operations has been…	1	2	3	4	5	6	7
the volume of waste in processes that we record has been…	1	2	3	4	5	6	7
the volume of material waste recorded in our company has been…	1	2	3	4	5	6	7
overhead costs incurred by our company has been…	1	2	3	4	5	6	7
the volume of idle capacity/ resources our company experiences has been…	1	2	3	4	5	6	7

SCALE***: 1= "strongly disagree"*** to ***7= "strongly agree"*** ***For the past 3 years, whenever disruptive events occur…,***	***Strongly disagree***						***Strongly agree***
our company is able to carry out its regular functions	1	2	3	4	5	6	7
our company grants us much time to consider a reasonable response	1	2	3	4	5	6	7
our company is able to carry out its functions despite some damage done to it	1	2	3	4	5	6	7
without much deviation, we are able to meet normal operational and market needs	1	2	3	4	5	6	7
without adaptations being necessary, our company performs well over a wide variety of possible scenarios	1	2	3	4	5	6	7
our company's operations retain the same stable situation as it had before disruptions occur for a long time	1	2	3	4	5	6	7

SCALE***: 1= "strongly disagree"*** to ***7= "strongly agree"*** ***Over the past 3 years, whenever our operations fail or breakdown due to a disruptive event,***	***Strongly disagree***						***Strongly agree***
it does not take long for us to restore normal operation	1	2	3	4	5	6	7
our company reliably recovers to its normal operating state	1	2	3	4	5	6	7
our company easily recovers to its normal operating state	1	2	3	4	5	6	7
our company effectively restores operations back to normal quickly	1	2	3	4	5	6	7
we are able to resume operations within the shortest possible time	1	2	3	4	5	6	7

SCALE***: 1= "strongly disagree"*** to ***7= "strongly agree"*** ***Unexpectedly,***	***Strongly disagree***						***Strongly agree***
some of our employees leave their posts (i.e. quit their job)	1	2	3	4	5	6	7
some of our suppliers fail to make deliveries	1	2	3	4	5	6	7

we experience vehicular breakdowns	1	2	3	4	5	6	7
we experience service/product failure	1	2	3	4	5	6	7
we run out of cash for running day-to-day operations	1	2	3	4	5	6	7
we experience machine/technology downtime/ failure	1	2	3	4	5	6	7
we experience shortage of raw materials	1	2	3	4	5	6	7
we experience power cuts	1	2	3	4	5	6	7
some of our service providers fail to honour their promises	1	2	3	4	5	6	7

>> *In which industry does your company operate?* ☐ Manufacturing ☐ Service
>> *How many years (approximately) has your company been in existence?* _________ years
>> *Our total number of full-time employees in currently is about*___________________________________

>> *What is your gender?* ☐ Male ☐ Female
>> *What is your age group?* ☐ 20 to 29 ☐ 30 to 39 ☐ 40 to 49 ☐ 50 or more
>> *What is your highest level of education?* ☐ Senior high school ☐ Diploma ☐ 1st Degree ☐ Masters' degree ☐ PhD
>> *What is your position in your company?* ☐ CEO ☐ Managing director ☐ General manager ☐ Operations manager
☐ Other (**kindly indicate**____)
>> *How long (in years) have you held this current position*? About ______________________________years

To what extent do you disagree or agree with the following statements?	***Strongly disagree***						***Strongly agree***
The questionnaire deals with issues I am very knowledgeable about	1	2	3	4	5	6	7
I am completely confident about my answers to the questions	1	2	3	4	5	6	7
I am confident that my answers reflect the company's situation	1	2	3	4	5	6	7

APPENDIX 2: INDICATIVE INTERVIEW RESPONSES CAPTURING ATTENTION TO THREATS

Table 1: Indicative Interview Responses that tap into Attention to Threats

Case	Indicative responses to the question: *How does your company (or do you) deal with issues in the business environment that threaten its (your company's) operations?*	Interviewee position	Interviewee experience (current position)	Interviewee's education level	Interviewee's gender	Firm age (years)	Firm size	Firm Industry
1	We have a research and development department. Our guys are able to predict and spot on some of these emerging threats that we believe will affect our business in the not too distant future. So, occasionally, as management, we also tend to discuss it extensively and plan to be able to meet it. We always take note of those threats and see how we can turn them into opportunities. There is a lot of predictions that go on. We try and get feedback from customers to find out changes in their needs.	Operations manager	5 years	Masters	Male	14 years	Large	Service
2	We study the [local] economy. And [we study] the world market too. For instance, if there is an indication that wire price will go down at the world market, what we do is, we import more and store them. Our CEO has experience. He's been in the industry for long so you can trust what he tells you. He always studies how things are moving and how they are going to affect us. We discuss whatever he comes up with at meetings.	Marketing/ sales manager	12 years	Masters	Male	26 years	Medium	Manufacturing
3	The thing is, you have to be smart. There is a lot of changes occurring in our industry that makes us vulnerable. So, we give a lot of attention to that. We monitor the changes [occurring in the industry] and that helps us make right decisions.	Administrative manager	3 years	Masters	Female	11 years	Medium	Service
4	I research to help us understand the dynamics in our market. We put our ears on the ground, listen to what's going on, so we try to prepare ourselves for anything that might come, so we can mitigate it.	CEO	6 years	Bachelor	Male	6 years	Small	Service

5	I use my connections and I contact lot of people for information and also to assist us when we face problems. I discuss with them to find out issues that are likely to affect us and this helps us to plan.	CEO	4 years	Masters	Male	4 years	Small	Manufacturing